

1st Semester Examination – 2021
Spectroscopy-I, CH-406, Full Marks: 50, Time: 2 h

Group A

(2x10)

1. How many planes of symmetry are present in $F_2C=O$ and $[HCO_2^-]$.
2. What point group is obtained by adding a σ_h plane to C_{2v} point group.
3. Write the formula and explain the transition moment integral.
4. What are the conditions for light absorption by a molecule.
5. What is the difference between R-S coupling and spin-orbit coupling.
6. Charge-transfer spectra, Explain briefly.
7. What is the ground term for the configuration of $3d^3$ of Cr^{3+} .
8. Indicate the relationship between I_a , I_b and I_c of HCN and CH_3I molecules.
9. Mention the complete rotational selection rules.
10. Draw the Photoelectron spectrum of H-atom

Group B

1. (a) Prove that conjugate matrices have identical character taking an example. (3)
(b) Note down the symmetry elements and identify the point group of (4)
(i) $trans-PCl_3F_2$ and (ii) $Ni(CN)_4^{2-}$.
(c) Give an account of factors on which the intensity of spectral lines depends. (3)
Or
(a) Prove that: (i) $C_4(z) \sigma(xz) = \sigma_d$ (ii) $S_2 = i$. (3)
(b) Briefly discuss the properties of conjugate elements. (4)
(c) What are the factors affecting the broadness of spectral lines (3)
2. Discuss the atomic spectra of hydrogen. (5)
Or
State Franck-Condon principle. How does it explain the electronic spectra in a molecule?
3. What is the term symbols for p^5 and d^1 configuration? (5)
Or
Find all possible arrangements of orbital and spin quantum numbers of a p^2 configurations? Deduce the term out of it.
4. Show that $J_{max} = (kT/2hB)^{1/2} - 1/2$, where the terms have their usual meanings. (5)
Or
Describe the influence of nuclear spin on the rotational spectral lines.
5. Discuss the Photoelectron spectrum of H_2O molecule (5)
Or
Write notes on ESCA (Electron Spectroscopy of Chemical Analysis)