



BCF-003-001505

Seat No. _____

B. Sc. (Sem. V) (CBCS) (W.E.F. 2012) Examination

August – 2021

C - 501 : Chemistry

(Inorganic Chemistry and industrial Chemistry)

(Old Course)

Faculty Code : 003

Subject Code : 001505

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

- Instructions :** (1) All questions are compulsory.
(2) Q. 1 carries 20 marks.
(3) Q. 2 and 3 carries 25 marks each.

1 Answer the following : 20

- (1) What is an operator ?
- (2) For zero point energy, the value of n is _____.
- (3) Give equation of orthogonality condition.
- (4) How many nodal point are present inside the box for the state with wave function Ψ_n where $n=4$?
- (5) Give the full form CFSE.
- (6) Give the equation to calculate CFSE for octahedral crystal field.
- (7) Calculate magnetic moment of $[\text{Mn}(\text{H}_2\text{O})_6]^{+2}$.
- (8) Which carbonyls are prepared by the direct method ?
- (9) What is doubly bridging CO group ?
- (10) Shape of $\text{Fe}(\text{CO})_5$ is _____
- (11) Give the name and formula of C_3S .
- (12) Give the full form of RCC.
- (13) Define water proof cement.
- (14) Write primary nutrients of fertilizers.
- (15) Write the structure of urea and ammonium carbamate.
- (16) Give the name $3[\text{Ca}(\text{H}_2\text{PO}_4)_2]$ fertilizers.

- (17) Give the use of glycerol.
 (18) Give the name of compound obtain from propylene.
 (19) Complete it $CH_4 + H_2O \rightleftharpoons \underline{\hspace{2cm}} + \underline{\hspace{2cm}} + \Delta H$
 (20) Which catalyst used for preparation of ethylene glycol from ethylene.

2 (A) Answer any **three** : 6

- (1) Define and explain multiplication of operator.
- (2) Explain communication operators.
- (3) What is splitting energy ? List only the factors affecting splitting energy.
- (4) Define high spin and low spin complex.
- (5) Give any one method for the preparation of metal carbonyls with example.
- (6) Give two chemical properties of metal-carbonyls.

(B) Answer any **three** : 9

- (1) Explain energy levels in one dimensional box system.
- (2) Explain the term Hamiltonian operator.
- (3) Calculate CFSE and magnetic moment for $[Fe(H_2O)_6]^{+2}$ where $\Delta_o = 13700 \text{ cm}^{-1}$ and pairing energy is 30000 cm^{-1} .
- (4) Splitting of d-orbitals in tetrahedral ligand field.
- (5) Give reaction for preparation of $Fe_3(Co)_{12}$ and draw its molecular structure.
- (6) Give a short note on metal complexes with neutral NO.

(C) Answer any **Two** : 10

- (1) Define orthogonal and normalized wave functions. Prove that normalized wave function Ψ_m and Ψ_n are orthogonal to each other where

$$\Psi_m = \sqrt{\frac{2}{a}} \sin \frac{n\Omega x}{q}; \Psi_n = \sqrt{\frac{2}{a}} \sin \frac{n'\Omega x}{a} \text{ and } 0 < x < a.$$

- (2) Write Schrodinger's equation in polar coordinate and derive R, θ, ϕ equations by variable separation.

- (3) Discuss splitting of d-orbitals in octahedral ligand field.
- (4) Describe classification of metal-carbonyls with types of cgroups.
- (5) Write a short note on structure $\text{Ni}(\text{CO})_4$.

3 (A) Answer any **three** : 6

- (1) Explain Mortar.
- (2) Give the uses of cement.
- (3) Write the natural elements and micro nutrients for plants.
- (4) Classify fertilizers according to method of use.
- (5) Give only reaction of glycerol via allyl chloride.
- (6) Give the all chemical reactions manufacturing of glycerol.

(B) Answer any **three** : 9

- (1) Derive the difference between dry and wet process of cement.
- (2) Explain concrete and RCC.
- (3) Give the process flow diagram of mono-ammonium phosphate in detail.
- (4) Give the flow diagram of manufacture of ammonium sulphate from gypsum.
- (5) Draw the diagram for production of chlorinated hydrocarbons.
- (6) Give manufacture of ethylene glycol from ethylene.

(C) Answer any **two** : 10

- (1) Explain manufacturing process of portland cement with reactions and diagram.
- (2) Write a note on properties of cement.
- (3) Write a note on potassium fertilizers.
- (4) Discuss production of NPK fertilizer with flow diagram.
- (5) Discuss the manufacture process of synthetic gas from methane with diagram.