

**A-1179**

Total Pages : 3

Roll No. ....

**MSCPH-507**

**M.Sc. Physics (MSCPH)**

**Spectroscopy**

Examination February, 2026

Time : 2:00 Hrs.

Max. Marks : 70

*Note :-* This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. *Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.*

**Section-A**

**(Long Answer Type Questions) (2×19=38)**

*Note :-* Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

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( 1 )

P.T.O.

1. Discuss the Franck-Condon Principle in detail. Explain its significance in electronic spectroscopy.
2. Explain the effect of anharmonicity on the vibrational spectra of a diatomic molecule.
3. Derive the rotational energy value for a diatomic rigid rotator by using the quantum mechanical model. Identify the transition frequency value for two rotational level transition.
4. What do you understand by L-S coupling ? Discuss various interaction energy terms involved in L-S coupling of an atom.
5. Explain clearly the phenomenon of anomalous Zeeman effect and Paschen-Back effect. Describe the spectral patterns expected for the yellow lines of sodium according to these two effects.

### **Section–B**

**(Short Answer Type Questions) (4×8=32)**

**Note** :- Section ‘B’ contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. Discuss vector model of an atom.
2. What is Raman Effect ? What do you mean by Raman shift ?

3. What are the advantages of the Photoacoustic technique over conventional optical spectroscopy methods ? Explain with examples.
4. Discuss stark effect with the overview of classical electrostatic.
5. Discuss the salient features of helium atom spectra. How does it differ from hydrogen spectra ?
6. Explain emission spectra of X-rays and deduce Moseley's law.
7. Calculate the Doppler half-life intensity breadth of the sodium D-lines at  $5893 \text{ \AA}$  corresponding to the temperature of 500 K. Value of  $R = 8.31 \text{ J/(mol-K)}$ ,  $c = 3 \times 10^8 \text{ m/s}$ , atomic weight of sodium = 22.99 g/mol.
8. Write short notes on any two of the following :
  - (i) Dipole Moment
  - (ii) Microwave Oven
  - (iii) Isotopic Effect on Rotational Spectroscopy

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