

Ramnarain Ruia Autonomous College



Syllabus for SEMESTER III and IV Program:
M.Sc. (RPSCHEI) Course: Inorganic Chemistry

Credit based semester and grading system with effect from
the academic year 2019-20

M.Sc. Semester III Inorganic Chemistry

Course Code	Unit	Topic	Credits	Lectures
RPSCHEI301	I	Descriptive Crystal Chemistry	4	15
	II	Imperfection in crystals and Non Stoichiometry		15
	III	Methods of Preparations		15
	IV	Behavior of Inorganic Solids		15
RPSCHEI302	I	Bioinorganic Chemistry	4	15
	II	Reactivity of Chemical Species –I		15
	III	Reactivity of Chemical Species –II		15
	IV	Synthesis, Structure and Bonding, and Stereochemistry		15
RPSCHEI303	I	Diffraction Methods-I	4	15
	II	Diffraction Methods-II		15
	III	Electron Spin Resonance Spectroscopy		15
	IV	Mossbauer Spectroscopy		15
RPSCHEIEC-I 304	I	Manufacture and Applications of Inorganic Compounds-I	4	15
	II	Metallurgy		15
	III	Inorganic Pharmaceuticals		15
	IV	Environmental Monitoring and Assessment		15
RPSCHEIEC-II 304	I	Advances in Nanomaterials	4	15
	II	Inorganic Materials		15
	III	Nuclear Chemistry and Some Selected Topics		15
	IV	Safety in Chemistry Laboratories		15
RPSCHEI3P1		Practical	8	16
RPSCHEI3P2				
RPSCHEI3P3				
RPSCHEI3P4				

M.Sc. Semester IV Inorganic Chemistry

Course Code	Unit	Topic	Credits	Lectures
RPSCHEI401	I	Inorganic Materials- Properties-I	4	15
	II	Magnetic Properties		15
	III	Thermal and Optical Properties		15
	IV	Applications of group theory to – Electronic structures		15
RPSCHEI402	I	Organometallic Chemistry	4	15
	II	Applications of Organometallic Compounds		15
	III	Inorganic cluster and cage compounds		15
	IV	Inorganic ring and chain compounds		15
RPSCHEI403	I	Spectroscopy	4	15
	II	Microscopy of Surface Chemistry-I		15
	III	Microscopy of Surface Chemistry-II		15
	IV	Thermal Methods		15
RPSCHEIEC-I 404	I	Intellectual Property - I	4	15
	II	Intellectual Property - II		15
	III	Cheminformatics – I Introduction		15
	IV	Cheminformatics – II Applications		15
RPSCHEIEC-II 404	I	Review of Literature	4	15
	II	Data Analysis		15
	III	Methods Of Scientific Research And Writing Scientific Papers		15
	IV	Chemical Safety & Ethical Handling Of Chemicals		15
RPSCHEI3P1	Practical		8	16

Ramnarain Ruia Autonomous College

M.Sc. Inorganic Chemistry

SEMESTER – III

RPSCHEI301

Credits 4

Paper – I Solid State Chemistry-I

Unit	Topics	Lecture
I	Descriptive Crystal Chemistry	15
	<p>a) Simple structures Structures of AB type compounds (PbO and CuO), AB₂ type (β cristobalite, CaC₂ and Cs₂O), A₂B₃ type (Cr₂O₃ and Bi₂O₃), AB₃ (ReO₃, Li₃N), ABO₃ type, relation between ReO₃ and perovskite BaTiO₃ and its polymorphic forms, Oxide bronzes, ilmenite structure, AB₂O₄ type, normal, inverse, and random spinel Structures.</p> <p>b) Linked Polyhedra</p> <p>i. Corner sharing: tetrahedral structure (Silicates) and octahedral structure (ReO₃) and rotation of ReO₃ resulting in VF₃, RhF₃ and calcite type structures.</p> <p>ii. Edge sharing: tetrahedral structures (SiS₂) and octahedral structures (BiI₃ and AlCl₃). pyrochlores, octahedral tunnel structures and lamellar structures.</p>	
II	Imperfection in crystals and Non- Stoichiometry	15
	<p>a) Point defects: Point defects in metals and ionic Crystal – Frenkel defect and Schottky defect. Thermodynamics formation of these defects (Mathematical derivation to find defect concentration); Defects in non- Stoichiometric compounds, colour centres.</p> <p>b) Line defects: Edge and Screw Dislocations. Mechanical Properties and Reactivity of Solids.</p> <p>c) Surface Defects: Grain Boundary and Stacking Fault. Dislocation and Grain Boundaries, Vacancies and Interstitial Space in Non-Stoichiometric Crystals, Defect Clusters, Interchangeable Atoms and Extended Atom Defects.</p>	
III	Methods of Preparations	15
	<p>a) Methods of Synthesis: Chemical Method, High Pressure Method, Arc Technique and Skull Method (with examples).</p> <p>b) Different methods for single crystal growth:</p> <p>i. Crystal Growth from Melt–: Bridgman and Stockbargar,</p>	

	<p>Czochralski and Vernuil methods.</p> <p>ii. Crystal growth from liquid solution: Flux growth and temperature gradient methods</p> <p>iii. Crystal growth from vapor phase: – Epitaxial growth methods.</p> <p>c) Thin film preparation: Physical and Chemical methods.</p> <p>d) Solid Solutions: Formation of Substitutional, Interstitial and Complex Solid Solutions; Mechanistic Approach; Study of Solid solutions by X-ray Powder Diffraction and Density Measurement.</p>	
IV	Behaviour of Inorganic Solids	15
	<p>a) Diffusion in Solids: Fick’s Laws of Diffusion; Kirkendal Effect; Wagner mechanism, Diffusion and Ionic Conductivity; Applications of Diffusion in Carburizing and non-Carburizing Processes in Steel Making.</p> <p>b) Solid state reactions: General principles and factors influencing reactions of solids, Reactivity of solids.</p> <p>c) Liquid Crystals: Introduction and classification of thermotropic liquid crystals, Polymorphism in liquid crystal, Properties and applications of liquid crystals.</p>	

Ramnarain Ruia Autonomous College

M.Sc. Inorganic Chemistry

SEMESTER – III

RPSCHEI302

Credits 4

Paper – II Bioinorganic and Coordination Chemistry

Unit	Topics	Lecture
I	Bioinorganic Chemistry	15
	<ul style="list-style-type: none"> a) Coordination geometry of the metal ion and functions. b) Zn in biological systems: Carbonic anhydrase, protolytic enzymes, e.g. carboxy peptidase, Zinc finger c) Role of metal ions in biological electron transfer processes: iron sulphur proteins, d) Less common ions in biology e.g. Mn (arginase; structure and reactivity), Ni (urease ; structure and reactivity) e) Biomineralization 	
II	Reactivity of Chemical Species –I	15
	<ul style="list-style-type: none"> a) Recapitulation of the definition of Lewis acids and bases, b) Classification of Lewis acids and bases based on frontier Molecular orbital topology, Reactivity matrix of Lewis acids and bases. c) Group Characteristic of Lewis acids (Gp-1, 13- 17). d) Pauling rules to determine the strength of oxoacids; classification and Structural anomalies. 	
III	Reactivity of Chemical Species –II	15
	<ul style="list-style-type: none"> a) Pourbaix Diagrams. <ul style="list-style-type: none"> i. Amphoteric behavior, Periodic trends in amphoteric properties of p-block and d-block elements ii. Measures of hardness and Softness of Acids and Bases iii. Applications of acid-base Chemistry: Super acids and Super bases, heterogeneous acid-base reactions. iv. Pauling and Drago-Wayland Equation b) Latimer Diagrams c) Frost diagrams 	
IV	Synthesis, Structure and Bonding, and Stereochemistry	15
	<ul style="list-style-type: none"> a) Synthesis of Coordination Compounds <ul style="list-style-type: none"> i. Addition Reactions, ii. Substitution Reactions, iii. Redox Reactions iv. Thermal Dissociation of Solid Complexes v. Reactions in Absence of Oxygen vi. Reactions of Coordination Compounds vii. Trans Effect 	

	<p>b) Structure and Bonding.</p> <ul style="list-style-type: none"> i. Molecular Orbital Theory for Complexes with Coordination Number 4 and 5 for the central ion (sigma as well as Pi bonding) ii. Angular Overlap Model for octahedral and tetrahedral complexes for sigma and pi bond. <p>c) Stereochemistry of Coordination Compounds.</p> <ul style="list-style-type: none"> i. Chirality and Fluxionality of Coordination Compounds with Higher Coordination Numbers. ii. Geometries of Coordination compounds from Coordination number 6 to 9. 	
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Ramnarain Ruia Autonomous College

M.Sc. Inorganic Chemistry

SEMESTER – III

RPSCHEI303

Credits 4

Paper – III Instrumental Methods of Analysis

Unit	Topics	Lecture
I	Diffraction Methods-I	15
	X-Ray Diffraction: Bragg Condition; Miller Indices; Laue Method; Bragg Method; Debye Scherrer Method of X-Ray Structural Analysis of Crystals	
II	Diffraction Methods-II	15

	<p>a) Electron Diffraction: Scattering of electrons, Scattering Intensity versus Scattering Angle, Weirl Measurement Technique, Elucidation of Structures of Simple gas Phase Molecules</p> <p>b) Neutron Diffraction: Scattering of Neutrons: Scattering of neutrons by Solids and Liquids, Magnetic Scattering, Measurement Technique</p>	
III	Electron Spin Resonance Spectroscopy	15
	<p>a) Electron behavior, interaction between electron spin and magnetic field.</p> <p>b) Instrumentation: Source, Sample cavity. Magnet and Modulation coils, Microwave Bridge, Sensitivity.</p> <p>c) Relaxation processes and Line width in ESR transitions: <ul style="list-style-type: none"> i. ESR relaxation and chemical bonding. ii. Interaction between nuclear spin and electron spin (hyperfine coupling) iii. Spin polarization for atoms and transition metal ions, iv. Spin-orbit coupling and significance of g tensors, v. Application to transition metal complexes (having one unpaired electron) including biological systems and to inorganic free radicals such as PH_4, F_2 and BH_3 </p>	
IV	Mossbauer Spectroscopy	15
	<p>a) Introduction to Mossbauer Spectroscopy, Mossbauer theory and parameters.</p> <p>b) Instrumentation: Drive mechanism, sources, detectors, absorber, cosine effect calibration of instrument, conditions for good spectrum.</p> <p>c) Applications: Purity and characterization, detection of structurally different atoms, in polynuclear compounds, solid state decompositions, study of effect of temperature and pressure on Fe compound, bonding properties and structures.</p>	

Ramnarain Ruia Autonomous College

M.Sc. Inorganic Chemistry

SEMESTER – III

RPSCHEIEC - I 304

Credits 4

Paper – IV Applied Chemistry – I

Unit	Topics	Lecture
I	Manufacture and Applications of Inorganic Compounds-I	15

	<ul style="list-style-type: none"> a) Ceramics and refractory materials (ii) Cement b) Fertilizers and micronutrients c) Inorganic pesticides d) Paints and Pigments e) Glass 	
II	Metallurgy	15
	<ul style="list-style-type: none"> a) Occurrence, extraction and metallurgy of Zirconium, Hafnium, Niobium, Tantalum Platinum and Palladium metals. Physical and chemical properties and applications of these metals, compounds of these metals, alloys and their uses. b) Recycling & recovery of metals with reference to Silver, lead, cobalt, Nickel and chromium 	
III	Inorganic Pharmaceuticals	15
	<ul style="list-style-type: none"> a) Radiopharmaceuticals containing Tc and Bi, contrast agents for X-ray and NMR imaging. Gastrointestinal agents viz. (i) antacids(aluminium hydroxide, milk of magnesia, sodium bicarbonate and (ii) Cathartics(magnesium sulphate and sodium phosphate). Topical agents viz.(i) protectives and adsorbents(talc, calamine), (ii) antimicrobial agents(potassium permanganate, tincture iodine, boric acid) and astringents(potash alum). b) Supramolecular chemistry 	
IV	Environmental Monitoring and Assessment	15
	<ul style="list-style-type: none"> a) Environmental Monitoring: What is environmental quality? Quality of environment for life on earth and man; Advantages of Environmental Monitoring, Deterioration of environmental quality with reference to anthropogenic impact; Methods of assessment of environmental quality; Short term studies/surveys; Rapid assessment; Continuous short and long term monitoring b) Environmental Impact Assessment (EIA): Need of EIA; Scope and objectives; Types of environmental impacts; Steps involved in conducting the EIA Studies; Environmental Impact Assessment techniques-Ad-hoc method, checklist method, overlay mapping method, network method, simulation and modeling technique, matrix method, and system diagram technique; Merits and Demerits of EIA studies. c) Objectives and Provisions of Acts and Rules Indian Forest Act 1927, Indian Wildlife (Protection) Act, 1972, Forest Conservation Act 1980 , Environment (Protection) Act, 1986 , Bio-Medical Waste (Management & Handling) Rules,1998 , Recycled Plastics Manufacture and Usage Rules, 1999 , Municipal Solid Waste (Management and Handling Rules) 2000 , Biodiversity Act 2002 , EIA Notification 2006 , The 	

	<p style="color: red;">Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 , Wetland Rules 2009 , National Green Tribunal Act 2010 , Coastal Regulation Zones (CRZ) Rules 2011. , E-waste Management and Handling Rules 2011 , Plastics Manufacture, Sale and Usage Rules, 2011</p>	
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Ramnarain Ruia Autonomous College

M.Sc. Inorganic Chemistry

SEMESTER – III

RPSCHEIEC - II 304

Credits 4

Paper – IV Applied Chemistry – II

Unit	Topics	Lecture
I	Advances in Nanomaterials	15
	<p>a) Types of nanomaterials, e.g. nanotubes, nanorods, solid spheres, core-shell nanoparticles, mesoporous materials; General preparative methods for various nanomaterials.</p> <p>b) Some important properties of nanomaterials: optical properties of metal and semiconductor nanoparticles, magnetic properties.</p> <p>c) Some special nanomaterials: Carbon nanotubes: Types, synthesis using various methods, growth mechanism, electronic structure; Porous silicon: Preparation and mechanism of porous silicon formation, Factors affecting</p>	

	<p>porous structure, properties of porous silicon; Aerogels: Types of aerogels, Properties and applications of aerogels.</p> <p>d) Applications of nanomaterials in electronics, energy, automobiles, sports and toys, textile, cosmetics, medicine, space and defense. Environmental effects of nanotechnology</p>	
II	Inorganic Materials	15
	<p>a) Classification, manufacture and applications of (i) Inorganic fibers, and (ii) Inorganic fillers. Study of (i) Condensed phosphates, and (ii) Coordination polymers.</p> <p>b) Preparation, properties and uses of industrially important chemicals – potassium permanganate, sodium thiosulphate, bleaching powder, hydrogen peroxide, potassium dichromate, Lime, Chlorine and Caustic soda.</p>	
III	Nuclear Chemistry and Some Selected Topics	15
	<p>a) Nuclear Chemistry: Introduction to of nuclear fuels and separation of fission products from spent fuel rods by PUREX process. Super heavy element:, discovery, preparation, position in the periodic table.</p> <p>b) Some Selected Topics</p> <ol style="list-style-type: none"> i. Isopoly and Hetropoly acids, ii. Intercalation compounds iii. Inorganic explosives (mercury fulminate, Lead azide) 	
IV	Safety in Chemistry Laboratories	15
	<p>a) Good Laboratory Practices: Elements of Good Laboratory Practices; Standard Operating Procedures; Quality Assurance</p> <p>b) Handling of Hazardous Materials</p> <ol style="list-style-type: none"> i. Toxic Materials (Various types of toxins and their effects on humans) ii. Explosives and Inflammable Materials iii. Types of fire extinguishers iv. Bioactive materials. <p>c) Legal provisions regarding Chemical Laboratories.</p> <p>d) Environment Protection Act, 1986.</p>	

Ramnarain Ruia Autonomous College
M.Sc. Inorganic Chemistry
SEMESTER – III
Practical

RPSCHEI3P1: Analysis of ores/alloys

1. Analysis of Brass alloy:
 - i. Cu content by iodometric method,
 - ii. Zn content by complexometric method.
2. Analysis of Mangelium alloy:
 - i. Al content by gravimetric method as basic succinate,
 - ii. Mg content by complexometric method.
3. Analysis of Bronze alloy:
 - i. Cu content by complexometric method,
 - ii. Sn content by gravimetric method.
4. Analysis of steel nickel alloy:
Ni content by homogeneous precipitation method

RPSCHEI3P2: Solvent Extraction

1. Separation of Mn and Fe using isoamyl alcohol and estimation of Mn
2. Separation of Co and Ni using n-butyl alcohol and estimation of Co
3. Separation of U and Fe using 8- hydroxyquinoline in chloroform and estimation of U
4. Separation of Fe and Mo using isoamyl alcohol and estimation of Mo
5. Separation of Cu and Fe using n-butyl acetate and estimation of Cu

RPSCHEI3P3: Inorganic Preparations

1. Preparation of $V(\text{oxinate})_3$
2. Preparation of Sn(IV) Iodide
3. Preparation of $\text{Co}(\alpha\text{-nitroso-}\beta\text{-naphthol})_3$
4. Preparation of $\text{Ni}(\text{salicylaloxime})_2$
5. Hexamine cobalt (III) chloride
6. Preparation of Trans-bis (glycinato) Cu(II)

RPSCHEI3P4: Analysis of the following samples

1. Calcium tablet for its calcium content by complexometric titration.
2. Bleaching powder for its available chlorine content by iodometric method.
3. Iron tablet for its iron content colorimetry by 1, 10-phenonthroline method.
4. Nycil powder for its Zn content complexometrically.

Ramnarain Ruia Autonomous College

M.Sc. Inorganic Chemistry

SEMESTER – IV

RPSCHEI401

Credits 4

Paper – I Solid state chemistry-II

Unit	Topics	Lecture
I	Inorganic Materials- Properties-I	15
	<p>a) Electrical properties of solids: Conductivity: Solid Electrolytes; Fast Ion Conductors; Mechanism of Conductivity; Hopping Conduction.</p> <p>b) Other Electrical Properties: Thomson and Seebeck Effects; Thermocouples and their Applications; Hall Effect; Dielectric, Ferroelectric, Piezoelectric and Pyroelectric Materials and their Inter-relationships and Applications</p>	
II	Magnetic Properties	15
	<p>a) Behaviour of substances in magnetic field, mechanism of ferromagnetic and antiferromagnetic ordering, superexchange, Hysteresis, Hard and soft magnets, structures and magnetic Properties of Metals and Alloys;</p> <p>b) Transition metal Oxides; Spinels; garnets, Ilmenites; Perovskite and Magneto plumbites, Application in transformer cores, information storage, magnetic bubble memory devices and as permanent magnets.</p>	
III	Thermal and Optical Properties	15
	<p>a) Thermal Properties: Introduction, Heat Capacity and its Temperature Dependence; Thermal Expansion of Metals; Ceramics and Polymers and Thermal Stresses.</p> <p>b) Optical properties: Color Centers and Birefringence; Luminescent and Phosphor Materials; Coordinate Model; Phosphor Model; Anti Stokes Phosphor; Ruby Laser; Neodymium Laser</p>	
IV	Applications of group theory to –Electronic structures	15
	<p>a) Recapitulation of Point groups and Character tables.</p> <p>b) Transformation Properties of Atomic Orbitals;</p> <p>c) Sigma and pi- molecular orbitals for AB₄ (tetrahedral) and AB₆ (octahedral) molecules;</p> <p>d) Ligand Field Theory: Electronic structures of free atoms and ions; Splitting of levels and terms in a chemical environment; Construction of energy level diagrams; Direct product; Correlation diagrams for d² ions in octahedral and tetrahedral ligand field; Methods of Ascending and Descending Symmetry; Hole formalism.</p>	

SEMESTER – IV**RPSCHEI402****Credits 4****Paper – II Organometallic and main group Chemistry**

Unit	Topics	Lecture
I	Organometallic Chemistry	15
	a) Metal-Metal Bonding and Metal Clusters, b) Electron Count and Structures of Clusters,, c) Isolobal Analogy. d) Organo Palladium and Organo Platinum Complexes (preparations, properties and applications.)	
II	Applications of Organometallic Compounds	15
	a) Catalysis-Homogenous and Heterogenous Catalysis: Comparison, Fundamental Reaction Steps. b) Organometallics as Catalysts in Organic Reactions: (i)Hydrosilation, (ii)Hydroboratiomm. (iii) Water gas Shifts Reaction (iv) Wacker process(Oxidation of alkenes) (v)Alcohol corbonylation c) Coupling reactions : (i) Heck’s reaction (ii) Suzuki reaction	
III	Inorganic cluster and cage compounds	15
	a) Introduction b) Bonding in boranes c) Heteroboranes d) Carboranes e) Cluster compounds f) Electron precise compounds and their relation to clusters.	
IV	Inorganic ring and chain compounds	15
	a) Silicates, polysilicates and aluminosilicates, b) Phosphazenes, phosphazene polymers c) Polyanionic and polycationic compounds	

Ramnarain Ruia Autonomous College**M.Sc. Inorganic Chemistry****SEMESTER – IV**

RPSCHEI403

Credits 4

Paper – III Instrumental methods in Inorganic Chemistry

Unit	Topics	Lecture
I	Spectroscopy	15
	<p>a) Infrared spectroscopy: Fundamental modes of vibrations, selection rules, IR absorption bands of metal - donor atom, effect of complexation on the IR spectrum of ligands formations on the IR of ligands like NH₃, CN⁻, CO, olefins (C=C) and C₂O₄²⁻</p> <p>b) Raman spectroscopy: Raman spectroscopy for diatomic molecules. Determination of molecular structures like diatomic and triatomic molecules.</p> <p>c) Applications of Group theory in Infrared and Raman spectroscopy. Molecular Vibrations: Introduction; The Symmetry of Normal Vibrations; Determining the Symmetry Types of the Normal Modes; symmetry based Selection Rules of IR and Raman; Interpretation of IR and Raman Spectra for molecules such as H₂O, BF₃, N₂F₂, NH₃ and CH₄.</p> <p>d) Nuclear Magnetic Resonance Spectroscopy : Introduction to basic principles and instrumentation. Use of ¹H, ¹⁹F, ³¹P, ¹¹B NMR spectra in structural elucidation of inorganic compounds; Spectra of paramagnetic materials: Contact shift, application of contact shift, lanthanide shift reagent</p>	
II	Microscopy of Surface Chemistry-I	15
	<p>a) Introduction to surface spectroscopy, Microscopy, problems of surface analysis, distinction of surface species, sputter etching and depth profile and chemical imaging, instrumentations,</p> <p>b) Ion Scattering Spectra (ISS), Secondary Ion Mass Spectroscopy (SIMS)</p> <p>c) Auger Emission Spectroscopy (AES)</p>	
III	Microscopy of Surface Chemistry-II	15
	<p>a) ESCA, Scanning Electron Microscopy (SEM),</p> <p>b) Atomic force microscopy (AFM) and</p> <p>c) Transmission electron microscopy (TEM): Instrumentation and applications.</p>	
IV	Thermal Methods	15

	<p>a) Application of TGA in Thermal characterization of polymers, quantitative analysis of mixture of oxalates, moisture content in coal, study of oxidation state of alloys etc.</p> <p>b) Application of DSC and DTA in determination of thermodynamic parameters such as heat capacity and standard enthalpy of formation of the compounds, investigation of phase transitions, thermal stability of polymeric materials, purity of pharmaceuticals samples, M.P. and B.P. of organic compounds etc.</p> <p>c) Basic principle, instrumentation and applications to other thermal methods like Thermo mechanical analysis (TMA) and evolved gas analysis (EGA).</p>	
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Ramnarain Ruia Autonomous College

M.Sc. Inorganic Chemistry

SEMESTER – IV

RPSCHEIEC - I 404

Credits 4

Paper – IV (Intellectual Property Rights & Cheminformatics)

Unit	Topics	Lecture
I	Intellectual Property - I	15
	<p>a) Introduction: Historical Perspective, Different types of IP, Importance of protecting IP.</p> <p>b) Patents: Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Health care-balancing promoting innovation with public health, Software patents and their importance for India.</p> <p>c) Industrial Designs: Definition, How to obtain, features,</p>	

	<p>International design registration.</p> <p>d) Copyrights: Introduction, How to obtain, Differences from Patents.</p> <p>e) Trade Marks: Introduction, How to obtain, Different types of marks – Collective marks, certification marks, service marks, trade names etc.</p> <p>f) Geographical Indications: Definition, rules for registration, prevention of illegal exploitation, importance to India.</p>	
II	Intellectual Property - II	15
	<p>a) Trade Secrets: Introduction and Historical Perspectives, Scope of Protection, Risks involved and legal aspects of Trade Secret Protection.</p> <p>b) IP Infringement issue and enforcement: Role of Judiciary, Role of law enforcement agencies – Police, Customs etc.</p> <p>c) Economic Value of Intellectual Property: Intangible assests and their valuation, Intellectual Property in the Indian context – Various Laws in India Licensing and Technology transfer.</p> <p>d) Different International agreements:</p> <p style="padding-left: 20px;">i) World Trade Organization (WTO): General Agreement on Tariffs and Trade (GATT), Trade Related Intellectual Property Rights (TRIPS) agreement General Agreement on Trade Related Services (GATS) Madrid Protocol. Berne Convention Budapest Treaty</p> <p style="padding-left: 20px;">ii) Paris Convention: WIPO and TRIPS, IPR and Plant Breeders Rights, IPR and Biodiversity.</p>	
III	Cheminformatics – I - Introduction:	15
	<p>a) History and evolution of cheminformatics, Use of Cheminformatics, Prospects of cheminformatics, Molecular modeling and structure elucidation.</p> <p>b) Representation of molecules and chemical reactions: Nomenclature, Different types of notations, SMILES coding, Matrix representations, Structure of Molfiles and Sdfiles, Libraries and toolkits, Different electronic effects, Reaction classification.</p> <p>c) Searching Chemical Structures: Full structure search, sub-structure search, basic ideas, similarity search, three dimensional search methods, basics of computation of physical and chemical data and structure descriptors, data visualization.</p>	
IV	Cheminformatics – II- Applications:	15

	<p>a) Prediction of Properties of Compound, Linear Free Energy Relations, Quantitative Structure – Property Relations, Descriptor Analysis, Model Building, Modeling Toxicity, Structure – Spectra correlations, Prediction NMR, IR and Mass spectra,</p> <p>b) Computer Assisted Structure elucidations, Computer assisted Synthesis Design, Introduction to drug design, Target Identification and Validation, Lead Finding and Optimization, analysis of HTS data, Virtual Screening, Design of Combinatorial Libraries, Ligand-based and Structure based Drug design,</p> <p>c) Application of Cheminformatics in Drug Design.</p>	
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Ramnarain Ruia Autonomous College

M.Sc. Inorganic Chemistry

SEMESTER – IV

RPSCHEIEC - II 404

Credits 4

PAPER – IV: Research Methodology

Unit	Topics	Lecture
I	Review of Literature	15
	<p>a) Print: Primary, Secondary and Tertiary sources.</p> <p>b) Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, textbooks, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples.</p>	

	<p>c) Digital: Web sources, E-journals, Journal access, TOC alerts, Hot articles, Citation Index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, preprint servers, Search engines, Scirus, Google Scholar, ChemIndustry, Wiki-databases, ChemSpider, Science Direct, SciFinder, Scopus.</p> <p>d) Information Technology and Library Resources: The Internet and World wide web, Internet resources for Chemistry, finding and citing published information.</p>	
II	Data Analysis	15
	<p>a) The Investigative Approach: Making and recording Measurements, SI units and their use, Scientific methods and design of experiments.</p> <p>b) Analysis and Presentation of Data: Descriptive statistics, choosing and using statistical tests, Chemometrics, Analysis of Variance (ANOVA), Correlation and regression, curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, general polynomial fitting, linearizing transformations, exponential function fit, r and its abuse, basic aspects of multiple linear regression analysis.</p>	
III	Methods Of Scientific Research And Writing Scientific Papers	15
	<p>a) Reporting practical and project work, Writing literature surveys and reviews, organizing a poster display, giving an oral presentation.</p> <p>b) Writing Scientific Papers: Justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work, writing ethics, avoiding plagiarism.</p>	
IV	Chemical Safety & Ethical Handling Of Chemicals	15

	<p>a) Safe working procedure and protective environment, protective apparel, emergency procedure, first aid, laboratory ventilation, safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric pressure,</p> <p>b) safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals.</p>	
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Ramnarain Ruia Autonomous College
M.Sc. Inorganic Chemistry
SEMESTER – IV
Practical

RPSCHEI4P1: Analysis of ores/alloys

1. Analysis of galena ore:

- i) Pb content as PbCrO_4 by gravimetric method using 5% potassium chromate,
- ii) Fe content by colorimetrically using 1, 10- phenanthroline.

2. Analysis of Zinc blend ore:

- i) Zn content by complexometric method,
- ii) Fe content by colorimetric method (Azide method)

3. Analysis of Pyrolusite ore:

- i) Mn content by complexometric method,
- ii) Acid insoluble residue by gravimetric method.

RPSCHEI4P2: Coordination Chemistry

1. Determination of Stability constant of $[\text{Zn}(\text{NH}_3)_4]^{2+}$ by potentiometry.
2. Determination of Stability constant of $[\text{Ag}(\text{en})]^+$ by potentiometry
3. Determination of Stability constant of $[\text{Fe}(\text{SCN})]^{2+}$ by slope ratio method
4. Determination of CFSE values of hexa-aqua complexes of Ti^{3+} and Cr^{3+} .
5. Determination of Racah parameters for complex $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Ni}(\text{en})_3]^{2+}$

RPSCHEI4P3: Commercial sample Analysis

1. Electral powder for Na/K content flame photometrically.
2. Fasting salt for chloride content conductometrically.
3. Sea water for percentage salinity by Volhard's method.
4. Soil for mixed oxide content by gravimetric method.
5. Fertilizer for potassium content by flame photometry.

RPSCHEI4P4: Project Evaluation & Spectral interpretation

REFERENCE BOOKS

(Sem-III and IV) for RPSCHEI301 & RPSCHEI401

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MODALITY OF ASSESSMENT

Theory Examination Pattern:

A) Internal Assessment - 40%:

40 marks.

Sr No	Evaluation type	Marks
1	Presentation	20

2	Assignment	10
3	Active participation	10
	Total	40

B) External examination - 60 %

Semester End Theory Assessment - 60 marks

- i. Duration - These examinations shall be of **2.5 hours** duration.
- ii. Paper Pattern:
 1. There shall be **04** questions each of **15** marks. On each unit there will be one question.
 2. All questions shall be compulsory with internal choice within the questions.

Questions	Options	Marks	Questions on
Q.1)A)	Any 3 out of 5	12	Unit I
Q.1)B)	Any 1 out of 2	3	
Q.2)A)	Any 3 out of 5	12	Unit II
Q.2)B)	Any 1 out of 2	3	
Q.3)A)	Any 3 out of 5	12	Unit III
Q.3)B)	Any 1 out of 2	3	
Q.4)A)	Any 3 out of 5	12	Unit IV
Q.4)B)	Any 1 out of 2	3	

Practical Examination Pattern:

Semester end practical examination: 50 marks

Experimental work	40
Viva	05
Journal	05
Total	50

PRACTICAL BOOK/JOURNAL

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

In case of loss of Journal, a Lost Certificate should be obtained from Head/ Co-ordinator / In-charge of the department; failing which the student will not be allowed to appear for the practical examination.

Overall Examination and Marks Distribution Pattern

Semester: III and IV

Course	301/401			302/402			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Practicals			50			50	100

Course	303/403			304/404			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Practicals			50			50	100

Total: 600 marks