

Chemistry (P.G.)

[CBCS]

M.Sc. Third Semester End Examination-2023

(Regular & Supplementary Paper)

PAPER-CEM-301

Common Paper

(Advance Spectroscopy – I)

Full Marks: 40

Time: 02 Hrs

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

1. Answer any four questions of the following: 2.5x4= 10

- a) Draw the hyperfine esr spectra of hydrogen radicals.
- b) Why DPPH is used in ESR.
- c) How is the fluorescence of pyrene influenced by polarity of the medium?
- d) The benzene radical anion has $g = 2.0025$. At which field should you search resonance in a spectrometer operating at 9.302GHz?
- e) What structural information does an NQR spectrum give of a sample?

(2)

- f) What do you mean by adiabatic ionization energy and vertical ionization energy in photoelectron spectroscopy?
- g) Discuss the characteristics features of LASER.
- h) Write a short note on Ruby LASER.

2. Answer any four questions of the following: **4x5= 20**

- a) Explain the Jablonski diagram and obtain Stern Volmer equation.
- b) The ESR spectrum of $[(\text{NH}_3)_5\text{Co}-\text{O}_2-\text{Co}(\text{NH}_3)_5]^{5+}$ show fifteen lines. Derive structural information for this complex ion from this data.
- c) Describe principle of XPS spectroscopy.
- d) Write a note on NdYAG laser.
- e) A radical containing two non-equivalent protons with splitting constant 2.0mT and 2.6mT gives a spectrum centred on 332.5mT. At what field do the hyperfine lines lie and what are their relative intensity.
- f) Write down the reaction between excited state life time and the rate constant involving IC, ISC.

3. Answer any one question of the following: **1x10=10**

- a) (i) What is laser and its use? What will be the intensity lines in the esr spectrum of di-tertiary butyl nitroxide (DTBN).

(2+3) = 5

(3)

(ii) Discuss each step involved for unimolecular process and bimolecular process in a photo physical process. **5**

- b) (i) Fluorescence quenching process is dynamic or static in nature? Schematically show the potential energy of iodine molecule in its ground state and higher energy state.

(2+3) = 5

(ii) $[\text{Mo}(\text{CN})_8]^{3-}$ complex shows the single line of ESR spectrum but when C is replaced by ^{13}C gives nine lines Explain. **5**

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