13. (p) Give the condition for a molecule to show following spectra :

(i) Microwave spectra

(ii) Raman spectra. 2

(q) Show that line in the rotational absorption spectrum for diatomic rigid rotator are equispaced. 4

(r) Calculate vibrational degrees of freedom for CO_2, HCl and H_2O. 6

B.Sc. Part–III (Semester–V) Examination

5S : CHEMISTRY (New)

Time—Three Hours] [Maximum Marks—80

Note :— (i) Question No. **1** is compulsory.

(ii) Solve **ONE** question from each unit.

(iii) Draw diagrams and give equations wherever necessary.

(iv) Use of calculator is allowed.

1. (a) Fill in the blanks : 2

(i) In writing the formula of co-ordination compounds, the order of writing the ligands is _____, neutral and cationic.

(ii) The compounds which reduce the pain are called as _____.

(iii) The quantity $\log_{10}\frac{I_0}{I}$ is called _____ of the medium.

(iv) A chromogen without _____ can never act as a dye.

3. (p) Discuss the V.B. structure of $[Cr(NH_3)_6]^{3+}$ complex ion. 4

(q) Define with suitable example :

(i) Ligand

(ii) Co-ordination sphere. 2+2=4

(r) Explain with suitable example :

(i) Co-ordination isomerism

(ii) Linkage isomerism. 4

UNIT–II

4. (a) Explain crystal field splitting in tetrahedral complexes. 4

(b) Explain electronic spectrum of $[Ti(H_2O)_6]^{3+}$ ion. 4

(c) Find out the ground term symbol for d^2 configuration. 4

OR

5. (p) Give the assumptions of Crystal Field Theory (CFT). 4

(q) Give the relaxation to the Laporate selection rule. 4

(r) What is crystal field stabilization energy (CFSE) ? Give an equation to determine CFSE for octahedral complexes and tetrahedral complexes ? 4

UNIT–III

6. (a) Explain the orientation of nucleophilic substitution in pyridine on the basis of resonating structures. 4

(b) How will you convert the following :

(i) Grignard reagent to acetic acid

(ii) Organolithium compound to methane ? 4

(c) How will you synthesize :

(i) Pyrrole from furan

(ii) Pyridine from acetylene ? 4

OR

7. (p) Explain why pyrrole is weak base. 4

(q) How can you convert methyl magnesium bromide into :

(i) Methane

(ii) Ethyl alcohol ? 2×2=4

(r) How does pyridine reacts with :

(i) Sodamide in liquid ammonia

(ii) Nitrating mixture ? 4

UNIT–IV

8. (a) Give the preparation and uses of sulphadiazine. 4

(b) Give the preparation and uses of phenolphthalein. 4

(c) Explain the following terms :

(i) Fungicides

(ii) Pesticides. 4

OR

9. (p) How will you prepare [2, 4–D] from 2,4 dichlorophenol ? What are the different uses of [2, 4–D] ? 4

(q) Give the preparation and uses of sulphanilamide. 4

(r) Give the preparation of crystal violet. 4

UNIT–V

10. (a) Define the following terms ;

(i) Chemiluminescence

(ii) Photosensitized reaction

(iii) Photochemical reaction. 6

(b) Give the reasons for high and low quantum yield of photochemical reactions. 4

(c) Calculate the energy of one Einstein of a light of wavelength 3000 A° ?

($N = 6.023 \times 10^{23}$). 2

OR

(iv) The distance between two successive crests or troughs on an electromagnetic wave is known as :

(a) Wave number

(b) Velocity

(c) Frequency

(d) Wave length.

(c) Answer in **one** sentence : 1×4=4

(i) Give the structure of EDTA.

(ii) What is Crystal Field Stabilization Energy (CFSE) ?

(iii) What is Malathion ?

(iv) Give the wavelength limit of visible region.

UNIT–I

2. (a) Differentiate inner orbital and outer orbital octahedral complexes. 4

(b) Give the applications of chelate in analytical chemistry. 4

(c) Explain geometrical isomerism in octahedral complexes of the type Ma_4b_2 and Ma_3b_3 with suitable example. 4

OR

(b) Select the correct alternative : 2

(i) The hybridization of Fe in $K_4[Fe(CN)_6]$ complex is _____.

(a) d^2sp^2

(b) d^2sp^3

(c) dsp^2

(d) sp^3

(ii) The oxidation state of metal ion in $[Mn(CN)_6]^{3-}$ complex ion is _____.

(a) +2

(b) 0

(c) +3

(d) +4

(iii) The restoring force per unit displacement is called as _____.

(a) Gas constant

(b) Velocity constant

(c) Force constant

(d) None of the above

11. (p) Draw Jablonski diagram and explain radiative transitions. 4

(q) Define "quantum yield" ? Explain the function of uranyl oxalate actinometer in the determination of quantum yield. 4

(r) 0.003 m solution of a substance transmits 75% of incident light if the path length is 1 cm. Calculate the extinction coefficient and percent absorption for a 0.01 m solution. 4

UNIT–VI

12. (a) What is electromagnetic spectrum ? Give approximate wavelength limits in nm for UV, visible and IR regions. 4

(b) Explain the origin of Stoke's and Antistoke's line in the Raman spectrum on the basis of quantum theory. 4

(c) For HCl, the frequency difference between successive absorption lines has been found to be 20.7 cm^{-1}. Find the bond length for HCl molecule in the rotational spectrum. mH = 1.08 amu; mCl = 35.5 amu. 4

OR