



**BCF-003-1015005**

Seat No. \_\_\_\_\_

**B. Sc. (Sem. V) (CBCS) (W.E.F. 2016) Examination**

**August - 2021**

**C - 501 : Chemistry**

*(Inorganic Chemistry and industrial Chemistry)*

*(New Course)*

**Faculty Code : 003**

**Subject Code : 1015005**

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

[Total Marks : 70

**Instructions :** (1) There are ten questions. Answer any five questions.

(2) All questions carry equal marks (14 marks)

(3) Figure to the right indicates full marks.

1 (A) Answer the following questions : 4

(1) What is zero point energy ?

(2) Give the equation of Hamiltonian operator for a particle in one dimensional system.

(3) Give equation of orthogonality condition.

(4) Define operator.

(B) Explain multiplication of operator. 2

(C) Explain Hamiltonian operator. 3

(D) Discuss in detail particle moving in one dimensional box. 5

2 (A) Answer the following questions : 4

(1) Give the operator of addition

(2)  $\hat{A} = \log_e$  &  $\hat{B} = \frac{d}{dx}$ ,  $f(x) = x^2$  then  $(\widehat{A+B})f(x) =$

(3) What is linear operator ?

(4) Write down  $\nabla$  and  $\nabla^2$ .

- (B) Define subtraction of operators. **2**
- (C) What is degeneracy ? Calculate degeneracy of energy **3**  
level, where  $E = \frac{144^2}{8ma^2}$  in cubic box of length a.
- (D) Give the schrodinger equation in polar coordinates **5**  
and derive  $R, \theta, \phi$  variable separation.
- 3** (A) Answer the following questions : **4**
- (1) From  $[\text{Ni}(\text{CN})_4]^{2-}$  and  $[\text{Ni}(\text{Cl})_4]^{2-}$  which one is diamagnetic.
  - (2) Who explained the magnetic properties of complexes using CFT ?
  - (3) Give the equation of CFSE for tetrahedral field in terms of  $\Delta_t$  and  $\Delta_o$  both.
  - (4) Give the equation for calculate  $\mu_s$ .
- (B) Give the factors affecting splitting energy. **2**
- (C) Write short note on splitting of d-orbital in tetrahedral field. **3**
- (D) Discuss about the contribution of orbital angular momentum towards the magnetic momentum of 3d-metal complex. **5**
- 4** (A) Answer the following questions : **4**
- (1) For  $n = 2$ ; what is  $\mu_s$  ?
  - (2) Calculate CFSE for  $d^1$  system in octahedral ligand field.
  - (3) Give the full form of CFSE.
  - (4) An atom or group of atoms that donate its lone pair of electrons into metal orbitals is known as \_\_\_\_\_.
- (B) Give the splitting of d-orbitals in presence of octahedral and tetrahedral ligand field by figure only. **2**
- (C) Explain the strength of ligands. **3**
- (D) Discuss splitting of d-orbitals in octahedral ligand field. **5**

- 5 (A) Answer the following questions : 4
- (1) Define  $\Omega$  – acid ligands.
  - (2)  $\text{Ni}(\text{CO})_4$  is \_\_\_\_\_ in shape by \_\_\_\_\_ hybrids.
  - (3) Give the full form of RCC.
  - (4) What is slag cement ?
- (B) Explain the classification of metal carbonyls. 2
- (C) Give the difference between dry and wet process of cement. 3
- (D) Write short note on structure of  $\text{Fe}(\text{CO})_5$ . 5
- 6 (A) Answer the following questions : 4
- (1) Define metal nitrosyls.
  - (2) Which type of hybridization in  $\text{MN}_2(\text{CO})_{10}$  ?
  - (3) Define water proof cement.
  - (4) Give the name and formula of  $\text{C}_3\text{S}$ .
- (B) Give the uses of cement. 2
- (C) Give the reaction for preparation of  $\text{Fe}_3(\text{CO})_{12}$  and draw the molecular structure. 3
- (D) Discuss about types of cement. 5
- 7 (A) Answer the following questions : 4
- (1) Define fertilizers.
  - (2) Give the full form of DAP.
  - (3) What is complete and incomplete fertilizer
  - (4) Write secondary nutrients of fertilizers.
- (B) What is the effect of deficiency of N and P on plant growth ? 2
- (C) Give the process flow diagram of manufacture of ammonium sulphate from gypsum. 3
- (D) What is phosphate fertilizer ? List their names and describe manufacturing of any one of them. 5
- 8 (A) Answer the following questions : 4
- (1) What is micro nutrient ?
  - (2) Write primary nutrients of fertilizers ?
  - (3) Write the formula (structure) of triple super phosphate.
  - (4) Give the name of natural inorganic fertilizers.
- (B) Give the classification of fertilizers according to its sources. 2

- (C) List potassium fertilizer and give chemical reaction involved in manufacturing of  $\text{KNO}_3$ . **3**
- (D) List nitrogenous fertilizers and discuss production method of ammonium sulphate by sindri process with its action as fertilizer. **5**
- 9** (A) Answer the following questions : **4**
- (1) Define glass.
- (2) Which compounds are used for decolourise glass ?
- (3) Give the chemical formula of cryolite.
- (4) What is cullet ?
- (B) Give the physical properties of glass. **2**
- (C) Describe photochemical glass. **3**
- (D) Discuss about the manufacturing process of glass. **5**
- 10** (A) Answer the following questions : **4**
- (1) What is annealing ?
- (2) Give the name of chief ingredient of glass.
- (3) Write two oxidizing agents used in glass manufacturing.
- (4) Write the chemical structure of Dolomite.
- (B) Give the properties of borosilicate glass. **2**
- (C) Give the chemical reactions involved in glass manufacturing. **3**
- (D) Define glass. List the raw materials for glass with their functioning and importance. **5**
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