## B. Sc. (Sem. V) (CBCS) Examination

### October - 2017

## C - 501 : Inorganic & Industrial Chemistry

### Faculty Code : 003
### Subject Code : 001505

Time : $2\frac{1}{2}$ Hours]                              [Total Marks : **70**

**Instructions :** (1)   Questions one contains 20 short questions of one mark each. All are compulsory.

(2)   Questions 2 and 3 carries 25 marks each with internal options.

(3)   Write answers of all question in main answer sheet.

**1**    Answer the following questions :                              **20**

(1)   Let operator $\hat{A} = \dfrac{d}{dx}$ and $f(x) = \sin x,$   then

$\hat{A}^2 f(x) =$ ————————

(2)   What is DEL operator?

(3)   What is Degeneracy?

(4)   Write condition for orthogonal wave functions.

(5)   Why the splitting energy for Td complexes is less compared to Oh complexes?

(6)   In Td field, give angle between two e-orbitals and central metal and ligands and three $t_2$-orbitals and central metal and ligands.

(7)   Why s-orbital and p-orbital is not affected by ligand field?

(8)   Give Point group of $\left[ Fe(CO)_5 \right]$

(9)   Give example for metal nitrosyl compound containing neutral NO molecule.

(10) Write observed IR stretching frequency of $\left[ Fe(CO)_5 \right]$.

(11) Give any one name of floating agent used in cement rock beneficiation.

(12) Write formula and name of $C_3A$

(13) Which metal oxide is used for black and red colour cement?

(14) Give any two names of natural inorganic fertilizers.

(15) Complete the reaction and give name of product

$2\,NH_3 + CO_2 \rightarrow$ ————————

(16) Write only names of potash fertilizers.

(17) Complete the reaction

Calcium phosphate $+ 4H_3PO_4 \rightarrow$ —————————

(18) What is used as fire extinguisher or dry cleaning clothes?

(19) Write systematic name of Allyl alcohol

(20) Give structure of Acrolein

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

(1) Prove that; following wave function is a 'solution

of $\dfrac{d^2\Psi}{dx^2} + \alpha^2\,\Psi = 0$   $\Psi = A\sin\alpha\,x + B\cos\alpha\,x$

(2) Draw only structure of $\left[ Fe_3(CO)_{12} \right]$ complex.

(3) Draw the sketch of five d-orbitals.

(4) Define with example: $\pi$-Acid Ligands.

(5) Find out magnetic moment for $\left[ Ni(Cl)_4 \right]^{2-}$ complex.

(6) Let $\hat{A} = \log_e$, and $\hat{B} = \dfrac{d}{dx}$ and $f(x) = x^2$, then

$\left( \hat{A} + \hat{B} \right) f(x) = ?$  Calculate.

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

(1) Prove that in equation $\dfrac{d^2\phi}{d\phi^2} + m^2\phi = 0$ where "m" is magnetic quantum number.

(2) If $\hat{A} = \dfrac{d}{dx}$ and $\hat{B} = \dfrac{d^2}{dx^2}$ and $f(x) = \sin x$ then $\hat{A}$ and $\hat{B}$ is commuted or not? Prove it.

(3) Explain types of CO (carbonyls) group in metal carbonyls.

(4) Give electronic configuration with hybridization for $\left[ Mn_2(CO)_{10} \right]$ and draw its molecular structure.

(5) Why the splitting energy increases with the increase in principal quantum number of d-orbital in the complexes of same group metals ? Give reason with example.

(6) Calculate CFSE for $\left[ Fe(CN)_6 \right]^{4-}$ where splitting energy of d-orbitals is 32000 $cm^{-1}$ and pairing energy is 16500 $cm^{-1}$.

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

(1) Write Schrödinger equation in polar coordinate and derive R, $\Theta$ and $\Phi$ equations by variable separation method.

(2) Explain splitting of d-orbitals in tetrahedral ligand field with CFSE.

(3) Discuss high spin and low spin complexes with pairing energy.

(4) Discuss structure of $\left[ Co_2(CO)_8 \right]$ with hybridization.

(5) Calculate the C–C bond- length in 1,3-butadiene where absorption band is observed at 1100 $\overset{\circ}{A}$. [where, $m = 9.1 \times 10^{-28}$ gms and $h = 6.62 \times 10^{-27}$ erg-sec.]

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

(1) Write the names of water proofing agents added to make water proof cement.

(2) What is Sorel's cement? Write formula of Sorel's cement.

(3) What are different products obtained from methane? Write use of Methylene chloride.

(4) Give names and formulas of mono and diammonium phosphate.

(5) Give reaction for catalytic hydration process of Ethanol.

(6) Complete the following reactions

$$4 \, KCl + 4 \, HNO_3 + O_2 \rightarrow$$

$$NH_3 + H_3PO_4 \rightarrow$$
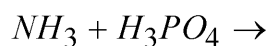
(B) Answer any **Three** :                                                    9

(1) What are ISI specifications of cement?

(2) Give the difference 'between Dry and Wet process of cement.

(3) Explain manufacturing process of ammonium sulphate from gypsum.

(4) Write short note on, role of micronutrients in plant growth.

(5) Explain method of manufacturing of ethylene glycol from ethylene by ethylene chlorohydrins.

(6) Give production of synthetic gas from methane.

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

(1) Explain mortars, concrete and RCC.

(2) Explain the production of calcium cyanamide with diagram

(3) Explain in brief classification of fertilizers.

(4) Explain with reaction: Synthesis of $C_2H_5OH$ from $CH_2 = CH_2$ by $H_2SO_4$ process.

(5) Describe the manufacture of $CH_2 = CH - CN$ from $CH_2 = CH - CH_3$ with diagram.

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