

5631

M.Sc. (Previous) Examination, 2024

CHEMISTRY

Fourth Paper-CH-404 (New)

(Spectroscopy & Diffraction Methods)

Time Allowed: Three Hours

Maximum Marks: 50

Attempt any five questions in all selecting one question from each Unit. All question carry equal marks.

Note: In each question paper 10 questions will be set. Candidates have to answer 5 questions selecting atleast one question from each unit.

No supplementary answer book will be given to any candidate. Hence the candidates should write the answer precisely in the main answer-book only.

All the parts of one question should be answered at one place in the answer-book. One complete question should not be answered at different places in the answer-book.

Unit-I

1. Explain the following -

[2½×4=10]

- ~~(a)~~ Interaction of electromagnetic radiation with matter.
- ~~(b)~~ Uncertainty relation.
- ~~(c)~~ Selection rule for absorption of radiations.
- ~~(d)~~ Intensity of spectral lines.

OR

2. (a) Discuss non-rigid rotator modal for diatomic molecule in microwave spectroscopy. [5]
- (b) Explain isotopic effect on rotational spectra [2]
- (c) Write Maxwell-Boltzmann distribution with reference to spectral lines. [3]

Unit-II

3. (a) What is vibrational rotational spectrum of a molecule? Explain selection rule for the vibrational transmission-of a diatomic molecule. [2+2=4]
- (b) Derive Quantum mechanical expression for a harmonic vibration of a diatomic molecule. [6]

OR

4. (a) What is Raman spectrum? What is the essential criteria for a molecule to be Raman active? Explain Mutual Exclusion Principle. [2+2+2=6]
- (b) Discuss Antistokes Raman Spectroscopy (CARS). [4]

Unit-III

5. Write notes on the followings -
- (a) Electronic spectra of alkali metal atoms. [4]
- (b) Vector coupling. [3]
- (c) Franck-Condon principle. [3]

OR

6. (a) Explain Koopman's theorem in detail. [4]
- (b) Discuss photoelectron spectra of simple molecules. [3]
- (c) What is Auger electron spectroscopy? [3]

Unit-IV

7. (a) What do you mean by chemical shift? Discuss factors affecting chemical shift. <https://www.uoronline.com> [1+3=4]
- (b) What is coupling constant? Discuss factors affecting of it. [1+3=4]
- (c) Explain NMR shift reagent. [2]

OR

8. Write notes on the following with reference to ESR.
- (a) Hyperfine coupling. [4]
- (b) Spin Hamiltonian. [3]
- (c) Choice of solvent. [3]

Unit-V

9. Explain the following X-ray diffraction methods.
- (a) Bragg's method. [5]
- (b) Debye-Scherrer method. [5]

OR

10. (a) Explain Wierl equation and correlation method. [5]
- (b) Discuss elucidation of structure of magnetically ordered unit cell. [5]