PG AND RESEARCH DEPARTMENT OF CHEMISTRY

POOMPUHAR COELLEGE (AUTONOMOUS)

MELAIYUR – 609 105

M. Sc CHEMISTRY

CHOICE BASED CREDIT SYSTEM

SYLLABUS

2022 – 2023 ONWARDS

S. No.	SEMESTER	COURSE	TITLE	HOURS	CREDITS	Marks		TOTAL
						Int	Ext	
1.	I	Core course -I	Organic Chemistry-I	6	5	25	75	100
2.		Core course -II	Inorganic Chemistry –I	6	4	25	75	100
3.		Core course -III	Physical Chemistry –I	6	4	25	75	100
4.		Core course - IV	Organic Practical-I	5	4	40	60	100
5.		Core course -V	Inorganic Practical-I	5	4	40	60	100
6.			Human Right	2	2	25	75	100
			Total	30	23	--	--	600
7.	II	Core course -VI	Inorganic Chemistry-II	6	5	25	75	100
8.		Core course -VII	Physical methods in Chemistry	6	4	25	75	100
9.		Core course - VIII	Organic Practical-II	5	4	40	60	100
10.		Core course - IX	Inorganic Practical-II	5	4	40	60	100
11.		Elective Course - I	Polymer Chemistry	5	4	25	75	100
12.		Open Elective - I	NME-I - Food Chemistry	3	3	25	75	100
			Total	30	24	--	--	600
13.	III	Core course – X	Organic Chemistry-III	6	4	25	75	100
14.		Core course - XI	Inorganic Chemistry -III	6	4	25	75	100
15.		Core course - XII	Physical Practical-I	5	4	40	60	100
16.		Core course XIII	Research Methodology	5	4	25	75	100
17.		Elective Course - II	Chemistry of Nanoscience and Nanotechnology	5	4	25	75	100
18.		Open Elective-II	NME-II Agricultural chemistry	3	3	25	75	100
			Total	30	23	--	--	600

19.	IV	Core course - XIV	Physical Chemistry -II	6	4	25	75	100
20.		Core course - XV	Advanced Analytical chemistry	6	4	25	75	100
21.		Core course - XVI	Physical chemistry practical - II	6	4	40	60	100
22.		Elective Course - III	Industrial chemistry (EC)	6	4	25	75	100
23.			Project	6	4	25	75	100
	Total			30	20	--	--	500
	Grand Total			120	90	--	--	2300

Programme Outcomes:

PO1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of a Postgraduate programme of study.

PO2: Ethical Value

Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.

PO3: Individual and Team Leadership Skill

Capability to lead themselves and the team to achieve organizational goals.

PO4: Employability & Entrepreneurial Skill

Inculcate contemporary business practices to enhance employability skills in the competitive environment. Equip with skills and competencies to become an entrepreneur.

PO5: Contribution to Society

Succeed in career endeavors and contribute significantly to society.

Programme Specific Outcomes (PSOs)

Upon successful completion **of M.Sc. Chemistry programme**, the student will be able to

PSO 1:

Acquire understanding of fundamental concepts and applications of chemical and various scientific theories. Appreciate the importance of various elements in the periodic table, coordination chemistry and structure of molecules, properties of compounds, structural determination of molecules /complexes using theories and experimental techniques.

.PSO 2:

Understand the background of organic /inorganic reaction mechanisms, chemical structures, experimental methods of chemical analysis, organic synthesis, molecular
rearrangements and separation techniques.

PSO 3:

Gather deep understanding about the physical aspects of atomic structure, quantum theory, molecular spectroscopy, thermodynamics, kinetics, catalysis, chemical equilibrium, reaction pathways with respect to time, various energy transformations, molecular assembly at surface level, significance of electrochemistry, and molecular segregation using their symmetry.

PSO 4:

Use technologies/instrumentation to acquire and analyze data of chemical systems in a sophisticated laboratory environment to secure challenging positions in industry, academics and government sectors by learning various analytical techniques such as UV, IR, NMR, MS, Chromatography etc and their applications. Develop analytical skills and problem solving skills requiring to develop new applications of chemistry.

PSO 5:

Gain knowledge in recent and advanced developments in the area of Nanochemistry, Medicinal Chemistry, Green Chemistry, Natural Products Chemistry, Bioinorganic Chemistry. Apply appropriate techniques for the qualitative and quantitative analysis of chemical system and carry out experiments in the area of organic / inorganic/ physical analysis -estimation, separation, derivative process, semi-micro analysis, preparation, conductometric / potentiometric methods.

SEMESTER - I

CORE COURSE – I

ORGANIC CHEMISTRY – I

Objectives

- To provide knowledge about the fundamental mechanism involved in electrophilic reactions, nucleophilic reactions and reactions that involve transient species.
- To provide knowledge about the basic aspects of Stereochemistry such as Chirality, Nomenclature, Stereoselectivity Vs Stereospecificity and Asymmetric synthesis.
- To provide knowledge about the conformational analysis of six member ring systems.
- To provide knowledge about Aromaticity and Heterocyclic compounds.
- To provide knowledge about important concepts of Organic Photo chemistry.
- To provide knowledge about the fundamental reactions, Reagents and its mechanism of Organic synthesisis.

UNIT-I NOMENCLATURE, REACTIVE INTERMEDIATES AND DETERMINATION OF REACTION MECHANISM

1.1 Nomenclature of Alicylic, Bicyclic and Tricyclic compounds, (Basic skeletal structures only with one or without substituent). Nomenclature of Heterocycles having not more than two hetero atoms such as Oxygen, Nitrogen and Sulphur.

1.2 Organic reactive intermediates: Generation, stability and Reactivity of Carbocations, Carbanions and Free radicals.

1.3 Thermodynamic and Kinetic controlled reactions, Energy profile diagram, Intermediate Vs Transition state, Non kinetic methods, determination of presence of intermediate – Isolation, Detection, Trapping – Cross over experiment – Isotopic labelling. Product analysis and its importance, Kinetic methods, Stereochemical studies, Isotopic and Substituent effects.

UNIT II AROMATICITY AND HETEROCYCLES

2.1 Aromatic character - Five, six, seven and eight-membered rings – Other systems with aromatic sextets – Huckel's theory of aromaticity, concept of homoaromaticity and antiaromaticity.

2.2 Electron occupancy in MO's and aromaticity – NMR concept of aromaticity and anti-aromaticity, systems with 2,4,8 and 10 electrons, systems with more than 10 electrons (Annulenes).

2.3 Bonding properties of systems with (4n+2) π-electrons and 4nπ-electrons, alternant and non-alternant hydrocarbons (Azulene type) – Aromaticity in heteroaromatic molecules, Sydnones and Fullerenes.

2.4 Synthesis, reactivity and applications of the following Heterocycles - Oxazoles, Pyridazines, Pyrimidine and Pyrazines.

UNIT III STEREOCHEMISTRY AND CONFORMATIONAL ANALYSIS

3.1 Stereoisomerism – Optical Isomerism - Symmetry – Enantiomers and Diastereomers – Conversions used in Stereochemistry. Newman, Sawhorse and Fischer notations and interconversions and representations. *R* and *S* Nomenclature – Optical activity and Chirality – Types of molecules exhibiting Optical Activity –

Absolute Configuration – Chirality in molecules with non carbon stereocenters (N, S and P) – Molecules with more than one Chiral centre – Atropisomerism.

3.2 Molecular Chirality – Allenes, Spiranes, Biphenyls. Geometrical isomerism- *E* and *Z* nomenclature – Determination of configuration of Geometrical isomers – Stereochemistry of Addition and Elimination reactions – Stereospecific and Stereoselective synthesis [Elementary examples].

3.3 Basic concepts of Conformational Analysis – Conformations of Cyclohexane, Cyclohexene and Decalin.

UNIT IV ORGANIC PHOTOCHEMISTRY

4.1 Organic Photochemistry - Fundamental concepts - Jablonski diagram - Energy transfer. Characteristics of Photo reactions, Photo Reduction and photo Oxidation and Photosensitization.

4.2 Photo reactions of Ketones and Enones - Norrish type I and II reactions. Parterno-Buchi reaction, Photo chemistry of Alkenes, Dienes and Aromatic compounds - Rearrangement.

4.3 Reactions of unactivated centers – Photolytic Cycloadditions and Photolytic rearrangements. Di-π-methane, Photo additions - Barton reaction.

UNIT V REAGENTS AND NAME REACTIONS IN ORGANIC SYNTHESIS

5.1 Oxidation, Jacobsen Epoxidation, Jones reagent, PCC, IBX, DMP, Swern Oxidation, Sommelet reaction.

5.2 Reduction- Palladium / Nickel based heterogeneous catalysts for Hydrogenation, Wilkinson's catalyst, Reductions using Li/Na/Ca in Liquid ammonia. Hydride transfer reagents –$LiAlH_4$, $NaBH_4$ and $NaCNBH_3$.

5.3 Bamford - Stevens reaction – Baylis - Hillman reaction – Enamines and selective mono and dialkylation via enamine reactions – Mitsunobu reaction – Mukaiyama-Aldol addition – Peterson Olefination – Prevost reaction – Ugi reaction – Weinreb Ketone synthesis – Palladium based reactions - Heck reaction – Sonogashira coupling – Stille coupling – Suzuki coupling.

Expected outcomes

- To enable the students to understand various types of reaction mechanisms involved in synthetic organic transformation.
- To enable the students to understand the basic stereochemistry concept in a proper perspective.
- To enable the students to understand the concept of asymmetric synthesis.
- To enable the students to understand Aromaticity and Chemistry Heterocyclic compounds.
- To enable the students to understand the important concepts of Organic Photo chemistry.
- To enable the students to understand fundamental of Organic synthesisis.

REFERENCES

1. J. March and M. B. Smith, March's Advanced Organic Chemistry- Reactions, Mechanisms, and Structure- 7th Ed., Wiley, New York, 2013.
2. I. L. Finar, Organic Chemistry- Vol.II, 7th Ed., Pearson education Ltd, New Delhi, 2009.
3. R. K. Bansal, Organic Reaction Mechanisms- 11th Ed., Tata McGraw Hill, Noida, 2006.
4. R. T. Morrison and R. N. Boyd, Organic Chemistry, 7th Ed., Pearson, New Delhi, 2011.
5. F. A. Carey and R. J. Sundberg, Advanced Organic Chemistry- Parts A and B, 5th Ed., Springer, Germany, 2007.
6. P. S. Kalsi, Stereochemistry- Wiley eastern limited- New Delhi, 2022.
7. D. Nasipuri, Stereochemistry of Organic Compounds - Principles and Applications- 2nd Ed., New Age International, New Delhi, 1994.
8. E. L. Eliel, and S. H. Wilen, Stereochemistry of Organic Compounds- John Wiley, New York, 1994.
9. J. D. Coyle, Organic Photochemistry- Wiley, New York, 1998.
10. G. R. Chatwal, Organic Phtochemistry- 1st Ed., Himalaya Publications house, Bangalore, 1998
11. David R. Klein, Organic Chemistry – 4rd edition 2020.
12. D.Nasipuri, Stereochemistry of organic compounds – 3rd edition 2018.

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	2	3	3	3
CO3	2	3	3	3	3
CO4	3	3	2	3	3
CO5	3	3	3	3	3

FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER - I **CORE COURSE – II**

INORGANIC CHEMISTRY – I

Objectives

- To provide knowledge of basic and advanced concepts in bonding and enable the students to identify the structure and bonding of simple molecules.
- To provide an understanding of the various types of solid state packing and the types of chemical forces.
- To enable students to appreciate the structure of inorganic chain and cluster compounds.
- To provide knowledge of the structure and bonding in boron compounds.
- To provide knowledge about Coordination complexes, Boding and reactions of coordination complexes.

UNIT I MAIN GROUP CHEMISTRY

1.1 Chemistry of Boron – Borane, higher Boranes, Carboranes, Borazines and Boron Nitrides. Chemistry of Silicon – Silanes, higher Silanes, multiple bonded systems. Disilanes, Silicon Nitrides, Siloxanes and Silicates, Cyclophospazanes.

1.2 Ionic Model - Lattice energy, Born-Haber Cycle - Born-Lande Equation - Kapustinskii equation - Application of Lattice Energy, High Temperature Superconductors - Band theory of Solids - Schotty, Frenckel defects, F- center.

UNIT II PRINCIPLES OF COORDINATION CHEMISTRY

2.1 Studies of Coordination compounds in solution - Detection of complex formation in solution - Stereo and Optical isomerism in coordination complexes. Stability constants - Stepwise and Overall Formation Constants.

2.2 Simple methods of determining the formation constants – (Jobs Continuous method of variation, Polarographic methods).

2.3 Factors Affecting Stability - Statistical and Chelate effects - Forced Configurations.

UNIT III THEORIES OF METAL – LIGAND BOND

3.1 Crystal Field Theory (CFT) - Splitting of d - orbitals under various geometries - Factors affecting splitting - Crystal Field Stabilisation Energy(CFSE) and evidence for CFSE (Structural and Thermodynamic effects).

3.2 Spectrochemical series – John-Teller distortion - Spectral and magnetic properties of complexes - Site preferences.

3.3 Limitations of CFT - Ligand field theory - MO theory - Sigma and Pi bonding in complexes. Nephelauxetic effect.

UNIT IV REACTION MECHANISM IN COORDINATION CHEMISTRY

4.1 Kinetics and mechanism of reactions in solution - Labile and Inert complexes

- Ligand displacement reactions in Octahedral and Square planar complexes - Acid Hydrolysis, Base Hydrolysis and Anation Reactions – Trans effect - Theory and Applications.

4.2 Electron Transfer Reactions - Electron Exchange Reactions - Complementary and Non- Complementary types - Inner Sphere and Outer Sphere processes.

4.3 Molecular rearrangement reactions of four and six coordinate complexes – Interconversion of stereoisomers - Reactions of coordinated Ligands - Template effect and its applications.

UNIT V INORGANIC PHOTOCHEMISTRY

5.1 Electronic transitions in metal complexes, Metal-centered and charge-Transfer transitions – Various photophysical and photochemical processes of coordination compounds.

5.2 Unimolecular charge-transfer photochemistry of Cobalt(III) complexes – mechanism of Charge Transfer To Metals(CTTM), photo Reduction – Ligand-field photochemistry of Chromium(III) complexes – Adamson's rules, photoactive excited states, E α P model – Photophysics and photochemistry of Ruthenium Polypyridine complexes, Emission and Redox properties - Reinecke's salt chemical Actinometer.

Expected outcomes

- Students are able to understand main group chemistry.
- Identify the bonding type of coordination chemistry.
- Understand the structure and bonds of metal-liogand bond.
- To appreciate the structure of electron transfer reaction
- Students are able to understand transition in metal complex and photochemistry of organometallic compounds..

REFERENCES

1. M. C. Day, J. Selbin and H. H. Sisler, Theoretical Inorganic Chemistry- Literary Licensing (LLC), Montana, 2012.
2. F. A. Cotton and G. Wilkinson, C. A. Murillo and M. Bochmann, Advanced Inorganic Chemistry- 6th Ed., A Wiley - Interscience Publications, John Wiley and Sons – 7th edition 2021.
3. J. E. Huheey, Inorganic Chemistry- 4th Ed., Harper and Row publisher, Singapore, 2006.
4. A. W. Adamson, Concept of Inorganic Photochemistry- John Wiley and Sons, New York, 1975.
5. S. F. A. Kettle, Physical Inorganic Chemistry – A Coordination Chemistry Approach, Spectrum- Academic Publishers, Oxford University Press, New York, 1996.
6. A. W. Adamson and P. D. Fleischauer, Concepts of Inorganic Photochemistry-

R. E. Krieger Pubs, Florida, 1984.

7. J. Ferraudi, Elements of Inorganic Photochemistry- Wiley, New York, 1988.
8. F. Basolo and R. G. Pearson, Mechanism of Inorganic Reactions- 2nd Ed., John Wiley, New York, 1967.
9. R. K. Sharma, Inorganic Reactions Mechanism- Discovery Publishing House, New Delhi, 2000.
10. James House , Inorganic chemistry – 3rd edition oct30, 2019.
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	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	2	3	2
CO3	3	3	3	3	3
CO4	3	2	3	3	3
CO5	3	3	3	3	3

FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER - I CORE COURSE III

PHYSICAL CHEMISTRY – I

Objectives

- To provide knowledge of basic and advanced concepts in chemistry of boron and ionic model.
- To provide an understanding of the various types of coordination compounds and stability constant.
- To provide knowledge of the crystal field theory, spectrochemical series.
- Understanding the knowledge of kinetics and mechanism of reaction in solution, electron transfer reaction and molecular rearrangements.
- To provide knowledge of the electronic transition in metal complexes, unimolecular charge-transfer, photochemistry of organometallic compounds.

UNIT I CONCEPTS OF GROUP THEORY

1.1 Symmetry elements and Operations – Point groups – Assignment of point groups to molecules – Group postulates and types of groups – Group multiplication tables (C_{2v} & C_{3v}) sub groups, similarity transformations – Conjugate elements and Classes.

1.2 Matrix representation of symmetry operations and point groups – Reducible and irreducible representations – Properties of irreducible representation.
The great Orthogonality theorem – Construction of character table – C_{2v} & C_{3v} – direct product – Projection Operators.
1.3. Hybridazation concept – CH_4 and BF_3 only. Symmetry of normal and active mode of vibration of H_2O and BF_3 only. Symmetry selection rule of IR and Raman Spectroscopy- SALC procedure for Ethylene molecule.

UNIT II QUANTUM CHEMISTRY – I

2.1 Black body radiation – Planck's quantum concept – Photoelectric effect – Wave-Particle Dualism – Uncertainty Principle – Schrodinger Equation – postulates of quantum mechanics – Operator Algebra - Linear Operator, Hermitian Operators, Eigen functions and Eigen values, Angular momentum operator – Orthogonality and Normalization**.**

2.2 Applications of wave mechanics to simple systems – Particle in a box, One and Three dimensional.

UNIT III CHEMICAL KINETICS - I

3.1 Theories of reaction rate – Absolute Reaction Rate Theory (ARRT) – Transmission coefficient, reaction co ordinate – Potential Energy Surfaces – Kinetic Isotope Effect – Hinshelwood theory – Kassel, Rice and Ramsperger Theory (KRRT) –Slater's Treatment.

3.2 Principle of Microscopic Reversibility – Steady State Approximation – Chain Reactions- Thermal and Photochemical Reactions between Hydrogen and Halogens – Explosions and Hydrogen-Oxygen Reactions.

UNIT IV MOLECULAR THERMODYNAMICS - II

4.1 Third law – Thermodynamics – Significance – Nernst Heat Theorem -

Thermodynamic quantities at Absolute Zero – Apparent exceptions to the third law.

4.2 Thermodynamics of systems of variable composition -Partial Molar Properties – Chemical Potential – Relationship between Partial Molar Quantities – Gibbs-Duhem equation and its applications (the experimental determination of Partial Molar Properties not included).

4.3 Thermodynamic properties of Real gases – Fugacity concept – Calculation of Fugacity of real gas – Activity and Activity Coefficient – Concept – Definition – Standard states and experimental determinations of Activity and Activity Coefficient of Electrolytes.

UNIT V FAST REACTION TECHNIQUES, PHOTOCHEMISTRY AND RADIATION CHEMISTRY

5.1 Introduction – Flow methods (continuous and stopped flow methods) – Relaxation methods (T and P jump methods) – Pulse techniques (Pulse Radiolysis, Flash Photolysis) .

5.2 Photophysical processes of electronically excited molecules –Jablonski diagram– Stern-Volmer Equation and its Applications – Experimental techniques in photochemistry – Chemical Actinometers– Lasers and their applications.

5.3 Differences between radiation chemistry and photochemistry- Sources of high energy radiation and interaction with matter – Radiolysis of water, solvated Electrons – Definition of G value, Curie, Linear Energy Transfer (LET) and Rad Scavenging techniques – Use of Dosimetry and Dosimeters in Radiation Chemistry – Applications of Radiation Chemistry.

Expected outcomes

- To understand and explore the group theory.
- To learn the theory and application of quantum chemistry.
- Understand the concepts of (ARRT), (KRRT).
- Understand the concept gibbs-duhem equation, activity coefficient of electrolytes.
- To learn about photochemistry and radiation chemistry.

REFERENCES

1. F. A. Cotton, Chemical Applications of Group Theory- 3rd Ed., John Wileyand Sons, Singapore, 2003.
2. R. L. Flurry, Jr, Symmetry Groups- Theory and Chemical Applications- Prentice Hall, New Jersy, 1980.
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16. HoriaMetiu, Physical Chemistry, Thermodynamics- Taylor and Francis, Singapore, 2006.
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	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	2
CO3	3	3	2	3	3
CO4	3	3	3	3	3
CO5	2	3	3	3	3

FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER – I CORE COURSE – IV (CORE PRACTICAL - I)
ORGANIC CHEMISTRY - I (P)

OBJECTIVES

- To perform the qualitative analysis of a given organic mixture.
- To carry out the preparation of organic compounds.

1. **Qualitative analysis of an organic mixture containing two components**

Mixtures containing two components are to be separated (pilot separation) and purified (bulk separation) and preparation of derivatives – The physical constants are to be reported.

(analysis).

2. Preparation of organic compounds (single stage)

1. Methyl-*m*-nitrobenzoate from methylbenzoate (nitration)
2. Glucose pentaacetate from glucose (acetylation)
3. Resacetophenone from resorcinol (acetylation)
4. Benzophenoneoxime from benzophenone (addition)
5. *o*-Chlorobenzoic acid from anthranilic acid (Sandmayer reaction)
6. *p*-Benzoquinone from hydroquinone (oxidation)
7. Phenylazo-2-naphthol from aniline (diazotization)

REFERENCES

1. J. Mohan, Organic Analytical Chemistry- Theory and Practice- Narosa, 2003.
2. V. K. Ahluwalia, P. Bhagat, and R. Agarwal, Laboratory Techniques in Organic Chemistry- I. K. International, 2005.
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4. A. I. Vogel, A. R. Tatchell, B. S. Furniss, A. J. Hannaford and P. W. G. Smith,Vogel's Textbook of Practical Organic Chemistry- 5th Ed., Prentice Hall, 1989.

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	2	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	2	3

FACULTY UNIVERSITY NOMINEE HOD

SEMESTER - I

CORE COURSE – V (CORE PRACTICAL - II)

INORGANIC CHEMISTRY I (P)

OBJECTIVES

- To perform the semi-micro qualitative analysis.
- To estimate the metal ions using colorimeter.

1. Semi-micro qualitative analysis

Mixture containing two common cations (Pb, Bi, Ca, Cd, Fe, Cr, Al, Co, Ni, Mn, Zn, Ba, Sr, Ca, Mg, NH_4) and two less common cations (W, Tl, Se, Te, Mo, Ce, Th, Zr, Ti, V, U, Li).

2. Estimation

Copper, Ferric, Nickel, Chromium and Manganese ions using photoelectric colorimeter.

REFERENCES

1. V. V. Ramanujam, Inorganic Semimicro Qualitative Analysis - 3rd Ed., National Pubs, London, 1988.
2. G. Svehla, Text Book of Macro and Semimicro Qualitative Inorganic Analysis - 5th Ed., Longman group Ltd, London, 1987.
3. A. I. Vogel, Text Book of Quantitative Inorganic Analysis-6th Ed., Longman, New Delhi, 2000.

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	2	3	3
CO4	3	2	3	3	3
CO5	3	3	3	3	3

FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER -I HUMAN RIGHTS

OBJECTIVES:

- To understand the word of Human Rights are the rights of all Human Beings.
- To learn the role of UN in protecting and promoting awareness of Human Rights is highly significant.
- To trace the development of regional instruments drafted aiming at protection of Human Rights and its enforceability
- To understand the development of Human Rights jurisprudence in India is traced.
- To predict the duty to protect human right of all individuals more particularly those are vulnerable remains more as a National obligation

UNIT-1: Human Rights Introduction

Meaning, Definition, Nature, Content- Legitimacy of Human Rights- Origin and Development of Human Rights- Theories – Principles of Magna Carta – Modern Movements of Human Rights – The Future of Human Rights.

UNIT-II: The International Perspective International human rights

Human Right concepts Prior and after World War II – UNO – Universal Declaration of Human Rights (UDHR) – International Covenant on Civil and Political Rights (ICCPR) – International Covenant on Economic, Social and Cultural Rights (ICESCR)- Optional Protocols- Human Right Declarations – Role of United Nation Commissions – Convention on the Elimination of All forms of Discrimination against women (CEDAW) – United Nations Convention against Torture (UNCAT) - United Nations Convention on the Rights of the Child (CRC or UNCRC) - Conventions on the Protection of the Rights of Migrant Workers and Disabled.

UNIT-III: Regional Human Rights

European Human Rights System- African Human Rights System – Enforceability before Domestic Courts – UNO – Universal Declaration of Human Rights.(UDHR)

UNIT-IV: Human Rights in India

The Constitution of India – Fundamental Rights – Right to Life and Liberty – Direction Principles of State Policy – Fundamental Duties – Individual and Group Rights – Other facets of Human Rights – Measures for Protection of Human Rights in India.

UNIT-V: Human Right Violations and Redressal Mechanism

Human Right Infringement of Human Right by State Machinery and by Individual – Remedies for State action and inaction – Constitutional remedies – Public Interest Litigation (PIL) - Protection of Human Rights Act, 1993 – National Human Rights Commission – State Human Rights Commissions – Constitution of Human Right Courts.

EXPECTED OUTCOMES:

- After studying unit-1, the student will be able to know the nature of human rights its origin, the theories, the movements in the march of human rights and the facets of future of human rights.

- After studying unit-2, the student will be able to know the international dimension of human rights, the role of UN and the global effort in formulating conventions and declarations
- After studying unit-3, the student will be able to Perceive the regional developments of human rights in Europe , Africa and Asia and the enforceable value of human rights in international arena.
- After studying unit-4, the student will be able to have knowledge on the human rights perspectives in India, more developed by its constitution and special legislations
- After studying unit-5, the student will be able to know the redressal mechanism made available in case of human rights violation confined to India.

TEXT BOOKS:

1. Human Rights Lalit Parmar, Anmol Publications Pvt. Limited, 1998
2. Human Rights In International Relations, David P. Forsythe, Cambridge University Press
3. Alston, Philip, And Frederic Megret, Eds. The United Nations And Human Rights: A Critical Appraisal. Second Edition. Oxford University Press, 2014.
4. Bassiouni, M. Cherif, And William A. Schabas, Eds. New Challenges For The UN Human Rights Machinery: What Future For The UN Treaty Body System And The Human Rights Council Procedures? Intersentia, 2011.
5. Kruckenberg, Lena J. The Unreal World Of Human Rights: An Ethnography Of The UN Committee On The Elimination Of Racial Discrimination. Nomos Publishers, 2012.
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16. The Human Rights Watch Global Report On Women's Human Rights 2000 Oxford Publication
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18. Julies Stone Human Law And Human Justice 2000 Universal Publication
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FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER-II **CORE COURSE – VI**

INORGANIC CHEMISTRY – II

OBJECTIVES:

- To provide understanding the knowledge of Bronsted amd lewis acids and bases, classification of acids and bases.
- To learn the concept of radioactive decay and artificial radioactive decay.
- Understanding the concept ofmetallo proteins-iron containing proteins, metallo enzymes.
- To provide knowledge of types of ligands and dinitrogen complex.
- Understanding the concept of organometallics reaction and polymerization of olefins.

UNIT I ACIDS AND BASES

1.1 Bronsted and Lewis Acids and Bases, Protonic Acid, Proton Affinities - differentiating and leveling solvents - Acidic behavior of the Binary Hydrides -strength of Oxy Acids - Hydrolysis - Amphoteric Oxides - Non Protonic concepts of Acid- Base reactions - Lux concept.

1.2 Non-aqueous solvents - Liquid Ammonia, Acetic Acid, Bromine trifluoride, Dinitrogen tetroxide and liquid Hydrogen fluoride.

1.3 Classifications of acids and bases - Hard or Soft - Acid - Base strength and hardness and softness.

UNIT II NUCLEAR CHEMISTRY

2.1 Radioactive decay - Theories of decay process - Laws of radioactivity. Detection and measurement of radiations - Nuclear structure - Composition of nuclei - Properties of nuclei - Nuclear radii and nuclear spin. Nuclear forces - Meson Field Theory - Nuclear stability - Nuclear models - Liquid drop, Shell and Collective models.

2.2 Artificial radioactivity - Nuclear reactions – Transmutation, Stripping, Pickup, Spallation, Fragmentation and Scattering reactions – Nuclear fission and fusion reactions - Fission products and fission yields - Nuclear Cross Section - Q value - Nuclear reactors - Charged particle accelerators - Neutron sources - Gamma ray and X-ray sources.

2.3 Radioactive techniques - Tracer technique – Neutron Activation, Isotopic Dilution and Carbon Dating Analyses – Agricultural and Medicinal applications of Radio Isotopes.

UNIT III ORGANOMETALLICS

3.1 Types of ligands – Hapticity – 18 electron rule and its limitations – Structure and bonding in metal carbonyls – Metal nitrosyls (bent and linear) – Metal olefin, (Zeises salt), Metal allyl and Metal acetylene complexes.

3.2 Metallocenes (Ferrocene) – Dinitrogen Coomplexes – Metal carbenes - Isolobal concept and its applications.

3.3 Metals in medicine - Chemotherapy – Lithium complexes as anti-depressive drugs, Gold complexes as anti-arthritis drugs, Platinum complexes as anti-cancer drugs - Cisplatin and its action, Radiopharmaceuticals.

UNIT IV BIO- INORGANIC CHEMISTRY

4.1 Metallo proteins - Iron containing proteins - Metalloporphyrins - Haemoglobin and Myoglobin – Structures and work functions - Synthetic oxygen carriers - Electron carrier proteins and its work functions – Cytochromes - Structure and Work Function – Cytochrome c oxidase - Vitamin B12 - Structure and Work Function - Iron sulphur proteins and its classification – Ferridoxins and Rubredoxins.

4.2 Non Heme Proteins - Magnesium containing proteins: Chlorophyll – Structure and photosynthetic sequence. Copper containing proteins – Classification, Blue Copper proteins.

4.3 Metallo enzymes - Carboxy Peptidase, Carbonic Anhydrase and Superoxide Dismutase – Ion transport across membranes - Ion transport across the membrane – Sodium and Potassium ion pumps.

UNIT V REACTIONS AND CATALYSIS BY ORGANOMETALLICS

5.1 Organometallic reactions – Ligand Association and Dissociation – Oxidative Addition and Reductive Elimination – Migratory insertion reactions.

5.2 Reactions of coordinated ligands in organometallics – Hydrogenation, Hydroformylation (oxo process), Epoxidation, Olefin metathesis.

5.3 Acetic acid synthesis – Wacker process - Polymerization of olefins – Fischer Tropsch synthesis and Zeigler Natta Polymerization and Carbonylation of methanol (Monsanto process).

OUTCOMES:

The student will be able to

- Explain about carbon donors and describe the structure and bonding of organometallic reaction.
- Illustrate the different types of reaction of Bio-inorganic chemistry.
- Discuss the various catalysis by organometallics.
- To learn about radioactive decay and artificial decay.
- Discuss the various concept of acids and base reaction.

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FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER – II CORE COURSE – VII

PHYSICAL METHODS IN CHEMISTRY

Objectives

- To learn the principles, instrumentation, interpretation and applications of Microwave spectroscopy and infrared spectroscopy.
- To understaned the knowledge of Raman spectroscopy, UV-Visible spectroscopy and ORD.
- Understanding the concept of Nuclear Magnetic Resonance Spectroscopy.
- To able to learn about Massbauer Spectroscopy amd Mass Spectroscopy.

UNIT I PRINCIPLES OF MOLECULAR SPECTROSCOPY

1.1 Microwave spectroscopy – Rotational spectra of diatomic molecules, rigid and non-rigid rotors – Intensity of spectral lines – Effects of isotopic substitution.

1.2 Infrared spectroscopy – Diatomic molecules, simple harmonic and anharmonic oscillators– Vibration spectrum of carbon monoxide – Interaction of rotation and vibration (breakdown of Born-Oppenheimer approximation) – Group Vibration concept - Fermi Resonance - Factors influencing group frequencies – Quantitative studies – Hydrogen bonding (intermolecular and intramolecular).

UNIT II UV-VISIBLE AND ORD SPECTROSCOPY

2.1 Raman spectra – Rotational Raman spectra of linear and symmetric top molecules – Rotational fine structure.

2.2 Electronic spectra of diatomic molecules – Vibrational coarse structure – intensity of vibrational lines in electronic spectra – Rotational fine structure – Fortrat diagram - UV-Visible spectroscopy – Woodward-Fieser and Scott's rules for conjugated dienes and polymers, ketones, Aldehydes, α, β-unsaturated acids, Esters, Nitriles and Amides – Differentiation of geometrical isomers and positional isomers – Disubsitituted Benzene derivatives – Study of Steric effect in Aromaticity.

2.3 Optical rotatory dispersion and circular dichroism– Introduction to theory and terminology – Cotton effect – ORD curves – Axial haloketone rule and its applications – The Octant rule – Its applications.

UNIT III NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

3.1 ^{1}H NMR Spectroscopy – Multiplicity – Coupling constant – Spin-Spin splitting – Vicinal and geminal coupling constants – Karplus equation – Long range coupling constants, influence of stereochemical factors on chemical shift of protons.

3.2 Simplification of complex spectra – Double resonance techniques, shift reagents – An elementary treatment of NOE phenomenon.

3.3 ^{13}C NMR Spectroscopy – Broad band decoupling – Off resonance decoupling – Chemical shifts of common functional groups – FT NMR and its importance – DEPT spectra – 2D techniques- ^{1}H–^{1}H COSY, ^{1}H–^{13}C HETCOSY – NOESY.

UNIT IV MASSBAUER SPECTROSCOPY

.

4.1 Mossbauer Spectroscopy **–** Introduction, principle, Instrumentation, Recoil

energy, Doppler effect, number of MB signals, Isomer shift, Quadrupole splitting, Magnetic hyperfine splitting- Applications to ^{57}Fe, ^{119}Sn and ^{129}I compounds.

4.2 NQR spectroscopy – Characteristics of quadrupolar nucleus – Effects of field gradient and magnetic field upon quadrupolar energy levels – NQR transitions – Applications of NQR Spectroscopy

UNIT V MASS SPECTROSCOPY

5.1 Mass Spectrometry – Instrumentation – Resolution – ESI, EI, CI and FAB methods – Base peak, Isotopic peaks, Metastable peaks – Importance of Metastable peaks, Parent peak, Recognition of molecular ion peak – Fragmentation – General rules – Pattern of fragmentation for various classes of compounds, McLafferty rearrangement – Nitrogen rule.

5.2 Structural elucidation of organic molecules using Mass and combined spectral data.

Expected outcomes

- After completing this course, the students will
- Understand the principles, instrumentation, interpretation and applications of micro wave, IR and Raman spectroscopy ⎫ Understand the principles, instrumentation and applications of OR and CD.
- Understand the principles, instrumentation and applications of NQR Spectroscopy.
- Understand the principles, instrumentation and applications of Mass Spectroscopy.

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FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER - II CORE COURSE – VIII (CORE PRATICAL - III)

ORGANIC CHEMISTRY - II (P)

OBJECTIVES

1. To carry out the qualitative analysis of an organic mixture.

2. To perform the preparation of organic compounds.

1. Quantitative analysis of organic compounds

Estimation of Phenol, Aniline, Ketone, Glucose, saponification value of an oil and Iodine value of oil.

2. Preparation of organic compounds (double stage)

1. *p*-Bromoacetanilide from Aniline (Acetylation and bromination).
2. Acetylsalicylic acid from Methyl Salicylate (Hydrolysis and Acetylation).
3. 1,3,5-Tribromobenzene from aniline (Bromination, Diazotization and Hydrolysis)
4. *p*-Nitroaniline from Acetanilide (Nitration and Hydrolysis)
5. Benzilic acid from Benzoin (Rearrangement)
6. *p*-Aminobenzoic acid from p-Nitrotoluene (Oxidation and Reduction)
7. Benzanilide from Benzophenone (Rearrangement)
8. *p*-Bromoaniline from Acetanilide (Bromination and Hydrolysis)
9. *m*-Nitroaniline from Nitrobenzene (Nitration and Reduction)
10. 1,2,4-Triacetoxy Benzene from Hydroquinone (Oxidation and Acylation)

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2. V. K. Ahluwalia, P. Bhagat and R. Agarwal, Laboratory Techniques in Organic Chemistry- I. K. International, 2005.
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FACULTY UNIVERSITY NOMINEE HOD

SEMESTER - II CORE COURSE – IX (CORE PRACTICAL - IV)

INORGANIC CHEMISTRY II (P)

OBJECTIVES

1. To carry out the Titrimetric and Gravimetric analyses.
2. To perform the preparation of compounds.

1. Titrimetry and Gravimetry

A mixture of solution(s) should be given for

i). Estimation Cu (Volumetrically) and Ni(Gravimetrically)

ii). Estimation of Cu (Volumetrically) and Zn (Gravimetrically)

iii) Estimation of Fe (Volumetrically) and Zn (Gravimetrically)

iv) Estimation of Fe (Volumetrically) and Ni (Gravimetrically)

v) Estimation of Zn (Volumetrically) and Cu (Gravimetrically)

2. Preparation of complexes

1. Tris(thiourea)copper(I) chloride
2. Tetraamminecopper(II) sulphate
3. Potassium trioxalatoferrate
4. Potassium trioxalatoaluminate(III)
5. Potassium trioxalatochromate(III)
6. Tris(thiourea)copper(I) sulphate

REFERENCES

1. A. I. Vogel, Text Book of Quantitative Inorganic Analysis- 6th Ed., Longman, New Delhi, 2000.

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CO5	3	3	3	3	2

FACULTY UNIVERSITY NOMINEE HOD

SEMESTER – II **ELECTIVE COURSE – I**

POLYMER CHEMISTRY

OBJECTIVES:

- To provide a thorough understanding of the basic concept of polymers
- To gain knowledge about the different polymerization mechanisms
- To learn the molecular weight determination and characterization of polymers.
- To exploit the polymer processing techniques for various applications.
- To study the importance of advanced polymers

UNIT I CLASSIFICATION AND MOLECULAR WEIGHT DETERMINATION

1.1 Basic concepts of polymer science-Molecular forces and chemical bonding in polymers-Classification of polymers-Addition polymers, Condensation polymers, Biopolymers – Polymer Synthesis-Polymerization Techniques.

1.2 Molar mass and size of polymers, Number average and weight average molecular weight-Methods of molecular weight determination - Osmometry, Viscosity, Light scattering, Sedimentation, Ultracentrifuge -Molecular weight distribution curve.

UNIT II SYNTHESIS AND KINETICS

2.1 Kinetics of polymerization – Free radical chain polymerization, Cationic polymerization, Anionic polymerization, Copolymerization.

2.2 Degree of polymerization, Chain length, Chain transfer, Chain termination, Stereo regular polymerization, Zeigler -Natta Catalysts.

UNIT III CHARACTERIZATION

3.1 Crystalline nature-x-ray diffraction-Study of polymers, Degree of crystallinity, Differential Scanning Calorimetry, Thermogravimetric analysis of polymers. Glass Transition Temperature-Factors affecting Glass Transition Temperature, The properties associated with glass transition temperature and crystallinity and melting point-Relation to structure.

UNIT IV CHEMICAL REACTIONS

4.1 Hydrolysis, Acidolysis, Hydrogenation, Addition and Substitution reactions-Cyclization, Cross Linking-Vulcanization, Graft and Block Copolymers.

4.2 Types of Degradation- Thermal, Mechanical, Oxidative, Hydrolytic and Photo degradation

UNIT V PHYSICAL PROPERTIES AND APPLICATIONS

5.1 Mechanical – Stress - Strain measurements.

5.2 Industry important polymers - Natural and synthetic rubber, Polyesters, Polytetrafluoroethylene (PTFE), Polystyrene, Ion exchange resins, Nafion, Polyacylonitrile – Carbon fibres, Polyvinyl chloride and Poly acrylates.

5.3 Conducting polymers – Classification – Doping – p-doping and n-doping – Synthesis, properties and applications of Polyacetylene and Polyaniline.

EXPECTED OUTCOMES:

- Understand the basic concept of polymers and the molecular weighing depth.
- Understand the chemistry of organic and inorganic polymers.
- Understand the polymerization mechanism kinetics and various polymerization techniques.
- Choose an appropriate analytical method to characterize polymers.
- Select an appropriate moulding technique to process a particular polymer.
- Realize the importance of advanced polymers.

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FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER - II **OPEN ELECTIVE - I (NME)**

FOOD CHEMISTRY

OBJECTIVES:

- To understand the principles of food fermentation technology.
- To study about packaged drinking water.
- To study importance of beverages and its types.
- To study about food adulteration
- To understand about food preservation and packaging,

UNIT-I: Fermented Foods

Fermentation - Definition, types of fermentation; Fermented foods - Sauerkraut, Cucumber pickles, Olive pickles; Oriental fermented foods - Soysauce, Tofu; Traditional fermented foods - Idli, Dosa, etc.; Fermented meat and milk products.

UNIT-II: Packaged drinking water

Packaged drinking water – Definition and types; Manufacturing processes of raw and processed water - Quality evaluation of raw and processed water - Methods of water treatment - BIS quality standards (for bottled water; mineral water, natural spring water).

UNIT-III: Beverages and its Types

Beverages: Types, Definitions - Manufacturing process and technology - Note on Specialty beverages based on tea coffee - Dairy-based beverages - Synthetic Beverages – Technology of carbonated beverages - Low-calorie and dry beverages - Isotonic and sports drinks - Role of various ingredients of soft drinks - Carbonation of soft drinks.

UNIT-IV: Food adulteration and food poisoning

Food adulteration - Sources of foods, Types, Advantages and Disadvantages, Constituents of foods, Carbohydrate, Protein, Fats and, Oils, Colours, Flavours, Natural toxicants. Food poisoning -Sources, causes and remedy-Causes and remedies for acidity, gastritis indigestion and constipation.

UNIT-V: Food preservation and processing

Food Spoilage-Definition–Prevention-Food Preservatives-Definition-Classification- Food preservation- Methods of preservation - Classification – Low and high temperature - Preservatives processing by heating-Sterilisation, Pasteurization -Food additives-Definition–Classification and their functions.

EXPECTED OUTCOMES:

- The Students will be able to
- Acquire knowledge of fermented food.
- Acquire knowledge about packaged drinking water.
- Illustrate the importance of beverages and its types.
- Acquire knowledge about food adulteration.
- Illustrate the importance of food preservative.

TEX BOOK BOOKS:

1. B.Sri Lakshmi. (2005),Food Science New Age International Publisher,3rd edn
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FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER - III **CORE COURSE – X**

ORGANIC CHEMISTRY – II

OBJECTIVES

- Understanding the concept of Aliphatic and Aromatic substitution along with their mechanism and synthetic utility.
- Understanding the concept of Nucleophilic Substitution reaction.
- Understanding various types of oxidation and reduction reactions along with their mechanism and synthetic utility.
- Understing the concept of Pericyclic reaction and Natural product.

UNIT I NUCLEOPHILIC SUBSTITUTION REACTIONS

1.1 Aliphatic nucleophilic substitution – Mechanisms – SN_1, SN_2, SN_i– Ion-pair in SN_1 mechanisms – Neighbouring Group Participation - Substitutions at Allylic and vinylic Carbons.

1.2 Correlation of Structure with Reactivity – Solvent effects.

1.3 Rearrangements involving Carbocations – Wagner-Meerwein and Dienone-Phenol Rearrangements.

1.4 Aromatic nucleophilic substitutions – SN_1, SNAr, Benzyne mechanism – reactivity orientation – Ullmann, Sandmeyer and Chichibabin reaction – rearrangements involving nucleophilic substitution – Stevens – Von-Richter rearrangements.

UNIT II ELECTROPHILIC SUBSTITUTION REACTIONS

2.1 Aromatic electrophilic substitution reaction – Orientation, reactivity and mechanisms based on transition state theory with suitable reactions – Substitutions in Thiophene and Pyridine – N-oxide.

2.2 Quantitative treatment of the structural effects on reactivity - Substituent effects – Origin of Hammett equation – Principles of Hammett correlation – Effect of structure on reaction mechanisms - Hammett Parameters –σ and ρ, modified forms of Hammett E+quation, Taft Equation.

2.3 Aliphatic electrophilic substitution – SE_2, SE_i and SE_1 mechanisms – Diazonium coupling reactions – Metals as electrophile in substitution reactions and decomposition of diazonium salts.

UNIT III ADDITION AND ELIMINATION REACTIONS

3.1 Addition to Carbon-Carbon multiple bonds – Electrophilic, Nucleophilic and Free radical additions – Orientation of the addition – Stereochemical factors influencing the addition of bromine and hydrogen bromide, Hydroxylation – Hydroboration leading to formation of alcohols.

3.2 Addition to carbonyl and conjugated carbonyl systems – Mechanism – Grignard reagents – 1,2- and 1,4-additions (dimethylcuprate) – Addition to carbon-oxygen double bond – Benzoin, Knoevenagel, Stobbe, Darzens Glycidicester Condensation and Reformatsky reactions.

3.3 Elimination reactions – Mechanisms- E_1, E_2, E_1CB – Stereochemistry of

elimination, Hofmann and Saytzeff rules – Competition between elimination and substitution – Pyrolytic *cis* elimination, Chugaev reaction – examples such as dehydration, Dehydrohalogenation, Cope elimination– Bredt's rule with examples.

UNIT IV PERICYCLIC REACTIONS

4.1 Concerted reactions –Stereochemistry – Orbital symmetry and Concerted symmetry and Correlation diagram. Frontier Molecular Orbital approach – Woodward and Hoffmann rules - Electrocyclic reactions - Cycloaddition reactions.

4.2 Sigmatropic rearrangements – Selection rules and examples with simple molecules - 1,3and 1,5 -hydrogen shifts – Cope - Claisen - Sommelet- Hauser rearrangements.

UNIT V NATURAL PRODUCTS

5.1 Terpenes - Classification - Structural elucidation, Medicinal values and synthesis of α – pinene, Camphor and Zingiberene.

5.2 Alkaloids- Structural elucidation, Medicinal values and synthesis of Quinine, Cinchonine.

5.3 Vitamins - Physiological importance – Structural elucidation of Vitamins B6.

5.4 Steroids – Classification – Structural elucidation and synthesis of Progesterone and Androsterone.

EXPECTED OUTCOMES

- To enable the students to understand reaction mechanisms involved in additions, and elimination reactions.
- To enable the students to understand reaction mechanisms involved in rearrangements as well as name reactions along with their synthetic utilities.
- To enable the students to understand various types of Electrophilic reactions along with their synthetic utilities.
- To enable the student to understand of Pericyclic reaction and Natural products.

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FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER – III **CORE COURSE – XI**

INORGANIC CHEMISTRY – III

OBJECTIVES:

- To analyze and interpret the IR, RAMAN, NMR spectra of Inorganic compounds and coordination complexes.
- To study the concept of electronic spectroscopy.
- To gain knowledge about the principle and applications of EPR Spectroscopy and Magnetic properties.
- To analyze and interpret the X-Ray Crystallography.

OBJECTIVES:

UNIT I ELECTRONIC SPECTROSCOPY

1.1 Microstates and Term symbols for transition metal ions - Possible Term symbols for p^2 and d^2.

1.2 Hund's rule - RS and j - j coupling - Selection rules - Orgel diagrams for d^n, oh and Td systems. Tanabe -Sugano diagram calculation of β and 10 Dq - factors affecting 10 Dq - Charge transfer spectra.

UNIT II IR AND RAMAN SPECTROSCOPY

2.1 IR selection rule – Group vibration concept and its limitation. Effect of coordination of ligand vibrations - Uses of group vibrations in the structural elucidation of ligand – Uses of group vibration in the structural elucidation of metal complexes of Urea, Thiourea, Cynide, Thiocyanate, Nitrate, Sulphate and Dimethylsulphoxide.

2.2 Effect of isotopic substitution on the Vibrational spectra of molecules - Vibrational spectra of metal carbonyls with references to the nature of bonding geometry and number of C-O stretching vibrations (Group theoretical treatment). Combined application of IR and Raman spectroscopy in the structural elucidation of simple molecules like H_2O, ClF_3,NO_3,ClO_3.

UNIT III NMR SPECTROSCOPY

3.1 Chemical shift and Coupling constants (spin – spin coupling involving different nuclei ^{1}H, ^{31}P, ^{13}C) interpretation and application to inorganic compounds. Effects of quadrupolar nuclei (^{1}H, ^{10}B, ^{11}B) on the ^{1}H NMR Spectrum.

3.2 NMR paramagnetic molecules - Isotopic shifts, Contact and Pseudo contact interactions. Lanthanide shift reagents, Stereochemistry of non-rigid molecules. Satellite spectra - Applications of ^{1}H, ^{31}P, ^{13}C NMR of Inorganic molecules.

UNIT IV EPR SPECTORSCOPY AND MAGNETIC PROPERTIES

4.1 Basic principles - "g" values and its types - Factors affecting "g" values - Hyperfine spiliting - Zero field splitting and Kramer's degeneracy – Spectra of Cu(II) complex. Applications of ESR to Free radicals and Inorganic molecules.

4.2 Magnetic properties - Dia, Para, Ferro and Antiferro magnetisms - First order

and second order Zeeman effect – Temperature independent paramagnetism-magnetic properties of Lanthanides and Actinides.

UNIT V X-RAY CRYSTALLOGRAPHY

5.1 Solid state- Difference between point group and space group - Screw axis - Glide planes. Crystal symmetry elements - Crystal classes - Crystal systems - Unit cell - Bravis lattices, Asymmetric unit space group - Equivalent positions - Relations between molecular symmetry and crystallographic symmetry - Basic concepts. The concept of reciprocal lattice and its applications – X- ray diffraction by single crystal – Structure factor - Systematic absences - Determination of space group - Heavy Atom Method.

5.2 Neutron diffraction - Basic principles (elementary treatment) – Comparison of X-ray diffraction and Neutron diffraction.

EXPECTED OUTCOMES:

- Explain about carbon donors and describe the Electronic Spectroscopy.
- Illustrate the IR and Raman Spectroscopy.
- Discuss the princilple and application of NMR Spectroscopy.
- Illustrate the EPR Spectroscopy and Magnetic properties.
- To learn about X-Ray crystallography.

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1. B.N Figgis "Introduction to ligand fields" wiley eastern, new delhi.
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8. Antony R.West "Solid state chemistry and its application "John wiley, New york
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10. A.B.P Lever "Inorganic electronic spectroscopy" 3nd edition. Elsevier, London 2013.
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	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
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FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER – III CORE COURSE – XII (CORE PRACTICAL - V)

PHYSICAL CHEMISTRY I (P)

OBJECTIVES

- To perform the various techniques of physical chemistry experiments.

Experiments

Any ten experiments (to be decided by the course teacher) out of the following experiments.

1. Kinetics-acid hydrolysis of Ester–comparison of strengths of acids.
2. Kinetics-acid hydrolysis of Ester–determination of energy of activation (Ea).
3. Kinetics-saponification of Ester–determination of Ethyl acetate by conductometry.
4. Kinetics-Persulphate-Iodine reaction –determination of order, effective of ionic strength on rate constant.
5. Determination of molecular weight of substance by transition temperature method.
6. Determination of molecular weight of substances by Rast method.
7. Determination of Critical Solution Temperature (CST) of phenol-water system and effect of impurity on CST.
8. Study of phase diagram of two components forming a simple eutectic.
9. Study of phase diagram of two compounds forming a compound.
10. Study of phase diagram of three components system.
11. Determination of molecular weight of substances by Cryoscopy method.
12. Determination of integral and differential heat of solutions by Colorimetry.
13. Polymerization-rate of polymerization of Acrylamide.
14. Distribution law – study of Iodine-Iodine equilibrium.
15. Distribution law – study of association of Benzoic acid in Benzene.
16. Adsorption – Oxalic acid/Acetic acid on charcoal using Freundlich isotherm.

REFERENCES

1. B. P. Levitt, Findlay's Practical Physical Chemistry- 9th Ed., Longman, 1985.
2. J. N. Gurtu and R. Kapoor, Advanced Experimental Chemistry- Vol. 1-Physical, S. Chand and Co., Ne.

	PO1	PO2	PO3	PO4	PO5
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CO5	3	3	3	3	3

FACULTY UNIVERSITY NOMINEE HOD

SEMESTER –III RESEARCH METHODOLOGY

OBJECTIVES:

- To understand the importance of research and literature sources.
- To gain knowledge about the Chemical Abstract search in Chemical research.
- Acquire knowledge on choosing a research problem and science writing.
- Adequate knowledge on assessing the quality of analytical data.
- Working knowledge on Computer aided literature search

UNIT I: Literature Survey

Source of chemical information – primary, secondary, tertiary sources-literature survey-Indexes and abstracts in science and technology – Applied science and technology index, chemical abstracts, chemical titles, current chemical reactions, current contents and science citation index. Classical and comprehensive reference works in chemistry-synthetic methods and techniques, treatises, reviews, patents and monographs.

UNIT II: Chemical Abstracts:

Current awareness searching: CA weekly issues, CA issue indexes. Retrospective searching: CA volume indexes-general subject index, chemical substance index-formula index, index of ring systems, author index, patent index. CA collective indexes: collective index (CI), decennial index (DI). Access points for searching CA indexes- Index guide, general subject, terms, chemical substance names, molecular formulas, ring systems, author names, patent numbers. Locating the reference: finding the abstract, finding the original document chemical abstract - Service source index.

UNIT III: Choosing a Research Problem and Scientific Writing

Identification of research problem – Assessing the status of the problem - guidance from the supervisor – actual investigation and analysis of experimental results – conclusions. Scientific writing-research reports, thesis, journal articles and books.

UNIT IV: Scientific Writing & Conduct of Research Work

Steps to publishing a scientific article in a journal – types of publications-communications, articles, reviews, when to publish, where to publish ,specific format required for submission. Documenting- Abstracts-indicative (or) descriptive abstracts, informative abstract, footnotes, end notes, referencing styles-bibliography-journal abbreviations (CASSI), abbreviation used in scientific writing.

UNIT V: Computer Searches and Literature.

ASAP–Alerts, CA Alerts, scifinder, chemport, science direct, STN international, journal home pages. Online browsing of research articles–online submission of research papers in various Journals (ACS, RSC, Elsevier, Springer etc.)–Instructions to the authors – Impact factors. Writing project proposal to funding agencies (UGC, DST etc.).

EXPECTED OUTCOMES:

- The Students will be able to aquire knowledge of Literature survey
- Acquire knowledge about thesis writing.
- Acquire knowledge about Reseach work.
- Identify the importance of errors involved chemical analysis.
- Illustrate the importance of online browsing of literature.

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TEXTBOOKS

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2. A.J. Durston, Thesis and assignment writing.
3. R.O.Bullet, Preparing thesis and other manuscripts.
4. R. L. Dominoswki, Research Methods, Prentice Hall, 1981.
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6. H. F. Ebel, C. Bliefert and W. E. Russey, The Art of Scientific Writing, VCH, Weinheim, 1988.
7. B. E. Cain, The Basis of Technical Communicating, ACS., Washington, D.C., 1988.
8. H. M. Kanare, Writing the Laboratory Notebook; American Chemical Society: Washington, DC, 1985.
9. S.M.Khopkar, Basic concepts of analytical chemistry

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FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER - III **ELECTIVE COURSE – II**

CHEMISTRY OF NANOSCIENCE AND NANOTECHNOLOGY

OBJECTIVES:

- To understand the scientific background, classification and properties of nanomaterials.
- To gain knowledge about special nonmaterial's and to identify the bonding in nanostructure.
- To acquire knowledge about various methods of synthesis of nanomaterials
- To learn characterization techniques used for nanosystems .
- To study various industrial applications of nanotechnology**.**

UNIT I SYNTHESIS OF NANO MATERIALS

1.1 Definition of Nanodimensional materials – Historical milestones – Unique properties due to Nano size, Quantum dots, Classification of Nanomaterials.

1.2 General methods of synthesis of Nanomaterials – Hydrothermal Synthesis, solvothermal synthesis – Microwave irradiation– sol-gel and precipitation technologies – Combustion flame – Chemical vapour condensation process – Gas-phase condensation synthesis – Reverse Micelle Synthesis – Polymer- Mediated synthesis – Protein microtubule - Mediated synthesis – Synthesis of nanomaterials using microorganisms and other biological agents – Sonochemical Synthesis – Hydrodynamic Cavitation.

1.3 Inorganic Nanomaterials – Typical examples – Nano TiO_2/ZnO/CdO/CdS, Organic Nanomaterials – Examples – Rotaxanes and Catenanes

UNIT II CHARACTERISATION OF NANOSCALE MATERIALS

2.1 Principles of Atomic Force Microscopy (AFM) – Scanning Electron Microscopy(SEM), Transmission Electron Microscopy(TEM). XRD, XPS and AFM techniques.

2.2 Resolution and Scanning Transmission Electron Microscopy (STEM) – Scanning Tunneling Microscopy (STM).

UNIT III REACTIONS IN NANOPARTICLES

3.1 Reactions in Nanospace – Nanoconfinement – Nanocapsules

3.2 Cavitands, Cucurbiturils, Zeolites, M.O.Fs, Porous Silicon, Nanocatalysis, Rotaxanes and Catenanes

UNIT IV CARBON CLUSTERS AND NANOSTRUCTURES

4.1 Nature of carbon bond − New carbon structures − Carbon clusters – Discovery of C_{60} − Alkali doped C_{60} − Superconductivity in C_{60} − larger and smaller fullerenes.

4.2 Carbon nanotubes – Synthesis − Single Walled Carbon Nanotubes − Structure and Characterization − Mechanism of formation − Chemically Modified Carbon Nanotubes − Doping − Functionalizing Nanotubes − Applications of carbon Nanotubes.

4.3 Nanowires −Synthetic Strategies − Gas phase and Solution phase growth –

Growth control − Properties.

UNIT V NANO TECHNOLOGY AND APPLICATION

5.1 Application of Nanotechnology - Agriculture, Medicine, Sensors, Solar energy, Fuel cells, Food Industry, Nuclear Power Plant and Environmental Pollution. Protein Nano array, Nanopipettes, Molecular Diodes, Self Assembled Nano Transistors, Nanoparticle Mediated Transfection.

EXPECTED OUTCOMES:

- Discuss on the scientific background on nanomaterials
- Know various methods of synthesis of nanomaterials
- Know the characterization techniques used for nanosystems
- Understand the properties of nanomaterials in depth
- Acquire knowledge in various industrial applications of nanotechnology

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1. C. N. R. Rao, A. Muller and A. K. Cheetham (Eds), The Chemistry of Nanomaterials- Vol. 1 and 2- Wiley-VCH-Germany, Weinheim, 2004.
2. C. P. Poole, Jr- and F. J. Owens, Introduction to Nanotechnology- Wiley Interscience, New Jersey, 2003.
3. K. J. Klabunde (Ed), Nanoscale Materials in Chemistry- 2nd Ed., Wiley-Interscience, New York, 2009.
4. T. Pradeep, Nano- The Essentials in Understanding Nanoscience and Nanotechnology- 1st Ed., Tata McGraw Hill, New York, 2007.
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10. A. Nabok, Organic and Inorganic Nanostructures- Artech House, Boston, 2005.
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12. Home page of Prof. Ned Seeman - http-//seemanlab4.chem.nyu.edu/

13. Nanoletters - http-//pubs.acs.org/journals/nalefd/index.html

14. Nanotation – http-//www.acsnanotation.org.

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FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER –III **OPEN ELECTIVE II**

AGRICUTURAL CHEMISTRY

OBJECTIVES:

- To make the students to learn about the different types of fertilizers.
- To understand the classification of manures.
- To understand the usage of pesticides and insecticides.
- To learn the importance of fungicide and herbicide.
- To make the students aware of different soils.

UNITI:Fertilizers

Effect of Nitrogen, Potassium and Phosphorous on Plant Growth – Commercial method of preparation of Urea, Triple Super Phosphate. Complex Fertilizers and Mixed Fertilizers – their Manufacture and Composition. Secondary Nutrients – Micronutrients – their function in plants.

UNIT II: Manures

Bulky organic manures – Green manure – Compost manure–Farmyard manure – Handling and Storage. Oil cakes. Blood meal – Fish manures.

UNIT-III: Pesticides and Insectides

Pesticides – Classification of Insecticides , Fungicides, Herbicides as Organic and Inorganic – General methods of Application and Toxicity. Safety measures when using Pesticides Insecticides: Plant products – Nicotine, Pyrethrin – Inorganic Pesticides – Borates. Organic Pesticides – D.D.T. and BHC.

UNIT IV: Fungicides and Herbicides

Fungicide : Sulphur compounds, Copper compounds, Bordeaux mixture. Herbicides: Acaricides – Rodenticides. Attractants– Repellants. Preservation of Seeds.

UNIT V: Soils

Classification and Properties of soils – Soil Water, Soil Temperature, Soil minerals, Soil Structure - Bulk Density - Porosity – Consistence – Soil Colour - Soil Acidity and Soil Testing.

EXPECTED OUTCOMES:

- Differentiate between different types of fertilizers.
- Acquire knowledge on the various types of manures.
- Appreciate the usage of different pesticides with caution.
- Illustrate the importance of types of herbicides and preservation of seeds.
- Analyze the characteristics of different soils.

TEXT BOOKS:

1. G.T.Austinshreve's G.T,.(1984). *ChemicalProcess Industries* (5th ed.).Mc-Graw-Hill.
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FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER IV **CORE COURSE - XIV**

PHYSICAL CHEMISTRY – II

OBJECTIVES:

- To know the foundations and the physical and mathematical basis of quantum mechanics.
- To apply the concepts of quantum mechanics to solve problems in microscopic systems.
- To understand the quantum mechanical approach to the atomic and molecular electronic structure.
- To know the concept of electrochemistry, Debye-Huckel, Onsager theory and wien effect.
- To know the concept of surface phenomena, BET isotherms and application of ARRT theory.
- To know about statistical thermodynamic and quantum statistics.

UNIT I QUANTUM CHEMISTRY - II

1.1 Application of Schodinger equation, the rigid rotator, Harmonic oscillator - Hydrogen atom solution - Shapes and Nodal properties of orbitals - Space quantization - Electron spin - Many electron atoms - One electron orbital - Pauli Principle - Determinantal form of Wave Function, Helium atom and Effective Nuclear charge - Approximation method - Variation methods - Perturbation methods – Application to Helium atom.

1.2 Angular momentum in many electron systems - Spin Orbit Interaction L-S and j-j Coupling Schemes.

1.3 Atomic Structure calculation – Self consistent method for atoms - Hartree and Hartree Fock method for atoms.

UNIT II ELECTROCHEMISTRY - I

2.1 Electrolytic Conductance, Debye – Huckel – Onsager theory - Debye Falkenhagen and Wien effect. Electrode – Electrolyte Equilibrium, Electrode Potential - Concentration cells - Liquid Junction Potentials.

2.2 Process at Electrode - The rate of Charge Transfer - Current Density - Butler - Volmer equation - Tafel equation - Electrical Double Layer Potential - Theory of Multiple Layers at Electrode - Electrolyte Interfaces - Double Layer Capacity - Electro kinetic phenomena , Applications - Fuel cells and Power Storage like Rechargeable batteries (Lead acid, Ni-Cd and Li-ion)

UNIT III ELECTROCHEMISTRY – II

3.1 Principles and applications of Polarography - Instrumentation, Types of cells, Advantages of Dropping Mercury Electrode, Interpretation of Current Voltage Curves, Tests for reversibility, Determination of n values (usefulness of illkovic equation), Polarographic maxima, Current time curves.

3.2 Principles, Instrumentation and Applications of Cyclic Voltametry, Amperometry and Colourimetry techniques.

UNIT IV SURFACE CHEMISTRY AND CHEMICAL KINETICS - II

4.1 Surface phenomena – Gibbs adsorption isotherm – Physisorption and Chemisorption – Langmuir, BET isotherms – Surface area determination. Kinetics of Surface Reactions involving Adsorbed Species – Langmuir-

Hinshelwood Mechanism, Langmuir-Rideal Mechanism – Rideal-Eley mechanism – Some Interfacial Aspects on Micelles, Reverse Micelles, Microemulsions and Membranes.

4.2 Application of ARRT to solution kinetics – Effect of solvent and Ionic Strength, Influence of Pressure on rates in solution – Enzyme Catalysis – Mechanism of Single Substrate Reactions – Michaelis-Menten equation – Acidity functions – Kinetics of processes in Micellar and Reverse Micellar Systems.

UNIT V STATISTICAL THERMODYNAMICS

5.1 Thermodynamic Probability – Probability Theorems – Relation between Entropy and Probability (Boltzmann-Planck equation), Ensembles, Phase Space, – Partition Functions – Translational, Rotational, Vibrational and Electronic partition functions. Relationship between Partition Function and Thermodynamic Properties – Calculation of Equilibrium Constant from Partition Functions – Heat Capacities of Mono Atomic Crystals – Einstein theory and Debye theory.

5.2 Quantum Statistics – Bose-Einstein (B.E.) and Fermi-Dirac (F.D.) Distribution equations – Comparison of B.E. and F.D. Statistics with Boltzmann Statistics .

EXPECTED OUTCOMES:

- Identity the application of quantum chemistry , vibrational spectra amd mutual exclusion and fermic resonance.
- To know the concept of electrochemistry and polarograsphy.
- To enable to learn about the surface chemistry and chemical kinetics.
- To learn about the statistical thermodynamics.

REFERENCES

1. A. K. Chandra, Introductory Quantum Chemistry- 4th Ed., Tata McGraw Hill, Noida, 1994.
2. D. A. Mcquarrie, Quantum Chemistry- University Science Books, Herndon, 2008.
3. J. P. Lowe, and K. A. Peterson, Quantum Chemistry- 3rd Ed., Academic Press, Cambridge, 2005.
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FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMSTER –IV CORE COURSE XIV

ADVANCED ANALYTICAL CHEMISTRY

OBJECTIVES

- To understand the principles, instrumentation and applications of various thermal analysis techniques.
- To understand the various types of error and analysis of various correlation and general polynomial fitting.
- To enable to understand the concept of chromatography.
- To provide the concept of principles and application of thermo gravimetery analysis.
- To know about electrochemical sensors, amperometric titration and its application.

UNIT I INSTRUMENTAL METHODS OF ANALYSIS

1.1 Principles and applications of extended X-ray Absorption Fine Structure (EXAFS) - Surface Extended X-ray Absorption (SEXAFS).

1.2 Atomic Absorption Spectroscopy (AAS) - Flame Emission Spectroscopy (FES) – Turbidimetry and Nephelometry - Theory and Applications.

UNIT II DATA AND ERROR ANALYSIS

2.1 Various types of Error – Sources and Minimisation - Accuracy, Precision, Significant figures - Describing Data, Population and Sample, Mean, Variance, Standard Deviation, way of quoting uncertainty, Repeatability and Reproducibility of measurements.

2.2 Hypothesis testing, Levels of Confidence and Significance, Test for an outlier, Testing Variances, Means t-Test, paired t-Test - Analysis of Variance (ANOVA) - Correlation and Regression.

2.3 Curve fitting, Fitting of linear equations, Simple linear case, Weighted Linear Case, Analysis of residuals- General polynomial equation fitting.

UNIT III CHROMATOGRAPHY

3.1 Solvent Extraction - Principles of ion exchange, Paper, Thin-layer and Column Chromatographic Techniques. Columns, Absorbents, R_f values, McReynolds Constants and their uses.

3.2 HPLC techniques - Absorbents, Columns, Detection methods, Estimations, Preparative Column - GC - MS techniques, Principle and uses.

UNIT IV THERMOANALYTICAL METHODS AND FLUORESCENCE SPECTROSCOPY

4.1 Principles and Applications of Thermo Gravimetry Analysis (TGA), Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry (DSC)– Thermometric Titrations - Types - Advantages.

4.2 Thermo Mechanical Analysis (TMA).

UNIT V ELECTROANALYTICAL TECHNIQUES

5.1 Electrochemical Sensors, Ion Sensitive Electrodes, Glass - Membrane Electrodes – Solid Lliquid Membrane Electrodes, Ion - Selective Field Effect Transistors (ISFETs) - Sensors for the analysis of gases in solution

5.2 Amperometric Titrations - Principle Instrumental – Techniques - Applications.

5.3 Fluorimetry, Phosporimetry, Potentiometer, Electrogravimetry - Instrumentation and its applications.

EXPECTED OUTCOMES

- Understand the principles, instrumentation, application of EXAFS and SEXAFS.
- Understand the Concepts of types of error and hypothesis testing and general polynom ial equation fitting.
- Understand the concept of chromatography.
- Understand the principles, instrumentation and applications of thermoanalytical and fluorescence spectroscopy.
- Understanding the concept of electrochemical sensors, amperometric titrations.

REFERENCES

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FACULTY **UNIVERSITY NOMINEE** **HOD**

SEMESTER - IV CORE COURSE – XVI (CORE PRACTICAL - VI)

PHYSICAL CHEMISTRY - II (P)

OBJECTIVES

To perform the various electrical experiments.

Experiments

Any ten experiments (to be decided by the course teacher) out of the following experiments.

1. Conductometry–Acid-Alkali titrations.
2. Conductometry–Precipitation Titrations.
3. Conductometry–Displacement Titrations.
4. Conductometry–Determination of dissociation constant of weak acids.
5. Conductometry– solubility product of sparingly soluble silver salts.
6. Verification of Onsager equation - Conductivity method.
7. Determination of Degree of Hydrolysis and Hydrolysis constant of a substance.
8. Potentiometric Titrations – acid alkali titrations.
9. Potentiometric Titrations – precipitation titrations.
10. Potentiometric Titrations – redox titrations.
11. Potentiometry–Determination of dissociation constant of weak acids.
12. Potentiometry–Determination of solubility of silver salts.
13. Potentiometry–Determination of activity and activity coefficient of ions.
14. P^H Titration of *Ortho*-phosphoric acid.
15. To determine the relative strength of two acids by conductance measurements.
16. To determine the pH of a buffer solution using a Quinhydrone Electrode.

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1. J. B. Yadav, Advanced Practical Physical Chemistry- 20th Ed., GOEL Publishing House, Krishna Prakashan Media Ltd., Chennai, 2001.
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FACULTY UNIVERSITYNOMINEE HOD

SEMESTER - IV ELECTIVE COURSE – III

INDUSTRIAL CHEMISTRY

OBJECTIVES:

- Tounderstand the principles of industrial fuels.
- To understand the importance of leather and water industry.
- To study about small scale industries.
- To learn the importance of cement and glass industries.
- To understand the principles of paper industry.

UNIT I

1.1 Basic idea about unit operation – Flow charts – Chemical conversion - Batch versus continuous processing - Chemical process selection – Design chemical process control.

1.2 Chemical process economics – Market evaluation - Plant location - Management for productivity and creativity - Research and Development and its role in Chemical Industries.

UNIT II FUELS

2.1 Fossil fuels - Classification and unique features - Coal, Petroleum, Natural gas, Biofuels - Biomass - Biodiesel, Nuclear fuels - for various types of nuclear reactors. Hydrogen as fuel in the future, Hydrogen storage materials. Fuel Extinguisher, Fire Retardant Materials - Fire Retarding Wood - procedures for handling toxic chemicals.

UNIT III OILS, FATS, WAXES AND SOAPS

3.1 Introduction - Distinction between Oils and Fats -Properties and its classifications - Animal fats and oils - Difference between Animal, Vegetable and Mineral oils - Isolation of Essential oils and their uses - Saponification value, Ester value, Acid value, Iodide value - Wijs method - Reichert meissel value - Consideration in soap making - Manufacture of toilet and transparent soaps - Oil to be used for soap manufacturing - Cleaning action of soap.

UNIT IV PULP AND PAPER

4.1 Introduction - Manufacture of pulp - Sulphite (or)Kraft pulp - Soda pulp - Sulphate pulp - Reg pulp - Beating, Refining, Filling, Sizing and Colouring - Manufacture of paper – Calendaring - uses - Ecological problems of Indian Pulp and Paper Inducting.

UNIT V PAINTS, PIGMENTS AND VARNISHES

5.1 Introduction - Composition of Pigments, White Pigments - White lead, Zinc Oxide, Lithophone, titanium dioxide. Blue pigments - Ultra Marine blue, Cobalt blue, and Iron blue. Red Pigments - Red lead. Green Pigments - Chrome Green, guignets green, reinmann's green. Block pigments - Yellow pigments - Toners - Metallic powders as pigments. Paints - Classification of paints - Distempers - Constituents of paints - Manufacture of paints - Setting of the paints -Requirements of the good paints – Emulsion paints - Constituents of

emulsion paints – Advantages - Chemical action of emulsion paints, Luminescent paints - Fire retardant paints - Special application of paints.

5.2 Varnishes - Raw materials - Manufacture of Varnishes - Enamels (or) Glass finisher - Lacquers - Solvents and Thinners - Oils.

EXPECTED OUTCOMES:

- The Students will be able to acquire knowledge of industrial fuels.
- Illustrate the importance of leather and water industries.
- Acquire knowledge about small scale industries.
- Acquire knowledge about cement industries.
- Acquire knowledge about paper industries.

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	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	2	3	3	3
CO4	3	3	2	3	3
CO5	3	3	3	3	3

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