END OF SEMESTER EXAMINATIONS, APRIL / MAY – 2019
APPLIED SPECTROSCOPY
SUBJECT CODE: 09P3PH12

MAJOR : M.Sc. (Physics)   SEMESTER   : IV
TIME   : 3 HOURS   MAX. MARKS : 70

SECTION – A (10 x 1 = 10)

Answer ALL the Questions:

Choose the best Answer:

1. According to Back Goudsmit Effect, the breakdown of coupling occurs between nuclear – spin angular momentum and _____.

    a) electron spin angular momentum

    b) total angular momentum

    c) orbital angular momentum

    d) magnetic moment of electron

2. The selection rules for a molecule to be microwave active is _____.

    a) $\Delta J = 0, \Delta K = 0$ b) $\Delta J = \pm 1, \Delta K = \pm 1$

    c) $\Delta J = 0, \pm 1, \ \Delta K = 0$ d) $\Delta J = 0, \ \Delta K = 0, \pm 1$

3. The lines on the lower frequency side of Rayleigh line is called_____.

    a) stoke's line   b) anti – stoke's line

    c) resonance line   d) larmor line

4. The nuclear quadrupole moment for a prolate molecule is _____.

    a) greater then zero   b) lesser than zero

    c) equal to zero   d) is infinity

5. When a single electron interacts with one nucleus, the number of splittings will be equal to _____.

    a) $2I \pm 1$ b) $2I + 1$ c) $2I - 1$ d) $2I + s$

Answer in brief:

6. What is Ritz combination principle?

7. Give the different spectral regions of infrared radiations.

8. What is the rule of mutual exclusion.

9. State Frank – Condon principle.

10. Distinguish between spin lattice relaxation and spin – spin relaxation time.

SECTION – B (5 x 4 = 20)

Answer ALL the Questions:

11. a) Give an account of the salient features of alkali spectra.

(OR)

    b) Write a note of Lande's g – factor.

12. a) List the differences between *IR* and microwave spectroscopy.

13. a) Give the classical theory of Raman Effect.

(OR)

b) Briefly explain the transitions involved in vibrational – rotational Raman spectra.

14. a) Explain Predissociation.

(OR)

b) Discuss the basic principle of ESR.

15. a) Discuss the correlation between chemical bonding parameters and nuclear quadrupole coupling constant.

(OR)

b) Explain isomer shift in Mossbaur spectrum.

SECTION – C (5 x 8 = 40)

Answer ALL the Questions:

16. a) Discuss the principle of stark effect and the stark effect observed in hydrogen spectrum.

(OR)

b) Explain the anomalous Zeeman effect using relevant transition diagrams.

17. a) Give a detailed account of normal modes of vibration of CO_2 molecule.

(OR)

b) Explain the rotational spectra of a symmetric top molecule.

18. a) With the help of a neat diagram, explain the different parts of Raman spectrometer.

(OR)

b) Outline the method of determining the structure of XY_2 and XY_3 type molecule using IR and Raman spectroscopy.   http://www.onlinebu.com

19. a) Give an account of the rotational fine structure of electronic vibrational transitions.

(OR)

b) Briefly explain the ESR spectra of the following free radicals:

   i) $CH_3 radical$

   ii) *benzene anion*

20. a) Derive the Bloch equations.

(OR)

b) Outline the transitions that take place in axially symmetric systems in NQR spectroscopy.