SOLAPUR UNIVERSITY, SOLAPUR

M.Sc.II

Inorganic Chemistry Syllabus

Semester – III.
The students shall opt. three papers and one elective in each specialization.
Theory courses:
Inorganic chemistry: Core papers: ICH-301, ICH-302, ICH-303, ICH-304

Practical courses:
Semester – III

Two practical courses relevant to each Specilization :		**Practicals**
Inorganic Chemistry : ICH- 311 and	ICH- 312,	V&VI

Semester– IV
The students shall opt. three papers and one elective in each specialization.
Theory courses:
Inorganic chemistry: Core papers: ICH-401, ICH-402, ICH-403, ICH-404

Practicals

Two practical courses relevant to each Specialization :		**Practicals**
Inorganic Chemistry : ICH- 411 and	ICH- 412,	VII&VIII

M.Sc-II INORGANIC CHEMISTRY

Paper No-ICH-301, INORGANIC CHEMICAL SPECTROSCOPY

Unit-I

Group Theory [15]

Molecular symmetry, elements of symmetry and symmetry operations, Products of operation, point group, classification of Molecules into point group, reducible and irreducible representation, the great Orthogonality theorem, character table, symmetry aspects of Molecular orbitals.

Unit-II

Electronic absorption Spectroscopy [15]

Term symbols, energies of atomic and Molecular transitions, Selection rule, Morse potential energy diagram, electronic transitions, polarized absorption spectra. Nature of absorption spectra, nature of absorption spectra of transition metal complexes, Orgel diagram, Tanabe Sugano diagram, charge transfer spectra.

Unit-III [15]

A] Infrared and Raman Spectroscopy [9]

Molecular vibrations, force constants, Molecular vibrations and absorption of Infrared radiations Raman Spectroscopy, polarized Raman lines, Use of symmetry considerations to determine the no. of lines in IR and Raman Spectra, Spectra of gases, applications of Raman and Infrared spectroscopy. Selection rule in Inorganic structure determinations, Hydrogen bonding and infrared spectra, metal ligand and related vibrations.

B] Microwave spectroscopy [6]

Basic concept, rotation spectra of simple inorganic compounds, Classification of molecules, rigid rotor model, effect of isotopic substitution on transition frequencies & intensities non rigid rotor, stark effect nuclear and electron spin interaction and effect of external field. Applications of Micro wave Spectroscopy.

Unit-IV [15]

A] Nuclear Magnetic Resonance Spectroscopy [8]

Principle Instrumentation of NMR, the chemical shift, mechanism of electron shielding and factors contributing to the magnitude of chemical shift. Local & remote effect, spin-spin splitting, applications of spin coupling to structural determination, double Resonance techniques. The contact and Pseudo contact shifts Factors affecting nuclear relaxation, an overview of NMR of metal nuclear with emphasis on 195pg & 119sm NMR.

B] Electron & Photo acoustic Spectroscopy [7]

Introduction, principle, Instrumentation and applications of following techniques photo acoustic Spectroscopy (PAS) photo electron Spectroscopy (PES), auger electron Spectroscopy (AES)

Recommended books:

1. K. Burger, Coordination Chemistry-experimental methods, Butterworth's
2. R. Drago: Physical method in Inorganic Chemistry, DUSAP.
3. Hill & Day advanced methods in Inorganic Chemistry, J.Weily
4. F.A. Cotton, chemical application of group theory, Weily eastern
5. Figgis, Introduction to ligand field theory field
6. Schaefer & Gilman: Basic principles of ligand field Theory, J. Wiely
7. P.R. Backer: Molecular symmetry and Spectroscopy A.P.
8. Ferraro Ziomeek, Introduction to Group theory, plenum
9. Soctland Molecular symmetry DVN
10. Dorian: symmetry in Chemistry EWAP
11. Hall: Group theory and symmetry in Chemistry MGLt
12. Nakamoto Infrared R Raman Spectra of Inorganic & Coordination compounds J.Weily
13. Nakanisha: Spectroscopy and structure J. Weily
14. Ferroro: Metal ligand and related vibrations
15. CNR Rao Spectroscopy in Inorganic Chemistry Vol I,II,III
16. Durie: vibrations spectra and structure Vol. I to IV, Elsevier
17. Dudd, chemical Spectroscopy Elsevier
18. Popel : H.N.M.R. Spectroscopy J.Weily
19. R.J. Abraham, J.Fisher and P Loftus Wiley Introduction to NMR spectroscopy.
20. P.K. Bhattacharya: Group Theory & Its Chemical Applications
21. K.V. Reddy: Symmetry & spectroscopy of Molecules.

Paper No. ICH-302: COORDINATION CHEMISTRY – I

UNIT-I

Theories of Metal-Ligand bonding [15]

Molecular Orbital treatment, Octahedral (with and without pi bonding) tetrahedral and square planer complexes in a qualitative manner, comparison of theories of bonding, VBT, CFT, LFT and MOT.

UNIT-II

Structural studies of coordination compounds [15]

Compounds of first transition series elements, with respect to their electronic spectra, magnetic & thermal properties (DTA, TGA)

UNIT-III

Magneto Chemistry [15]

Diamagnetic correction, single & multielectron system, types of the magnetic behaviour, Diamagnetism, Para magnetism, Ferro & Ferri, Antiferro and magnetic interaction, The origin of Para magnetism, Magnetic behavior of complexes, Simplification of Van Velck equation, magnitude of magnetic moments, Determination of magnetic susceptibility by Gouy and faraday method.

UNIT-IV [15]

A] Transition metal complexes & catalysis [8]

Introduction, General Principle, catalysis by transition metal complexes, Hydrocarbons Oxidation by Molecular oxygen, olefin Oxidation, olefin polymerization, olefin hydrogenation, Arene reactions catalyzed by metal complexes, catalysis of condensation polymerization reaction, Current and feature trend in catalysis.

B] Mixed Ligand complexes [7]

Stabilities of ternary complexes, Dynamics of formation of ternary complexes reaction of Coordination ligand in ternary complexes, Mimicking reactions in biological systems, enzyme models, Amino acids ester hydrolysis, peptide synthesis & hydrolysis, Detarbodylation of B keto acids

Recommended Books.

1. Jones: Elementary Coordination Chemistry. J. Weily
2. Graddon: Introduction to Coordination Chemistry. J. Weily
3. Drago: Physical methods of Inorganic Chemistry. J. Weily.
4. Graddon: Introduction to coordination Chemistry, Parasmom
5. Lewis and Wilkins: Coordination Chemistry. J. Weily
6. Msrtel: Coordination Chemistry Vol I, II VNR
7. Earnshaw: Introduction to Magneto Chemistry
8. Mabbs & Machin Magnetism & transition metal complexes Chamman hall
9. Calvin, Magnetic properties of transition metal complexes.
10. L.N. Maley: Magneto Chemistry
11. Datta & Shymlal Elements of Magneto Chemistry
12. Martel & Taqui Khan: homogeneous catalysis with metal complexes Vol.I & II AP.
13. James E. Huheey: Inorganic Chemistry Principles of Structure and reactivity, Harber & Row, Publishers Inc. New York 1972.
14. K.P. Purcell & J.C. Kote: An Introduction to Inorganic Chemistry Holt Sounders, Japan 1980.
15. William L. Jolly: Modern Inorganic Chemistry, Mecgrow Hill USA,1984
16. F.A. Cotton & R.G. Willkinson: Advanced Inorganic Chemistry.

Paper No. ICH 303 : NUCLEAR CHEMISTRY

UNIT-I

Nuclear Structure and Stability [15]

Binding energy, empirical mass equation, The nuclear models, the liquid drop model, the shell model, the Fermi gas model & collective nuclear model, nuclear spin, parity & magnetic moments of odd mass numbers nuclei.

UNIT-II [15]

A] Nuclear reaction. [8]

Introduction, Production of projectiles, nuclear cross section, nuclear dynamics, threshold energy of nuclear reaction, Coulomb scattering, potential barrier, potential well, formation of a compound nucleus, Nuclear reactions, direct Nuclear reactions, heavy ion induced nuclear reactions, photonuclear reactions.

B] Nuclear fission [7]

Liquid drop model of fission, fission barrier and threshold, fission cross section, mass energy and charge distribution of fission products, symmetric and A symmetric fission, decay chains and delayed neutrons.

UNIT-III [15]

A] Reactor Theory - [10]

Nuclear fission as a source of energy, Nuclear chain reacting systems, critical size of a reaction, research reactors, graphite moderated, heterogeneous, enriched uranium reactors, light water moderated, heterogeneous, enriched uranium reactors, water boilers enriched aq. Homogeneous reactors, Thermonuclear reactors, gamma interactions, shielding and health protection. Reactors in India.

B] Nuclear Resources in India [5]

Uranium and Thorium resources in India and their extractions, Heavy water manufacturing in India.

UNIT-IV

Elements of Radiation Chemistry 15]

Radiation Chemistry, Interaction of radiation with matter, Passage of neutrons through matter, Interaction of gamma radiation with matter, Units for measuring radiation absorption, Radiolysis of water, Free radicals in water radiolysis, Radiolysis of some aqueous solutions

Reference Books.

1. Friedlander, Kennedy and Miller, Nuclear and Radio Chemistry: John Wiley
2. B.G. Harvey, Nuclear Chemistry
3. Hassinsky: Translated by D.G. Tuck, Nuclear Chemistry and its application: Addison Wiley
4. B.G. Harvey, Introduction to Nuclear Physics and Chemistry
5. Maeclefort: Nuclear Chemistry: D.Van Nostrand
6. An N.Nesmeyannoy: Radiochemistry: Mir
7. Jacobs et al: Basic Principles of nuclear Science and Reactors, V.Nost & EWAP
8. N.Jay: Nuclear Power Today Tomorrow: ELBS
9. Kenneth: Nuclear Power Today, Tomorrow: ELBS
10. Essentials of Nuclear Chemistry, H.J. Arnikar, John Wiley
11. Nuclear and Radiation Chemistry: B.K. Sharma, Krishna Publication
12. A Introduction to Nuclear Physics: R. Babber. And Puri

Paper ICH 304: ENVIRONMENTAL CHEMISTRY

UNIT-I **[15]**

A] Air Pollution **[8]**

Sources and sinks of gases pollutants, classification & effects of air pollutants on living and nonliving things, Air pollution problems in India, pollution problems in industrial area, global air pollution problems, green house effect, acid rain, ozone depletion and their consequences on Environment. Major air pollution disasters.

B] Water pollution **[7]**

Types, sources and classification of water pollutants, Industrial water pollution, constituents of aquatic Environment, oxygen contents of water and aquatic life, oxygen electrode, and its use, mercury pollution and estimation of organomercurials, industrial water, Effects of water pollutants on life and Environment.

UNIT-II **[15]**

A] Method of control of air pollution **[8]**

Method of control of air pollution, electrostatic precipitation wet & dries scrubber, filters, gravity and cyclonic separation, Adsorption, absorption and condensation of gaseous effluent

B] Method of control of water pollution **[7]**

Water and waste water treatment, aerobic and anaerobic, aeration of water, principle of coagulation, flocculation, softening, disinfection, demineralization and fluoridation.

UNIT-III **[15]**

Sampling & analysis of air and water pollutants.

a) Methods of sampling gaseous, liquid and solid pollutants, analysis of CO, CO_2, NO_2, SO_2,H_2S,CO_2, analysis of toxic heavy metals, Cd, Cr, As, Pb, Cu, Separation of Co, Cu, Mg, Mn, Fe, analysis of SO_4^{-2} P_4^{3-}, NO_3^-, NO_2^-, analysis of total cationic and anionic burdens of water.

b) Pesticide, residue analysis soil pollution, Sources of pesticides residue in the Environment, pesticides degradation by natural forces, effect of pesticide residue on life, Analytical techniques for pesticides residue analysis.

UNIT-IV **[15]**

A] Radiation pollution-classification & effects of radiation, effects of ionizing radiation on man, Effects of non ionizing radiation on life, radioactivity and Nuclear fall out, protection and control from radiation.

B] Environmental toxicology

Chemical solutions to environmental problems biodegradability, principles of decomposition better industrial processes, Bhopal gas tragedy, Chernobyl, three mile island, sewozo and minamata disasters.

Reference Books:

1. Environmental Pollution, A.K. De
2. Air Pollution, Wark & Werner
3. Environmental Pollution Control in Process Industries, S.P. Mahajan
4. Environmental Pollution, B.K. Sharma & H.Kaur
5. Introduction to Air Pollution, P.K. Trivedi
6. Environmental Pollution Analysis, S.M. Khopkar
7. A Text Book of Environmental Pollution: D.D. Tyagi, M. Mehre
8. Environmental Pollution Engineering and Control, C.S. Rao
9. Chemical in the Environment, Satake & M. Midu
10. Environmental Sciences, E.G. Engel
11. Environmental Chemistry, B.K. Sharma & H.Kaur

M.Sc. II Practical Courses SEM - III, Inorganic Chemistry Course ICH - 311 & ICH 312

1. Ore Analysis - 3
2. Alloy Analysis - 3
3. Preparation of coordination complexes
4. Ion exchange study of separation of mixtures & estimations
5. Spectrophotometry
6. Separation & estimation of ions using ion exchange chromatography
7. Nephelometry
8. Potentiometry
9. Conductometry
10. Thermal analysis
11. Magnetic properties of transition metal complexes
12. Spectro Fluorimetry
13. Solvent extraction
14. Nuclear chemistry
15. Soil analysis
16. Data analysis

SEMESTER-- IV

Paper No. ICH - 401, Instrumental Techniques

UNIT-I **[15]**

X-ray & neutron diffraction

a) Fundamentals of x-ray diffraction

Theory of x-ray diffraction, diffraction of x-rays by crystals, determination of crystal structure (powder as well as single crystals), Instrumentation, determination of lattice parameters, x-ray intensity calculations and application of x-rays

b) Introduction to neutron diffraction, theory, Instrumentation and application.

UNIT-II

Thermal method of analysis **[15]**

Thermogravimetriy [TG], differential thermal analysis [DTA], differential Scanning calorimetric [DCS], Thermo mechanical analysis [TMA] Instrumentation and application, thermometric titrations.

UNIT-III **[15]**

Mossbaur Spectroscopy

Introduction to Mossabaur effect, recoilless emission & absorption of x-rays, Instrumentation, isomer shift, Quadrapole splitting and hyperfine interactions, application of Mossbaur effect to the investigations of compounds of iron and tin .

UNIT-IV **[15]**

A] Electron spin Resonance [ESR] **[8]**

Principles of ESR, hyperfine splitting in simple systems, Instrumentation, factors affecting G values, applications to inorganic complexes.

B] Nuclear Quadra pole Resonance Spectroscopy [NQR] **[7]**

Introduction, effects of magnetic field on the spectra, relation between electric field gradient and structure, application of NQR.

Recommended Books:

1. Elements of x-ray diffraction, B.DCullity, Addison Wisley, 1967.
2. Diffraction Method, Wormald, Oxford University, Press, 1973
3. Standard Method of Chemical Analysis IIIA6th end.
4. Neutron Scattering in Chemistry, Baun, G.E. Butleworth, London, 1971.
5. Mossbaur Spectroscopy, Greenwood N.N., Gibbs T.C., Chapmann Hall, 1971.
6. Chemical Application of Mossbaur Spectroscopy, Goldanski V.I & Harber R.H., Academic Press 1968.
7. Spectroscopy in Inorganic Compounds CNR Rao & Ferraro G.R., Academic Press, 1970.
8. Basic Principles of Spectroscopy Cheney R.Mac Grows Hill, 1971.
9. Thermal Method, Wendlandt, W.W. John, Wiley, 1986.
10. Principles of Instrumental analysis, Skoog, III rd edn., Sounders, 1985/

Paper No. ICH-402 CO-ORDINATION CHEMISTRY-II

UNIT-I **[15]**

A] Classification of Inorganic reactions, reaction intermediates, order of a reaction and reaction mechanism techniques to follow rate of reactions, liability of complexes and crystal field interpretation.

B] Substitution reaction, reactions of transition metal complexes, kinetics and mechanism of substitution reactions of octahedral complexes, acid hydrolysis, base hydrolysis, kinetics and mechanism of substitution reaction.

UNIT-II **[15]**

A] Stereo chemical aspects of substitution reaction of Octahedral Complexes, Stereochemical changes in dissociation (SN^2) and displacement (SN^2) mechanism through various geometries of coordination compounds. Isomerization and r-acemization reactions in octahedral complexes.

B] Substitution reaction of labile transition metal complexes

General discussion of some of the metal complexes, the effect of other bonded liquids on rate, reaction in nonaqueous solvents.

C] Mechanism of atom and electron transfer reactions

Key ideas concerning electron transfer, outer sphere electron transfer and inner sphere electron transfer two electron transfer, $[Co(CN)_5]_3$ A redox & catalytic reagent.

UNIT-III **[15]**

Photochemistry

Photochemistry of Coordination compounds, electronically exited states of metal complexes, types of photochemical reactions, substitution reactions, rearrangement reactions, redox reaction, and photochemistry of metallocene.

UNIT-IV **[15]**

Optical rotation and circular dichroism (CD) curves, their use in Coordination Chemistry, principles, optically active molecules, optically rotatory dispersion, circular dichroism, fundamentals, relationship between optically rotatory dispersion (ORD) and circular dichroism (CD) curves.

Recommended Books:

1. F.Basolo & R. Pearsons: Mechanism of Inorganic Reactions: A Study of Metal Complexes in Solution.
2. Obe, M.L. Inorganic reaction mechanism, Nelson, London, 1972.
3. Taube, electron transfer reactions of metal complex ions is solution. Academic Press, 1970.
4. E.S. Tould, Inorganic Chemistry
5. K.F. Purcell & J.C. Kotz, An Introduction to Inorganic Chemistry, Holt Sounder, Japan.
6. V. Balzani & V. Cavassiti, Photochemistry of Coordination compounds, AP, London, 1970.
7. K. Burger, Coordination Chemistry Experimental Methods, Butterworths's
8. K.K. Rastogi & Mukharjee, Fundamentals of photochemistry, Wiley eastern
9. J.G. Calverts & J.N. Pits, Photochemicals of Photochemistry, John Wiley
10. Wells, Introduction to Photochemistry.

Paper No ICH: 403: Chemistry of Inorganic Materials

UNIT-I **[15]**

A] Lattice Defects **[8]**

Introduction to types of Solids, Perfect & imperfect crystals, point defects, Line defect and plane defect defect (definition & explanation of meaning) order & disorder phenomena, thermodynamics of Schottky & frenkel defect formation, Determination of defect, Nonstiochiometric defect (structural and thermodynamic aspects) incorporation of stiochometric excess of defects, thermodynamics of Nonstiochiometric phases.

B] Synthesis of Inorganic materials **[7]**

Synthesis of solid state materials using different techniques ceramic techniques, co precipitation techniques, sol gel techniques, precursor techniques, high temperature & high pressure synthesis.

UNIT-II **[15]**

A] Ionic Conductors

Types of ionic conductors, mechanism of ionic conduction, interstitial jumps, vacancy mechanism, diffusion, super ionic conductors, phase transition & mechanism of conduction in super ionic conductors, examples and applications of ionic conductors.

B] Electronic properties of materials

a) Organic semiconductors, examples, properties and application
b) Superconductivity, superconductivity in metals, alloys and ceramics materials (mixed oxides) BCS theory, Meissner effect, type I & II superconductors, application Fullerenes as superconductors.
c) Dielectric polarization: piezoelectricity and Ferro electricity.
d) Lasers and Masers actions, laser production and application.

UNIT-III **[15]**

A] Magnetic properties of Materials

Introduction, Magnetization, Electron spin and magnetic moment, Theory of diamagnetism, langevins theory & paramagnetic susceptibility of solids, ferromagnetism, Domain theory. Hysteresis in magnetism, ferrimagnetisms (ferries) Applications of magnetic materials.

B] Magnetic Materials

I] Structure and Properties of i) Metal and Alloys ii) Transition metal Oxides iii) Spinels iv) Ilmenites v) Perovskite and vi) Magneto-plumbites. II] Hard and Soft magnetic materials , hysteresis loop and their application in transformer cores, magnetic bubble memory devices for information storage and permanent magnets III] Spin glasses: Formation and characteristics.

UNIT-IV **[15]**

A] Advanced Inorganic Materials **[8]**

Nanotechnology and its business applications, Introduction to nanoscale, Potential applications of nanomaterials, Challenges and opportunities scope of nanotechnology, Commercialization scope Nanotechnology research in 21st century, Basic nanotechnology science and chemistry concepts, basic nanostructures , nanocomposites, Thin films, nanofoam, nanoclusters, smart nanostructures, manufacturing techniques of nanomaterials.

B] Glass, ceramics, Refractory materials **[7]**

Glassy states, Glass formers and glass modifiers, applications, ceramic structures, mechanical properties, clay products, refractory characterization, properties.

Recommended Books

1. Solid State Chemistry: A.H. Hanny
2. C.N.R. Rao, Solid State Chemistry : Dekker
3. Wilcox : Preparation and Properties of Solid State Materials: Vol I & II, Dekker
4. Hagenmuller, Preparative Methods in Solis State Chemistry
5. Lohn Wulff, The Structure and Properties of Materials Vol. IV, Electronic Properties (Wily Eastern)
6. N.N. Greenwood: Ionic Crystals, Lattice Defects and Nonstiochiometry (Butterworth's)
7. L.V. Azoroof and J.J. Brophy: Electronic Processes in Materials, MacGraw Hills.
8. T.J. Rey et al : The Defect Solid State (Interscience)
9. E.A. Kroger, Chemistry of Imprefect Crystals (Holland)
10. A.R. West, Solid State Chemistry
11. H.V.K Keer, Principles of the Solid State Chemistry, Wiley Eastern.
12. S.O. Pillai Academic press: Solid state physics

Paper No. ICH 404: Applied Inorganic Chemistry

UNIT-I

1. Catalysis **[15]**

a) Basic principles, thermodynamics and kinetic aspects, industrial requirements, classification, theories of catalysis, homogeneous & heterogeneous catalysis, reaction catalyzed by transition metal complexes

b) **Organometallic compounds**
Classification of Organometallic compounds based on the nature of metal-carbon bond, Bonding in pi-metal complexes, Aromatic character of Ferrocene, Reaction of ferrocene, Inert gas rule.

c) **Zeolites**, synthesis of different zeolites, characterization, determination of surface acidity, shape, selectivity and application.

UNIT-II

Inorganic Polymers **[15]**

General properties of Inorganic polymers, Types of inorganic polymers, Phosphorus based network polymers, Sulphur –based polymers, Boron- based polymers, Silicon- based polymers, Natural Co-ordination polymers, Chain co-ordination polymers,

UNIT-III

Non conventional sources of energy **[15]**

a) Alternate source of energy

Solar sources: Photochemical methods, thermodynamic efficiency of energy conversion, energy from solar radiations, transition metal complexes for energy production, solar hydrogen system, photochemical processes at semiconductors electrodes, photo galvanic & Photovoltaic cells based on Inorganic photochemical systems.

b) Geothermal energy

c) Energy from biogas

d) Tidal wind sources

e) Energy from fission and fusion reactions.

UNIT-IV

[15]

Introduction to Nano-materials

Definition and types of nano-materials, Importance of nano-materials ,
Size dependent properties, Various techniques for making nano-materials
Applications of nano-materials

Recommended Books:

1. Introduction to Solids- L.V. Azaroff (Tata MaGraw Hill)
2. Principals of Materials Science and Engineering- Willams F. Smith (Wiley, 1991)
3. Heterogeneous catalysis 2nd edn., Bond C. Chapman all (1987)
4. The application & Chemistry of catalysis by suitable transition metal complexes Parashall. W. Weily N. 1980.
5. Homogeneous transition metal catalysis, A general art, Masters C. Chapmann and Hall, London 1981.
6. Introduction to the principles of heterogeneous catalysis, Thomas J.M., Thomas W.J. Academic press N.Y. 1967
7. Inorganic polymers: Mark J.F., Allock H.R. West, Prentice hall
8. Inorganic polymers: Ring N.H., Academic Press N.Y. 1978
9. The Inorganic heterocyclic chemistry of sulphur, nitrogen, phosphorous, Heal A.G. Aca, Press N.Y. 1980.
10. Solar energy Principles of thermal collections and storage, Sukhatme S.P., Tata Macgrow Hill New Delhi 1984.
11. Fuel Cells, Bockeris JOM, Sriniwasan S. and Mac grow Hills 1969
12. Solar Energy Rai C.D.
13. Energy Resources, Simon A.L. 1975
14. Direct Energy Conversion, Addison Wesley, 1970, All M and Kottani S.
15. Outlines in Chemical Technology Vol I, S.D. Sukla & Pandey G.N.

M.Sc. II Practical Courses SEM - IV, Inorganic Chemistry Course ICH - 411 & ICH 412

1. Ore analysis (Three)
2. preparation of coordination compounds(Three) and preparations of mixed metal oxides (two)
3. Ion exchange chromatography; separation of multicomponent mixtures
4. Solvent extraction
5. Spectrophotometry
6. PH Metry
7. Conductometry
8. Polarography
9. Electrogravimetry
10. Nuclear and radiochemistry

B) Interpretation exercises

1. X-ray powder diffraction analysis of cubic compound

a. Determination of lattice constants and geometry
b. Partical Size
c. Density

2. Interpretation of Mossbaur spectrum with reference to determination of a) isomer shift b) quadruple splitting c) Internal magnetic field d) general comment
3. Interpretation of IR spectrum with reference to stretching vibration 0-2 C=N, C=O, N-, M-O
4. Interpretation of NMR spectrum with reference to calculation of chemical shifts and general comments.
5. Interpretation of absorption spectra for

a. Verification of position of ligands in spectrochemical series.
b. Determination of gemetry (Octahedral, square planer, tetrahedral) of a given compound.
c. Calculation of spectral splitting parameters.

6. Interpretation of polar gram for determination of half wave potentials and unknown concentration.
7. Calculation of band gap of semiconductors with the help of plots of log & vs. 10 3/4.