P.B.SIDDHARTHA COLLEGE OF ARTS & SCIENCE

DEPARTMENT OF CHEMISTRY

M.Sc – CHEMISTRY (ORGANIC CHEMISTRY)

II SEMESTER

W.E.F 2022-23 (R22 Regulations)

Title of the Paper: ADVANCED INORGANIC CHEMISTRY

Course Code	**22CH2T1**	Course Delivery Method	Class Room / Blended Mode - Both
Credits	4	CIA Marks	30
No. of Lecture Hours / Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction :2017- 18	Year of Offering:	Year of Revision:	Percentage of Revision: 0 %

S.No	COURSE OUTCOMES	PO`S
	After completion of the course, the student will be able to :	
1	Memorize the fundamental concepts of Metallic & non metallic clusters, Inorganic reaction mechanisms, organo metallic chemistry, electronic spectra & magnetic properties of complexes and bioinorganic chemistry.	2,7
2	Comprehend the basic and advanced concepts of metallic & non metallic clusters, Inorganic reaction mechanisms, organo metallic chemistry, electronic & magnetic properties of complexes and bioinorganic chemistry.	1,2,6
3	Apply the conceptual knowledge gained in the areas of metallic & nonmetallic clusters, inorganic reaction mechanisms, organo metallic chemistry, electronic & magnetic properties of complexes and bio inorganic chemistry in other fields of chemistry as well as in research.	1,2,7
4	Analyze the role of metallic & non metallic clusters / cages, inorganic Reaction mechanisms, organo metallic chemistry, electronic & magnetic properties of complexes and bio inorganic chemistry in understanding the similarities and differences among the concepts of chemistry.	1,3,2

Syllabus

Course Details:-

Unit	Learning Units	Lecture Hours
I	**Non-metal cages and metal clusters**: Structure and bonding in phosphorous-oxygen, phosphorous-Sulphur cages; structure and bonding in higher boranes with (special reference to B12 icosahedra). Carboranes, metalloboranes, metallocarboranes. Classification- LNCs and HNCs**,** Isoelectronic and Isolobal relationships, electron counting rules: Wade's and Lauher's rules. M-M multiple bonding; preparation, structure and bonding in dinuclear [Re2Cl8] 2- ion, trinuclear [Re3Cl9], tetra nuclear W4(OR)16, hexa nuclear [Mo6Cl8]4+ and [Nb6Cl12]2-.	12
II	**Organometallic chemistry of transition metals:** Classification and electron counting rules, hapticity, synthesis, structure and bonding of Olefinic complexes, Acetylene complexes, ferrocene, dibenzene chromium, cyclo heptatriene and tropylium complexes of transition	12

	metals. Reactions of organometallic compounds - oxidative addition reductive elimination, insertion and elimination. Applications of organometallic compounds, Catalytic hydrogenation, Hydroformylation, alkene polymerization.	
III	**Reaction mechanism of transition metal complexes:** Kinetics of octahedral substitution, acid hydrolysis, base hydrolysis-conjugate base (CB) mechanism. Direct and indirect evidences in favour of CB mechanism. Anation reactions. Reactions without metal-ligand bond cleavage. Factors affecting the substitution reactions in octahedral complexes. Trans effect on substitution reactions in square planar complexes. Mechanism of redox reactions, outer sphere mechanism, cross reactions and Marcus –Hush equation, inner sphere mechanism.	12
IV	**Term symbols and Electronic spectra: Term symbols:** Term symbols and their derivation, Microstates, Hunds rules to predict ground terms and ground states. List of ground energy and higher energy terms from d1 to d9 configurations; **Electronic spectra of transition metal complexes:**Spectroscopic terms. Selection rules, Slator–Condon parameters, Racah parameters, Term separation energies for dn configurations, Orgel diagrams. Tanabe-Sugano diagrams for d1 to d9 configurations. Calculations of Dq, B and β parameters. Charge transfer spectra.	12
V	**Bio-inorganic chemistry and Magnetic properties of complexes:** Storage and transport of dioxygen by Hemoglobin and Myoglobin, Vitamin B12 and its importance. **Magnetic properties of transition metal complexes:**Types of magnetism, factors affecting Para magnetism, anomalous magnetic moments - Orbital and spin contribution, spin-orbit coupling and magnetic moments chiro optical properties, cotton effect and Faraday effect.	12

Text books/ Reference books:

1. Inorganic Chemistry by Huheey. Harper and Row.
2. Concise inorganic chemistry by J. D. Lee, ELBS.
3. Inorganic chemistry, K.F. Purcell and J.C. Kotz, Holt Saunders international
4. Organometallic chemistry by R.C. Mehrotra and A. Singh. New Age International.
5. Advanced Inorganic Chemistry by Cotton and Wilkinson, Wiley Eastern
6. Inorganic reaction mechanism by Basolo and Pearson, Wiley Eastern
7. Bioinorganic Chemistry by K. Hussan Reddy
8. Biological Aspects of inorganic chemistry by A. W.Addiso, W. R. Cullen, D.Dorphin and G. J. James. Weliey Interscience.
9. Photochemistry of coordination compounds by V. Balzaniand V.Carassiti. Academic Press.
10. Text book of Coordination chemistry by K. Soma Sekhara Rao and K.N.K. Vani, Kalyani Publishers.

Course Focus: Employability.

M.Sc. DEGREE EXAMINATION
SECOND SEMESTER
Course Code : 22CH2T1

Paper-I :: Advanced Inorganic Chemistry

Time: 3 hours **Maximum Marks: 70**

SECTION – A **(5x4M=20M)**

1 (a). Write a short note on Phosphorous-Sulphur cages. (CO-2, L-2)

(Or)

(b).Explain the bonding aspects of $[Nb_6Cl_{12}]^{-2}$. (CO-2, L-2)

2 (a).Define hapticity. (CO-1, L-1)

(Or)

(b).Elaborate the classification of organometallic compounds. (CO-1, L-1)

3(a). Derive rate law of Anation reaction. (CO-2, L-2)

(Or)

(b). Write note on complementary and non-complementary reactions. (CO-2, L-2)

4(a). Discuss how Hund's rules can be used to predict ground terms. (CO-2, L-2)

(Or)

(b). Derive the ground term of d^3 and d^9 metal ions. (CO-3, L-3)

5(a). Give a short account on Faraday Effect. (CO-2, L-2)

(Or)

(b).Deliberate the effect of spin orbital coupling on magnetic moments. (CO-3, L-3)

SECTION – B **(5x10M=50M)**

UNIT - I

6.(a) Describe the bonding and structure in higher boranes and Metalloboranes. (CO-2, L-2)

(Or)

(b) Discuss the structure and bonding in $[Re_2Cl_8]^{2-}$ ion. (CO-2, L-2)

UNIT – II

7.(a) Elucidate the applications of organometallic compounds in catalytic hydrogenation and hydro formylation. (CO-3, L-3)

(Or)

(b) Explain oxidative addition, reductive elimination reactions of organometallic compounds. (CO-2, L-2)

UNIT – III

8.(a) Explain the outer sphere mechanism of redox reactions. (CO-2, L-2)

(Or)

(b) Discuss the direct and indirect evidences in favour of conjugate base mechanism. (CO-3, L-3)

UNIT - IV

9.(a) Discuss the calculation of D_q and β parameters. (CO-3, L-3)

(Or)

b) Draw the orgel diagram and Tanabe Sugano diagram for d^2 and d^9 configuration and explain. (CO-2, L-2)

UNIT - V

10.(a) Discuss the storage of dioxygen by myoglobin and write its importance. (CO-2, L-2)

(Or)

(b) Describe the factors affecting para magnetism. (CO-2, L-2)