13. (p) Derive $I = ur^2$ for diatomic rigid rotator. 5

(q) Show that spacing between two successive lines in rotational spectrum of diatomic molecule is always constant. 6

(r) State the selection rule for pure vibrational transition. 1



**AP–491**

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

**CHEMISTRY (Old)**

Time—Three Hours] [Maximum Marks—80

**Note :**—(1) Question No. **1** is compulsory.
(2) Solve **ONE** question from each Unit.
(3) Draw diagrams and give equations whenever necessary.
(4) Use of calculator is allowed.

1. (A) Fill in the blanks :

(i) The distance travelled by the wave in one second is called _____ of the wave.

(ii) The co-ordination number of central metal ion in $[Cu(NO_2)_6]^{3+}$ is _____.

(iii) Pyrrole is a _____ membered ring compound.

(iv) For a molecule to be microwave active, it must possess _____ dipole moment. 2

(B) Select the correct alternative :

(i) Raman effect is based on phenomenon of :

(a) Reflection (b) Refraction

(c) Diffraction (d) Scattering

(ii) Which of the following is Einstein photoelectric effect equation :

(a) $E = Nh\nu$

(b) $\frac{1}{2} mv^2 = h\nu - h\nu_0$

(c) $E = Nh\nu_0$

(d) $\nu = C/\lambda$

(iii) The oxidation state of central metal ion in $[CO(NO_2)_6]^{3-}$ is :

(a) +3 (b) –3

(c) +2 (d) Zero

(iv) The monomer unit of polymer polyvinyl chloride is :

(a) 1,4-Butadiene (b) Isoprene

(c) Ethylene (d) Vinyl Chloride

2

(C) Answer in **one** sentence :

(i) Name the chromophore present in the methyl orange dye.

(ii) Write the Schrodinger wave equation in one dimension.

(iii) What is effective atomic number ?

(iv) Define Chelate. 4



(b) What is compton effect ? State the expression for compton shift. 4

(c) What is the product of uncertainity in position and velocity for an electron of mass $9.11 \times 10^{-31}$ kg according to Heisenberg uncertainity principle. 4

**OR**

11. (p) Derive Schrodinger wave equation in one dimension. 5

(q) What is photoelectric effect ? Give the observations of photoelectric experiment. 4

(r) Calculate de-Broglie's wavelength of electron moving with a velocity of $1.20 \times 10^5 ms^{-1}$. 3

## UNIT—VI

12. (a) Explain formation of stokes and antistokes lines on the basis of quantum theory. 4

(b) Draw energy level diagram of a molecule indicating electronic, vibrational and rotational transitions. 4

(c) The microwave spectrum of HI molecule consists of a series of equidistant lines with spacing of 12.8 $cm^{-1}$. Calculate the band length for HI ($m_H$ = 1 amu, $m_I$ = 127 amu). 4

**OR**

(s) Complete the following reaction :

(i)  $+ NaNO_2 \xrightarrow[373\ K]{Liq\ NH_3} ? + ?$

(ii)  $+ HNO_3 \xrightarrow[573\ K]{Conc\ H_2SO_4} ? + ?$ 2

## UNIT—IV

8. (a) What is natural rubber ? Explain vulcanisation process. 4

(b) Give preparation and uses of crystal violet. 4

(c) Define with example :

(i) Analgesic

(ii) Antipyretic. 4

**OR**

9. (p) Give preparation and uses of Nylon 6,6. 4

(q) Give preparation and uses of sulphaguanidine. 4

(r) What are insecticides ? How does it differ from pesticide ? 4

## UNIT—V

10. (a) What do you mean by Black body radiation ? How does the wavelength of black body radiation depend on temperature ? 4



## UNIT—I

2. (a) Calculate EAN of Ni in $[Ni(en)_3]^{2+}$ ion.

(Given : At. no. of Ni = 28) 2

(b) Write geometrical isomers of complex type $[Ma_2b_2c_2]^{n\pm}$. 2

(c) Calculate unpaired electron and magnetic moment of following complex ion :

(i) $[Cr(NH_3)_6]^{3+}$

(ii) $[CO(NO_2)_6]^{3-}$. 4

(d) Discuss the application of chelates in :

(i) Gravimetric analysis

(ii) Colorimetric analysis. 4

**OR**

3. (p) Write the correct formulae of the following complexes :

(i) Pentammine nitrito (N) Cobalt (III) chloride

(ii) Tetracyanoorgentate (III) ion. 4

(q) Explain hybridisation and structure of $[Fe(CN)_6]^{3-}$ ion on the basis of VBT. 4

(r) Write geometrical and optical isomer of complex type $[M(AA)_2a_2]$ and explain optically active and inactive isomer of same type complex. 4

## UNIT—II

4. (a) Explain crystal field splitting in square planer complex. 4

(b) Explain different selection rule for d-d transitions. 4

(c) How electrons are distributed in $t_{2g}$ and eg orbitals in octahedral complex with following configuration :

(i) $d^6$ (high spin complex)

(ii) $d^6$ (low spin complex). 4

**OR**

5. (p) Calculate CFSE of octahedral complex with following configuration :

(i) $d^4$ (strong ligand field)

(ii) $d^4$ (weak ligand field). 4

(q) Calculate ground state term symbol of following complex ion :

(i) $[Fe(CN)_6]^{4-}$

(ii) $[Cr(NH_3)_6]^{3+}$. 4

(r) Explain crystal field splitting in tetrahedral complex. 4



## UNIT—III

6. (a) How can you synthesise pyrrole from :

(i) Acetylene

(ii) Succinaldehyde. 4

(b) Why pyridine is more basic than aniline ? 4

(c) Complete the following reaction :

(i) $CH_3 - Mg - Br + Cl - \overset{O}{\overset{\|}{C}} - O - C_2H_5 \rightarrow ? + ?$

(ii) $CH_3Mg - I + Cl - CN \rightarrow ? + ?$ 4

**OR**

7. (p) Define the following :

(i) Synthons

(ii) Synthetic equivalence. 2

(q) How can you synthesise the following from methyl lithium :

(i) Acetic acid

(ii) n-propyl alcohol. 4

(r) Why pyrrole undergoes electrophilic substitution reaction at position 2 rather than 3. 4