

**C161**

Total Pages : 3

Roll No. ....

**MSCPH-507**

**Spectroscopy**

M.Sc. Physics (MSCPH)

2nd Semester 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. 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 Raman spectra differ from the infrared spectra?

2. Give the main features of pure rotational band spectrum of a heteronuclear diatomic molecule. Discuss rotational spectrum of a diatomic molecule by treating it as rigid and non-rigid rotator.
3. Explain the intensity distribution in absorption and emission band from Franck-Condon principle.
4. Derive the expression for Lande's splitting g-factor and explain it with help of the Zeeman effect of sodium doublet components  $D_1$  and  $D_2$ .
5. Discuss the Normal and Anomalous Zeeman effect in detail. Compute the Zeeman pattern for  ${}^2D_{3/2} - {}^2P_{1/2}$  transition.

## 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. Show that the observation spectrum of rigid rotator consists of equidistant lines with constant separation. Show that the observation spectrum of rigid rotator consists of equidistant lines with constant separation.
2. Briefly discuss the energy-level diagram of helium atom.

3. Discuss the principal features of electronic spectrum of a diatomic molecule.
  4. Determine the rotational energy of CO molecule on the quantum levels  $J = 1$  and  $J = 2$ , if the equilibrium nucleus distance of CO is  $1.131 \text{ \AA}$ .
  5. Write a note on Born-Oppenheimer approximation.
  6. What are the P and R branches in the vibrational-rotation spectra?
  7. Write an expression for energy of a harmonic oscillator and explain zero point energy.
  8. Discuss stark effect in weak field and strong field in hydrogen.
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