

2022

M.Sc.

3rd Semester Examination

CHEMISTRY

PAPER – CEM-301

Full Marks :50

Time : 2 Hours

(CEM 301-Advanced Spectroscopy-I)

1. Answer any *four* questions 2×4 = 8
- (a) Identify the numbers of EPR lines for CD₃ radical.
 - (b) Explain the term 'chelation enhanced fluorescence (CHEF)'. Give an example.
 - (c) Life-time measurements are more fruitful to distinguish between static and dynamic fluorescence quenching. Explain.
 - (d) What standard is used to calibrate the ESR spectra? What type of frequencies is used in EPR?
 - (e) Phosphorescence is favoured in solid matrix and at low temperature. Why?
 - (f) How does the solvent polarity influence the emission of pyrene?
2. Answer any *four* questions 4×4 = 16
- (a) Draw and explain the possible transitions for fluorescence and phosphorescence in Jablonski diagram.
 - (b) (i) What do you mean by 'Kramer's degeneracy'? Write with diagram. (ii) Calculate the EPR lines with intensity ratio for [Cu(H₂O)₄(NH₃)₂]²⁺. 2+2

(c) (i) Give the schematic process of XPS spectroscopy. (ii) Give the number of NQR lines and their characteristics for anhydrous AlCl_3 as well as hydrated AlCl_3 with explanation. 2+2

(d) How does the pH affect the fluorescence intensity? What do you mean by the fluorophore? 3+1

(e) (i) Explain the "Drago's rule" with example. (ii) Explain Pascalian triangle on NH_3 radical. 2+2

(f) (i) How many lines are observed in the ESR spectrum of naphthayl radical? Mention the intensity ratios of the ESR signals observed in this radical. (ii) How do you differentiate EPR from NMR spectra though both are resonance spectra? 2+2

3. Answer any *two* questions

2×8 = 16

(a) (I) What method is used to record the EPR spectra? (II) Find out the EPR lines with their relative intensity ratio for the following cases (i) 1,3-butadiene (ii) one e^- spin interacts with two equivalent N nuclei ($I=1$) (iii) CH_2OH radical. 2+2+2+2

(b) (i) Justify the term 'Resonance' in EPR. (ii) How the energy state is splitted in presence of applied magnetic field in EPR. Explain with equation. (iii) Write down the uses of ESR spectra. 2+4+2

(c) (i) What do you mean by Twisted intramolecular charge transfer process? (ii) Write the possible photo-deactivation process. (iii) What do you mean by Delayed fluorescence? Draw the Jablonski diagram with explanation. 2+3+3

(d) i) Describe the working principle of Ruby LASER. (ii) Laser is capable of second harmonic generation. Explain. (iii) Write down the advantages of gas-laser over solid state laser. (iv) A laser cavity is 10.223 cm long and is operating at a wavelength of 530.34 nm. How many half-wavelengths are there along the length of the cavity? 1.5+2.5+2+2

Page-02