Course Code	Course Title	C	H	I	E	T
17P3CMC8	INORGANIC CHEMISTRY-III	4	4	25	75	100

UNIT I INTRODUCTION TO CO-ORDINATION CHEMISTRY 12 Hrs

Introduction – IUPAC nomenclature- co-ordination numbers- Isomerism- structural, geometrical and optical isomerism in square planar and octahedral complexes. Chelating ligand, chelate effectand its application, stability of complexes – complex equilibria – determination of stability constant- Spectrophotometric- Job's variation - Potentiometric methods. factors affecting stability constants. Irving-William series.

UNIT II THEORY OF CO-ORDINATION COMPONDS. 12 Hrs

Valence bond theory. Crystal field splittings in octahedral, tetrahedral, square pyramidal, trigonal bipyramidal and square planar geometries-Consequences of crystal field splitting on thermo dynamic, magnetic and spetroscopic properties. Applications of CFT, spectrochemical series-Nephelauxetic effect. Jahn-Teller effect. Inadequacy of CFT. The molecular orbital theory-octahedral, tetrahedral and square planar geometries. Experimental evidences for covalence in metal-ligand bonding.

UNIT III ELECTRONIC SPECTRA OF COMPLEX 12 Hrs

Atomic Term Symbol: Ground and higher states — methods of determining ground state term and complete terms –Pigeon hole diagram and Russel-Saunder microstates method for p^2 and d^2 configuration - term symbols for non- equivalent electrons.

A detalied survey of the electronic spectra of octahedral,tetrahedral and square planar complexes of transition metals-(i) effect of spin orbit coupling ii) Jahn-Teller distortions and its effect on the structure and spectrum , the nephelauxetic effect and the nephelauxetic series-Calculation of Dq,B,C from the spectrum. Orgel and Tanabe-Sugano diagrams and evaluation of 10Dq and beta for octahedral complexes of d^3, d^8 and tetrahedral complexes of d^2, d^7 configurations. Charge transfer spectra of complexes-ligand to metal, metal to ligand types and metal to metal type.

UNIT 1V NUCLEAR MAGNETC RESONANCE 12 Hrs

^{1}H,^{13}C,^{19}F and ^{31}P – NMR. Applications to inorganic compounds - NMR of paramagnetic complexes. Contact and pseudo contact interactions- structures of metal complexes-shift reagents structural problems of the compounds like $CFCl_3$, SF_4, PF_5, BrF_5, H_2PF_3, $PF_3(NH_2)_2$, P_4S_3, *mer* and *fac*- $Rh(PPh_3)_3Cl_3$, *cis* and *trans*-$[PtCl_2(PBu_3)(PPh_3)_3]$. Fluxional behavior of complexes.

Electron spin resonance: Spin-Hamiltonian, ESR phenomenon - hyperfine interactions-spin-orbit coupling- ESR spectra of D and F states in octahedral fields (Zero field splitting and Kramers degeneracy)- determination of the ground states of complexes.EPR spectra of transition metal ions complexes like bis(salicylaldimine)copper(II), $Co_3(CO)_9Se$, $[(NH_3)_5Co\text{-}O_2\text{-}$

$Co(NH_3)_5]^{5+}$, NH_2 radical and Mn^{2+} complexes – representative spectra of different d^n systems – evaluation of spin – orbit coupling.

UNIT V PHOTOELECTRON AND MOSSBAUER SPECTROSCOPY 12 Hrs

PES : Theory of XPES, UVPES – evaluation of ionisation potential – chemical identification of elements – ESCA – Koopmann's theorem – chemical shift – UPES of NH_3, N_2, O_2, CO, H_2O and HCl – vibrational fine structure and their origin – evaluation of vibrational constants from UPES – spin-spin coupling - spin-orbit coupling.

Mössbauer spectroscopy: Discovery - Nuclei suitable for Mössbauer experiment - Hyperfine interactions - isomershifts quadrupole splitting & magnetic hyperfine splitting - temperature effects - applications of Mössbauer spectoscopy to compounds & complexes of Fe & Sn.

Text Book(s):

1. Ballhausen, C.J., Introduction to ligand field theory, Mc GrawHill, New York, 1962.
2. Figgis, B.N., Introduction to ligand fields, John Wiley & Sons Ltd., London and New York 1966.
3. Kettle, S.F.A., Coordination compounds, Thomas Nelson and Sons,. Ltd., London, 1969.
4. Thomas M.Dunnand McClure and Pearson, "Some aspects of crystal theory fields, Harper-Row, New York, 1965.
5. Ballhanusen, C.J.,andHzry.B.Grey, "Molecular orbital theory" A Lecture note ReprintVolume,W. A. Benjamin, Inc. , New York, 1965.
6. Drago, R.S., Physical methods in chemistry,W.B.Saundar, 1977.
7. Cotton, F.A., and Wilkinson, Advanced Inorganic Chemistry,John Wiley & Sons Ltd.,London-New York, 1972.
8. Cotton, F.A., "Chemical Applications of Group Theory", Third Edition, Wiley Eastern Ltd., New Delhi, 2011.
9. Lever, A.B.P., Inorganic electronic Spectroscopy, Second Edition, Elsevier, Amsterdam, Oxford, New York, Tokio 1984.
10. Sutton,D., Electonic spectra of metal complexes, Second Edition McGraw-Hill, New York, 1968.
11.Figgis,B.N., Transition metal chemistry, volume IX, Marcel Uekker, Inc., Basel, 1982;
12. Hill, H. A. O., Day, P., Advanced Inorganic Chemistry, Darl H. McDaniel. J. Chem. Educ. , 1969
13. Ebsworth, E. A., David W. H. Rankin, Cradock**,** S.,Structural methods in Inorganic chemistry, ELBS.,CrcPr I Llc., 1991.
14. Purcell, K.F., Kotz J.C., Saunders W.B., Inorganic chemistry, Saunders College Publishing, Philadelphia, 1980.
15. Mabbs, F. E., Machin, D. J., Magnetism and transition metal complexes, John Wiley & Sons, Incorporated, 1973.

Reference Books:

1. Sutton, D., Electonic spectra of metal complexes, Second Edition, McGraw-Hill, New York, 1968.
2. Hill and Day, Advanced Inorganic Chemistry, First edition, John Wiley & Sons Ltd.,1968.
3. Walker,S., Straughan, B. P. SpectrocopyvolumeI, II & III, chapmen and Hall, 1976.
4. Figgis,B.N.,Transition metal chemistry, volume IX, Marcel Uekker, Inc., Basel, 1982
5. Semen, A. A., Boris M.K., Electron spin resonance, Wiley, 1974
6. Rao,CNR., andFeraro,J R.Inorganic spectroscopy, volume I&II, Academic press, New York, 1971.
7. Carrington, A., McLachlan, A. D. Introduction toMagnetic Resonance, Harper and Row, New York, 1967.
8. Carrington, McLachlan A.D., Introduction to Magnetic Resonance: With Applications to Chemistry and Chemical Physics, Harper& Row, New York ,1979.
9. Boudreaux, F.A., andMuley, L.N., Theory and application of molecular paramagnetism,John Wiley & Sons, Inc., New York, 1976
10. Nakamoto, Infrared and Raman Spectra of Inorganic and Coordination Compounds, Wiley–Interscience, Fourth edition, 1998.
11. Vertes, A., and Burger, K., Mossbauer Spectroscopy, Elsevier, Amsterdam, 1979.
12. Gibbs, T.C., Mossbauer Spectroscopy, Chapman and Hall, London, 1977.
9. F.A. Boudreaux & L.N. Muley: Theory and application of molecular paramagnetism. John – Wiley
10. Nakamoto : Infrared and Raman Spectra of Inorganic & Coordination Compounds Wiley - Interscience IV Edn.
11. A. Vertes & K. Burger Mossbauer Spectroscopy Elsivier
12. T.C. Gibbs Mossbauer Spectroscopy Chapman - Hall