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M.Sc. Chemistry (Semester-II) Examination 2025
Paper Title: Inorganic Chemistry-II
Paper Code: MCHCC – 203

Time 2 Hours

Maximum Marks 60

Note: This paper has 3 sections A, B, and C, Attempt all the three sections

Section A: Answer all the questions; Section B: Answer any 2 out of 4; Section C: Answer all the questions, each question has an internal choice.

Abbreviations Used:

CLO- Course Outcome, PLO- Program Outcome, BTL- Bloom Taxonomy Level: BT level 1-Remember; BT level 2-Understand; BT level 3-Apply; BT level 4-Analyse; BT level 5-Evaluate, BT level 6-Create

SECTION A

Very short type questions (Attempt all)

(10x1.5 = 15Marks)

Q. No.	Question	BTL	CLO	PLO
A1	Identify the 3d transition metal in $[M((\eta^5-C_5H_5)(CO)_4)]$ complex using 18 electron rule.	2	1	2
A2	Using 18-electron rule, calculate the unknown value in $[(\eta^3-C_5H_5)Mn(CO)_x]_2$ while complex contains double bonds between metals.	2	2	2
A3	Calculate the value of x in $[Ni(CO)_4]^x$ while complex follow 18 electron rule.	3	3	2
A4	What do you understand by siloxane? Discuss the synthesis and draw the structure.	2	2	2
A5	What is the general formula for heteropoly anions? Discuss each term.	3	3	3
A6	If molecules do not have any operation, then what will be the point group?	4	3	3
A7	Write the result by the multiplication of axis with perpendicular plane.	3	2	2
A8	Discuss the effect of temperature on insulator, semiconductor and conductor.	1	1	2
A9	Draw the ^{31}P NMR spectrum of $HFPO(OH)$ if $J_{P-F} > J_{P-H}$.	4	4	4
A10	Draw the normal modes of vibrations of CO_2 .	3	3	3

SECTION B

Long type questions (Attempt any two out of four)

(10x2 = 20)

Q. No.	Question	BTL	CLO	PLO
B1	i. Discuss the synthesis and properties of the metal carbonyl compounds. ii. Complex follows 18-electron rule. Calculate the total Co-Co bonds and per Co bonds in $\text{Rh}_4(\text{CO})_{12}$.	3	3	3
B2	What do you understand by intercalation? Discuss in brief some intercalation compounds. Explain the various intercalations in graphite and discuss their applications.	6	5	3
B3	Draw the Character table of C_{2v} point group using all four postulates whereas the symmetry elements are E, $1C_2(z)$, $1\sigma_v(xz)$ and $1\sigma_v(yz)$.	6	6	5
B4	Calculate the hyperfine lines in ESR spectrum of $^1\text{CF}_2\text{H}$ and $^{13}\text{CF}_2\text{H}$	4	3	3

SECTION C

Short type questions. (Attempt all the questions)

(5x5 = 25)

Q. No.	Question	BTL	CLO	PLO
⁴ C1	Find out the geometry of $\text{Ni}_5(\text{CO})_{12}^{2-}$. OR What do you understand by hapticity? Discuss the hapticity of 'allyl' and 'cyclopentadiene'.	3	3	2
C2	What do you understand by hetero catenation? Discuss in brief the compounds resulting from hetero catenation. OR Discuss the synthesis and properties of hexachlorocyclophosphazene and discuss the Craig and Paddock model to explain the pi bonding in it.	3	3	2
C3	Explain the diamagnetic and paramagnetic effects on ^1H NMR. OR Discuss the effect of s and p electron density on the isomer shift of Sn and Fe.	5	5	4
C4	Explain Mulliken's symbol T_{1u} , B'_{2g} and E'_{1g} . OR Derive the equation for the nearest neighbour and radius of the particles in SCC, FCC and BCC.	5	4	3
C5	Draw the catalytic cycle of the Wacker process for the oxidation of alkenes to aldehydes. OR Discuss the polymerisation of propene using the Ziegler-Natta catalyst.	4	4	4