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PHY-552

ELECTROMAGNETIC THEORY AND SPECTROSCOPY

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

2nd Year, Examination-2020

Time Allowed : 2 Hours Maximum Marks : 80

Note: This paper is of Eighty (80) marks divided into Two (02) sections A and B. Attempt the question 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. Discuss the salient features of near IR spectrum of a diatomic molecule and explain how these observations are quantum mechanically established. Why such spectra are not observed for homonuclear molecules?

2. Explain the intensity distribution in absorption and emission bond from Franck-condon principle.

3. Discuss the retarded potentials. Calculate the retarded potential of an infinite straight filamentary current.

4. Write down the Maxwell's Equation in free space and explain these equations also. How displacement current comes into consideration?

5. Find the expression for the electric potential due to an infinite line change of the electric field is given by $\vec{E} = 8\hat{x} + 4\hat{y} + 3\hat{z}$, calculate the electric flux through a surface of area 100 units lying in XY plane.

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. (4×10=40)

1. Explain Zeeman effect. Find out the expression for Zeeman shift of a single Valance electron.

2. Write short note on Franck-condon Principle.

3. Ground State of chlorine is $^2P_{z/2}$. Find the magnetic moment. How many sub states will split in weak magnetic field? Use the result to predict the splitting of the level when atom is place in external magnetic field of 0.1 task.

4. A certain fine-structure multiplet of levels corresponds to L = 2 S = 1 and I = $\frac{3}{2}$. Find the number of components and write operatorscopic designations for the multiplet. Find into how

many components each of these fine-structure levels will be further split by hyperfine-structure splitting. What is the total degeneracy of each of the fine-structure levels?

5. Express the continuity equation in four vector farms. Define four dimensial spaces.

6. Find the equation for electromagnetic wave propagating in a linear medium.

7. 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.

8. Find the equation for EM wave propagation in a conducting medium. Also define the skin depth.

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