Answer any four questions.   (4×10= 40)

1. a) What is hyperfine interaction in EPR? **b)** Discuss the nature of ESR spectra of CH_3 radical. **c)** Why 4×11 lines EPR spectrum is observed for bis-(salicylaldimine) copper (II). Explain intensity ratio of 11 lines in a set. (3+2+5)

2. a) What method is used to record the EPR spectra? **b)** 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.   (1+3×3)

3. a) Justify the term 'Resonance' in EPR. **b)** How the energy state is splitted in presence of applied magnetic field in EPR. Explain with equation. **c)** What standard is used to calibrate the ESR spectra? **(d)** Write down the uses of ESR spectra. (2+ 4+ 1+3)

4. a) What do you mean by 'Kramer's degeneracy? Write with diagram. **b)** Calculate the EPR lines with intensity ratio for molecules (i) naphthalene radical (ii) $[Cu(NH_3)_4]^{2+}$ (iii)$[Cr(H_2O)_4(NH_3)_2]^{2+}$ (1+3×3)

5. a) Explain the "Drago's rule" with example. **b)** Identify the nos of EPR lines for CD_3 radical. **c)** Explain Pascalian triangle on NH_3 radical. **d)** What type of frequencies are used in EPR.   (4+2+ 3 +1)

6.a) Explain the static quenching and dynamic quenching. **b)** Explain the Stern Volmer plot to determine the quenching constant.?

(5+5)

7. a) What do you mean by Twisted intramolecular charge transfer process? **(c)**What do you mean by Delayed fluorescence? **(d)** Draw the Jablonski diagram with explanation.

(4+3+3)

8. a) What do you meant by fluorescence quenching **b)** How quenching related to the life time of fluorophore and temperature (**c)** What do you mean by proton–coupled electron transfer process?   (2+4+4)