SENGAMALATHAYAAREDUCATIONALTRUSTWOMEN'SCOLLEGE

(AUTONOMOUS)

(*Affiliated to Bharathidasan University*)

(Accredited by NAAC; AnISO9001:2015CertifiedInstitution)

SUNDARAKKOTTAI,MANNARGUDI–614016.

TAMILNADU, INDIA.

M.Sc., CHEMISTRY

COURSE STRUCTURE WITH SYLLABUS UNDERCBCS

(*For the candidates admitted in the academic year2020–2021*)

SENGAMALA THAYAAR EDUCATIONALTRUST WOMEN'S COLLEGE

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TAMILNADU,INDIA.

M.Sc., CHEMISTRY COURSE STRUCTURE UNDER CBCS

For the candidates admitted in the academic year 2020–2021)

Eligibility: Candidates who have passed Bachelor level Examination in Chemistry.

Sem	Nature of the Course	Course Code	Title of the Course	Ins. Hrs/ Week	Credit	Exam Hrs	Marks		Total
							Int.	Ext.	
I	Core Course (CC) – I	20PCH101	Organic chemistry- I	5	5	3	25	75	100
	Core Course (CC) – II	20PCH102	Inorganic Chemistry –I	5	5	3	25	75	100
	Core Course (CC) – III	20PCH103	Physical Chemistry –I	5	5	3	25	75	100
	Core Course (CC) – IV	20PCH104	Reactions and mechanisms in Organic Chemistry	5	5	3	25	75	100
	Core Practical (CP) – I	20PCH105P	Organic Chemistry Practical	6	5	6	40	60	100
	Elective Course (EC) – I	20PCHE1A/ 20PCHE1B	(A) Green Chemistry/ (B) Industrial Chemistry	4	4	3	25	75	100
		TOTAL		**30**	**29**				**600**
II	Core Course (CC) – V	20PCH206	Organic Chemistry –II	4	4	3	25	75	100
	Core Course (CC) – VI	20PCH207	Inorganic Chemistry –II	4	4	3	25	75	100
	Core Course (CC) – VII	20PCH208	Physical Chemistry –II	5	5	3	25	75	100
	Core Course (CC) – VIII	20PCH209	Organic Spectroscopy	4	4	3	25	75	100
	Core Practical (CP) – II	20PCH210P	Inorganic Chemistry Practical	6	5	6	40	60	100
	Elective Course (EC) – II	20PCHE2A/ 20PCHE2B	(A) Chemistry of Nanoscience and nanotechnology/ (B)Supramolecular Chemistry	4	4	3	25	75	100
	Extra Disciplinary Course (EDC) – I	20PCHED1A/ 20PCHED1B	EnvironmentalChemistry/ Medicinal Chemistry	3	2	3	25	75	100
III		**TOTAL**		**30**	**28**				**700**
	Core Course (CC) – IX	21PCH311	Coordination Chemistry	6	3	3	25	75	100
	Core Course (CC) – X	21PCH312	Physical Chemistry - III	7	4	3	25	75	100
	Core Practical(CP) – III	21PCH313P	Physical Chemistry Practical	8	4	6	40	60	100
	Elective Course (EC) – III	21PCHE3A 21PCHE3B	(A) Analytical Chemistry/ (B) Pharmaceutical Chemistry	6	3	3	25	75	100
	Extra Disciplinary Course (EDC) – II	21PCHED2A/ 21PCHED2B		3	2	3	25	75	100
		TOTAL		**30**	**16**				**500**
IV	Core Course (CC) – XI	21PCH414	Organic Chemistry - III	6	4	3	25	75	100
	Core Course (CC) – XII	21PCH415	Spectral Techniques in Inorganic Compounds.	6	3	3	25	75	100
	Project	21PCHPW	Dissertation = 75 Marks Viva = 25 Marks	18	10		25	75	100
		TOTAL		**30**	**17**				**300**
		GRAND TOTAL		**120**	**90**		**90**		**2100**

Courses	No. of Courses	Total Credits
Core course	12	51
Core Practical	03	14
Elective Course	03	11
Extra Disciplinary Course	02	04
Project	01	10
Total	21	**90**

Note:				
1. Theory	Internal	25 marks	External	75 marks
2. Practical		40 marks		60 marks
3. Separate passing minimum is prescribed for Internal and External				

(a) The passing minimum for CIA shall be 40% out of 25 marks (i.e.10marks)
(b) The passing minimum for University Examinations shall be 40% out of 75marks (i.e.30marks)
(c) The passing minimum not less than 50% in the aggregate.

S.No.	Name of the Course	Course Code	Elective Courses (EC) (Anyone from the list)
1.	Elective Course (EC) – I	20PCHE1A	Green Chemistry
2.	Elective Course (EC) – I	20PCHE1B	Industrial Chemistry
3.	Elective Course (EC) – II	20PCHED1A	Chemistry of Nanoscience and Nanotechnology
4.	Elective Course (EC) – II	20PCHED1B	Supra molecular Chemistry
5.	Elective Course (EC) – III	20PCHE3A	Analytical Chemistry
6.	Elective Course (EC) – III	20PCHE3B	Pharmaceutical Chemistry

EXTRA DISCIPLINARY COURSES (EDC) OFFERED BY THE DEPARTMENT

S.No.	Name of the Course	Course Code	Extra Disciplinary Courses (EDC) (Anyone from the list)
1.	Extra Disciplinary Course (EDC) – I	20PCHED1A	Environmental Chemistry
2.	Extra Disciplinary Course (EDC) – I	20PCHED1B	Medicinal Chemistry
3.	Extra Disciplinary Course (EDC) – II	20PCHED2A	Food Chemistry
4.	Extra Disciplinary Course (EDC) – II	20PCHED2B	Bioinorganic Chemistry

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TAMILNADU, INDIA.

DEPARTMENT OF CHEMISTRY

M.Sc.,CHEMISTRY

(Forthe candidatesadmittedinthe academicyear2020–2021)

QuestionPaperPattern- (Theory)

Max time: 3 Hours **Max Marks: 75**

Section – A (10 x 2 = 20)

Answerallthequestions

AnswerinOneorTwo sentences each

1. Unit I
2.
3. Unit II
4.
5. Unit III
6.
7. Unit IV
8.
9. Unit V
10.

Section – B (5 x 5 = 25)

Answerallthequestions

Eachanswershouldnotexceed500 words

11. a (or) Unit I
    b
12. a (or) Unit II
    b
13. a (or) Unit III
    b
14. a (or) Unit IV
    b
15. a (or) Unit V
    b

Section – C (3 x 10 = 30)

Answerany THREEquestions in 1200 words

16. Unit I
17. Unit II
18. Unit III
19. Unit IV
20. Unit V

SEMESTER I

Semester: I - CC- I : ORGANIC CHEMISTRY - I

Ins. Hrs. /Week : 5 **Course Credit: 5** **Course Code :20PCH101**

OBJECTIVES

- To understand the basic concepts ofaromaticity, organic compounds by IUPACrules.
- To appreciate the stereochemical aspects of areaction and conformational analysis of stereochemical factors.
- To comprehend the the reagents in organic synthesis.

UNIT-I:AROMATICITY

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

Electron occupancy in MO's and aromaticity – NMR concept of aromaticity and antiaromaticity, systems with 2,4,8 and 10 electrons, systems of more than 10 electrons (annulenes), Mobius aromaticity.

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.

UNIT–II: NOMENCLATURE OF ORGANIC COMPOUNDS

Nomenclature – General rules - Naming of linear and branched alkanes, alkenes, polyenesand alkynes with two or three functional groups by IUPAC nomenclature. Aromatic and heteroaromaticsystems - nomenclature of heterocycleshaving not more than two hetero atoms such as oxygen, nitrogen and sulphur.Fusedheterocyclesand fused aromaticsystems.

Nomenclature of alicyclic, bicyclic and tricyclic compounds - organic molecules including regioand stereoisomers.

UNIT III: STEREOCHEMISTRY

Fundamentals of Organic Stereochemistry: - Principles of symmetry-Stereoisomerism-Optical isomerism-Definitions-Conventions used in Stereochemistry: Newmann, Sawhorse and Fischer notations and interconversions and representations. Nomenclature, correlation of configuration, Cahn-Ingold-Prelog rules for simple molecules, Optical activity and chirality. Types of molecules exhibiting optical activity-Fischer projection-Absolute configuration.Molecules with more than one chiral center-molecular chirality-Atropisomerism-Biphenyles, allenes and spiranes.

UNIT IV: CONFORMATIONAL ANALAYSIS

Methods of determining configuration.Prochiralcenters-Asymmetric synthesis-Recemisation and resolution. Geometrical Isomerism: E&Z Nomenclature, Determination of configuration of geometrical isomers. Stereochemistry of addition and elimination reactions.Stereoselective and stereospecific synthesis(Elementary examples)

Basic concepts of conformational analysis – conformations of cyclopentane,

cyclohexane, cyclohexene and fused (decalin) and bridged (norbornane type) ring systems – anomeric effect in cyclic compounds.

UNIT-V : REAGENTS

Use of the following reagents in organic synthesis:, Diazomethane, Dicyclohexylcarbodiimide, DIBAL, Griganard, Lead tetraacetate, Lithium aluminium hydroxide, Lindlar's catalyst, N-Bromosuccinimide, Osmium tetraoxide, PCC, Raney Nickel, Selenium dioxide, Wittig reagent.

COURSE OUTCOME:

1. Students should able to understand the concept of Aromaticity.
2. Students should identify the Compounds by IUPAC.
3. Students should recognize the Stereochemical factors.
4. Students should analysis the Conformational factors.
5. Students should understand the reagents in organic synthesis.

REFERENCES

1. J. March and M.B.Smith, March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure: 7th Ed., Wiley, New York,2013.
2. L. Finar, Organic Chemistry; Vol.II, 7thEd., Pearson education Ltd, New Delhi,2009.
3. Panico, W.H. Powell, L. Jean,C. Richer, A Guide of IUPAC Nomenclature of Organic compounds, 1993.
4. Jerry March,AdvancedOrganic Chemistry – Reaction Mechanisms and Structure, John Wiley, New York, 2004.
5. D. Nasipuri, Stereochemistry of Organic Compounds, New Age International Private Limited, New Delhi, 2004.
6. P.S. Kalsi, Stereochemistry, Conformations and Mechanism, New Age International Private Limited, New Delhi, 2004.
7. Ahluwalia V K, Organic Reaction Mechanism, Narosa Publication, 2010.
8. S.M. Mukherjiand S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., Patna, 1990.
9. R.S. Cahn andO.C.Dermer, Introductionto Chemical Nomenclature, Butterworths, London,1979.
10. Peter Sykes, A Guide Gook to Mechanism in Organic Chemistry, Pearson Education, New Delhi,2004.
11. E.L. Eliel, Stereochemistry of Carbon Compounds, McGraw Hill, New Delhi,2003.
12. Jonathan Clayden, Nick Greeves, Stuart Warren, Organic Chemistry, Oxford UniversityPress,USA,2000

E- RESOURCES

1. www.oreilly.com
2. www.spinger.com
3. www.elsevier.com
4. www.sciencedirect.com
5. www.scribd.com
6. www.icobo.com
7. www.topfreebooks

Semester: I - CC- II : Inorganic Chemistry - I

Ins. Hrs. /Week : 5 **Course Credit: 5** **Course Code :20PCH102**

OBJECTIVES

- To understand the basic concepts of main group elements.
- To learn homocyclic inorganic systems.
- To study the concepts of photochemistry and its applications.

UNIT I: MAIN GROUP CHEMISTRY

Chemistry of boron – borane, higher boranes, carboranes, borazines and boron nitrides – chemistry of silicon – silanes, higher silanes, multiple bonded systems, disilanes, silicon nitrides. P-N compounds, cyclophosphazanes and cyclophosphazenes – S-N compounds – S2N2, S4N4, (SN)x, polythiazyl SxN4 compounds – S-N cations and anions, S-P compounds – molecular sulphides such as P4S3, P4S7, P4S9 and P4S10 – Industrial application of borane and silanes.

UNIT II: HOMOCYCLIC INORGANIC SYSTEMS

Homocyclicinorganic systems – Oxo carbonanion.Ionic model – lattice energy – Born-Lande equation – Kapustinskii equation – high Tc superconductors – solid state reactions – tarnish reaction decomposition, solid-soild reaction and photographic process – factors affecting reaction rate. -Simple methods (potentiometric, pH metric and photometric methods) of determining the formation constants.

UNIT III:INSTRUMENTAL TECHNIQUES IN NUCLEAR CHEMISTRY

Nucleus- Structure of the nucleus, Radioactive equilibrium, orbital electron capture, Nuclear isomerism. Internal conversion Nuclear cross section – Q value of nuclear reaction, Coloumbic barrier, nuclear cross section, threshold energy and excitation function – Different types of nuclear reactions fragmentation, nuclear fission, nuclear fusion – proportional counter, Geiger-Muller counter, scintillation counter and Cherankov counter. – Applications:Carbondating,agriculture,medicineandindustry.

UNIT IV: IONICBONDINGANDCRYSTAL STRUCTURE

Packing of ions in crystals & crystal structure – ccp,hcp,bcc,fcc,- Radius ratio and structure of ionic lattices, calculation of radius ratio and Co-ordination No, stoichiometry and crystal structures of NaCl,CsCl, Zincblende, Wurtzite,rutile,Fluoride, Antifluorite, perovskite, CdI_2 ,β-cristobalite& ReO3 structure, Spinels and Inverse spinals- Lattice energy-Slater's rule,Born-Lande equation, Factors affecting Lattice Energy-crystal defects ,Stoichiometric and nnoon stoichiometric defects- Metal deficiency defects- calculation of number of defects.

UNIT V: INORGANIC PHOTOCHEMISTRY

Adamson's rules, photoactive excited states, V-C model – photophysics and photochemistry of ruthenium – polypyridine complexes, emission and redox properties. Photochemistry of organometallic compounds – metal carbonyl compounds – compounds with metal-metal bonding – Reinecke's salt chemical actinometer.

COURSE OUTCOME

1. The fundamentals of the chemistry of the main group elements, and important Realworldapplications of many of these species
2. Determine stability constant of particular complex through pH metry ,polagraphicmethods Etc.,
3. Justify the implication of nuclear chemistry in energy generation
4. Able to draw structures of different ionic solids.
5. Apply their understanding about the photochemical reactions of industrial significance.

TEXT BOOKS:

1. A text-book of inorganic chemistry, Book by J.R.Partington
2 .Structutrsl methods in inorganic chemistry, Text book by E.A.V Ebswort.

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, USA, 1999.
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. Lee J D, Concise Inorganic Chemistry, 6th Ed., ELBS, London, 1998
6. A. W. Adamson and P. D. Fleischauer, Concepts of Inorganic Photochemistry; R. E. Krieger Pubs, Florida, 1984.
7. Instrumental Methods Of Chemical Analysis 2018 Edition (Paperback, chatwal, gurdeep chatwal).
8.JamesE.Huheey,EllenAKeiterandRichardL.Keiter,InorganicChemistry:PrinciplesofStructureandReactivity,Addison-Wesley,NewYork,2003.(Unit-II)
9. R. K. Sharma, Inorganic Reactions Mechanism; Discovery Publishing House, New Delhi, 2007.

E-RESOURCES:

1. **www.sciencedirect.com**
2. **www.springer.com**
3. **www.e-booksdirectory.com**
4. **www.kobo.com**
5. **www.elsevier.com**

Semester: I : CC- III: Physical Chemistry - I

Ins. Hrs. /Week : 5 **Course Credit: 5** **Course Code :20PCH103**

OBJECTIVES

- To understand the concepts of group theory and quantum chemistry.
- To learn the chemical kinetics and thermodynamics.
- To study the theories of kinetics, photochemistry and radiation chemistry.

UNIT I: CONCEPTS OF GROUP THEORY

Symmetry elements and operations – point groups – assignment of pointgroups to molecules – group postulates and types of groups – groupmultiplication tables, sub groups, similarity transformations – conjugateelements and classes.Matrix representation of symmetry operations and point groups – reducible andirreducible representations – properties of irreducible representation.The great rthogonality theorem – construction of character table – directProduct – Application of group theory-SALC procedure

UNIT II: QUANTUM CHEMISTRY - I

Inadequacy of classical mechanics – black body radiation – Planck's quantumconcept – photoelectric effect – Bohr's theory of hydrogen atom – hydrogenspectra – wave-particle dualism – uncertainty principle – decline of oldquantum theory.

Schrodinger equation – postulates of quantum mechanics -eigenfunctions and eigenvalues, 0perator-linear operator, Hermitian operator angular momentum operator - orthogonality and normalization.

Applications of wave mechanics to simple systems – particle in a box, one and three dimensional.

UNIT III: CHEMICAL KINETICS - I

Theories of reaction rate – Eyringthoey-Activated complex theory-absolute reaction rate theory (ARRT) – transmission coefficient, reaction coordinate – potential energy surfaces – kinetic isotope effect – Hinshelwood theory – Kassel, Rice and Ramsperger theory (KRRT) –Slater's treatment.- Salt effect- primary , secondary salt effect.

Principle of microscopic reversibility – steady-state approximation – chain reactions: thermal and photochemical reactions between hydrogen andhalogens – explosions and hydrogen-oxygen reactions.

UNIT-IV: CLASSICAL THERMODYNAMICS :

Partial molar properties-Partial molar free energy (Chemical potential) - Partial molar volume and Partial molar heat content - Their significance and determination of these quantities.Variation of chemical potential with temperature and pressure. Definition of fugacity - determination of fugacity - variation of fugacity with temperature and pressure - the concept of activity and activity coefficients - determination of standard free energies - choice of standard states - determination of activity and activity coefficients for non electrolytes.

UNIT V: PHOTOCHEMISTRY

Introduction –Absorption of light-Assignment of n-π^*, -π -π^* Quantum yield-Reason for high and low quantum yield –Factors affecting quantum yield-Luminescence- Fluorescence-Phosphorescence-Photosensitisation

– Jablonski diagram– Stern-Volmer equation and its applications – experimental techniques in photochemistry – chemical actinometers – lasers and their applications.— Solar energy material- Photo emulsion sensitizer-bio medical applications of photo chemistry- Biochips , Bio imaging and Bio material for Artificial organs

COURSE OUTCOME

1. Students should be able to predict material properties from group theory
2. From quantum chemistry predict chemical and physical properties of molecules
3. To learn chemical kinetics reasonably guide as to know how to control the reaction conditions and improve the main reaction rate in order to increase the production of chemical products.
4. Students should be able to explain From thermodynamics, fundamental thermodynamic properties
5. Students should be able to propose a method for mechanistic studies of a particular photochemical system.

TEXT BOOKS

1. F. A. Cotton, Chemical Applications of Group Theory; 3rd Ed., John Wileand Sons, Singapore, 2003.
2. R. L. Flurry, Jr, Symmetry Groups: Theory and Chemical Applications; Prentice Hall, New Jersy, 1980.
3. S. F. A. Kettle, Symmetry and Structure; 2nd Ed., John Wiley and Sons, Chichester, 1995.
4. A. K. Chandra, Introductory Quantum Chemistry; 4th Ed., Tata McGrawHill, Noida, 1994.
5. D. A. Mcquarrie, Quantum Chemistry; University Science Books, Sausalito,2008.
6. I. N. Levine, Quantum Chemistry; 5th Ed., Prentice Hall, New Jersey, 2000.
7. R. K. Prasad, Quantum Chemistry; 4th Ed., New Age International Publishers, New Delhi, 2014.

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1. K. J. Laidler, Chemical Kinetics; 3rd Ed., Tata McGraw Hill, Noida, 1987.
2. J. W. Moore and R. G. Pearson, Kinetics and Mechanism; 3rd Ed., JohnWiley and Sons, New York, 1981.
3. M. Mortimer and P. G. Taylor, Chemical Kinetics and Mechanism; 1st Ed.,Royal Society of Chemistry, UK, 2002.
4. J. N. Gurtu and A. Gurtu, Advanced Physical Chemistry; 5th Ed., PragathiPrakashan, Meerut, 2006.
5. J. I. Steinfeld, J. S. Francisco and W. L. Hase, Chemical Kinetics andDynamics; 2nd Ed., Prentice Hall, New Jersey, 1999.
6. K. S. Gupta, Chemical Kinetics and Reaction Mechanism; RBSA Publishers,Jaipur, India, 1992.
7. P. W. Atkins, Physical Chemistry; 7th Ed., Oxford University Press, Oxford,2001.
8. J. Rajaram and J. C. Kuriacose, Thermodynamics for Students ofChemistry - Classical, Statistical and Irreversible; Pearson Education, NewDelhi, 2013.
9. HoriaMetiu, Physical Chemistry, Thermodynamics; Taylor and Francis,Singapore, 2006.

10. K. K. Rohatgi-Mukherjee, Fundamentals of Photochemistry; 3rd Ed., NewAge International Pvt. Ltd., New Delhi, 2014.
11. J. W. T. Spinks and R. J. Woods, Introduction to Radiation Chemistry; 3rd Ed., John Wiley and Sons, New York, 1990.

E- RESOURCES

1. **www.kobo.com**
2. **www.springer.com**
3. **www.elsevier.com**

Semester: I - CC- IV: Reactions and mechanisms in Organic Chemistry

Ins. Hrs. /Week : 5 **Course Credit: 5** **Course Code :20PCH104**

OBJECTIVES

- To learn reagentlessorganic reactions.
- To understand the principle behind thermal and photochemical organic reactions, importance of addition reactions in organic compounds.
- To learn structure, bonding and Reactive intermediate and important oxidizing and reducing reagents in organic synthesis

UNIT-I : PERICYCLIC REACTIONS

Concerted reactions – orbital symmetry and concerted symmetry – Woodward and Hoffmann rules – selection rules for electrocyclic reactions – frontier molecular orbital approach – correlation diagram – examples.

Selection rules for cycloaddition reactions – frontier molecular orbital approach – correlation diagram – examples – chelotropic and ene reactions.

Sigmatropic rearrangements – 1,3, 1,5 and 1,7-hydrogen shifts – examples – Cope and Claisenrearrangements – 1,3-dipolar cycloaddition reactions: types of dipoles, selectivity, scope and applications.

UNIT-II : ORGANIC PHOTOCHEMISTRY

Organic photochemistry – fundamental concepts - Jablonski Diagram – energy transfer – characteristics of photoreactions – photoreduction and photooxidation, photosensitization.

Photoreactions of ketones and enones – Norrish Type I and II reactions – Paterno-Büchireaction – photo-Fries rearrangement –Reactions of unactivated centres – photochemistry of α,β-unsaturated carbonyl compounds – photolytic cycloadditions and photolytic rearrangements – photo additions – Barton reaction.

UNIT-III :ADDITION REACTIONS

Addition to carbon-carbon multiple bonds-addition mechanisms electrophilic, nucleophilicand free-radical additions-cyclo addition orientation and reactivity.Selectedreactions - Birch reduction- catalytic semi reduction of alkynes - Hydroboration-selective hydroborating agents-oxymercuration- demercuration-epoxidationof alkene-Sharpless asymmetric epoxidation- Baeyer Villigerreaction- - Michelreaction.

Addition to carbon-hetero atom multiple bonds-addition orientation and reactivity - Selected name reactions - Acyloin ester condensation, Aldolcondensation, Benzoin condensation, Cannizaroreaction, Claisen reaction, Darzen's condensation, Knovenegal reaction, Mannich reaction and Stobbecondensation.

UNIT-IV: STRUCTURE, BONDING AND REACTIVE INTERMEDIATES

Structure and Bonding Localized Chemical Bonding: Electronic Structure of molecules; VB and MO - Inductive and Field Effects, Bond distances, Bond angles and Bond energies.

Delocalized Chemical Bonding: Bond energies and Bond distances in compounds containing delocalized bonds - Cross conjucation - Resonance - Hyperconjugation and Keto – Enoltautomerism. Reactive Intermediates: Generation, Structure, Stability and Reactivity of Carbocations and Carbanions, Free radicals, Carbenes, Nitrenes and Benzynes.

UNIT-V: REAGENTS FOR OXIDATION AND REDUCTION REACTIONS

Oxidation: Baeyer-Villiger, Jacobsen epoxidation, Shi epoxidation, Jones reagent, PCC, PDC, IBX, DMP, CAN, NOCl, Mn(OAc)3, Cu(OAC)2, Bi2O3, Swern oxidation, Sommelet reaction, Elbs reaction, Oxidative coupling of phenols, Prevost reaction and Woodward modification.

Reduction: palladium / platinum / rhodium / nickel based heterogeneous catalysts for hydrogenation, Wilkinson's catalyst, Noyori asymmetric hydrogenation – reductions using Li/Na/Ca in liquid ammonia.

COURSE OUTCOME:

1. Students should able to understand the concerted reactions.
2. Students should identify the thermal and Photo reactions.
3. Students should able to understand the carbon carbon multiple bonds.
4. Students should identify the Reactive intermediate.
5. Students should understand the reagents in organic synthesis.

REFERENCES

1. S.Sankararaman,Pericyclic Reactions-A Textbook: Reactions, Applications and Theory; Wiley-VCH, New York,2005.
2. J. D. Coyle, Organic Photochemistry; Wiley, New York,1998.
3. J. M. Coxon, and B. Halton, Organic Photochemistry; 2nd Ed., Cambridge, University Press, UK,1987.
4. G. R. Chatwal, Organic Photochemistry; 1st Ed., Himalaya Publications house, Bangalore,1998.
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6. Richard O.C. Norman, James M. CoxonPrinciplesof Organic Synthesis CRC Press,1993
7. R. K. Bansal, Organic Reaction Mechanisms; 11th Ed., Tata McGraw Hill, Noida,2006.
8. R. T. Morrison and R. N. Boyd, Organic Chemistry, 7th Ed., Pearson, New Delhi,2011.
9. F. A. Carey and R. J. Sundberg, Advanced Organic Chemistry; Parts A and B, 5th Ed., Springer, Germany,2007.
10. T. H. E. Lowry and K. S. Richardson, Mechanism and Theory in Organic Chemistry; Addison-Wesley, USA,1998.

E- RESOURCES

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3. www.elsevier.com
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Semester: I - CP- I : ORGANIC CHEMISTRY PRACTICAL

Ins. Hrs. /Week : 6 **Course Credit: 5** **Course Code :20PCH105P**

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) – 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. Benzophenoneoxime from benzophenone (addition)
4. *o*-Chlorobenzoic acid from anthranilic acid (Sandmayer reaction)
5. Phenylazo-2-naphthol from aniline (diazotization)

COURSE OUTCOME:

1. Students able to understand how to create and carryout ,work up and separation procedure
2. How to predict the outcome of organic reactions using a basic understanding of the general reactivity of functional groups and mechanisms
3. How to determine identity ,purity and percent yield of products

TEXT BOOKS

1.N. S. Gnanaprakasam and G. Ramamurthy, Organic Chemistry Lab Manual; S.V.Printers, 1987.
2.Vogel's Textbook of Practical Organic Chemistry; 5th Ed., Prentice Hall, 1989

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.
3. A. I. Vogel, A. R. Tatchell, B. S. Furniss, A. J. Hannaford and P. W. G. Smith

SCHEME OF VALUATION

1. Preparation - 10 marks

Crude sample - 5 marks

Recrystalised sample - 5 marks

2. Organic analysis - 45 marks

Items	**Compound I**	**Compound II**
Element present / Absent	4	4
Aromatic /Aliphatic	2	2
Saturated/ UnSaturated	2	2
Functional group identification	6	6
Confirmatory test	3	3
Derivative preparation	3	3
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	20	20
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Pilot method - 5 Marks

3. Viva-voce - 5 Marks

Semester: I - EC- IA: Green Chemistry

Ins. Hrs. /Week : 4 **Course Credit: 4** **Course Code :20PCHE1A**

OBJECTIVES

- To learn the green chemistry and their principles.
- To learn the importance of greener reactions.
- To understand the phase-transfer catalyst in green chemistry.

UNIT-I:INTRODUCTION TO GREEN CHEMISTRY

Twelve principles of green chemistry – planning a green synthesis in a chemical laboratory – evaluating the type of reaction involved – rearrangement, addition, substitution, elimination and pericyclic reactions. Selection of appropriate solvent – aqueous phase reaction – reactions in ionic liquids – organic synthesis in solid state – solid supported organic synthesis – selection of starting materials – use of protecting group – use of catalyst – use of microwaves and sonication.

UNIT-II:ADDITION AND CONDENSATION REACTIONS

Addition reactions – Michael addition in [aqueous medium and solid state] – DielsAlder reactions in aqueous phase.Condensation reactions – Aldol condensation of aldehydes with nitroalkanes and nitriles – Aldol condensation in solid phase – benzoin condensation under catalytic conditions – applications.

UNIT-III:OXIDATION AND REDUCTION REACTIONS

Oxidation reactions – Baeyer-Villiger oxidation in aqueous phase and solid state – enzymatic Baeyer-Villiger oxidation. Reduction reactions – Clemmensen reduction – mechanism – limitations – applications

UNIT-IV:PHASE-TRANSFER CATALYST REACTIONS:

Heck reaction – Michael addition reaction – oxidation of toluene to benzoic acid – Reimer-Tiemann reaction – Baker-Venkataramansynthesis – Williamson ether synthesis – Dozen reaction.

UNIT-V:SONICATION REACTIONS

Barbier reaction – Reformatsky reaction – Simmons-Smith reaction – Strecker synthesis – Ullmann coupling reaction – Wurtz reaction – Bouveault reaction.

COURSE OUTCOME

1. AnUnderstanding of the 12 principles of green chemistry.
2. An understanding of variousaddition and condensation reactions involved in greenChemistry
3. An understanding of variousOxidation and reduction reactions involved in green Chemistry
4. To learn the mechanism of Phase transfer catalysed reactions

5. To understand the significance of Sonication reactions

TEXT BOOKS

1. Mary M. Kirchhoff Green chemistry – Principles and practice, 2013
2. AnjuGiyal, Green chemistry: a new approach towards science, 2014.
3. Mike Lancaster, Green Chemistry – an introductory text, 2nd Edition, Royal Society of Chemistry publishers, 2010.

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1. V. K. Ahluwalia, Green Chemistry; 2nd Ed., Ane Books Pvt Ltd., New Delhi, 2016. [UNIT- I, II, III, IV, V]
2. P. T. Anastas and J. C. Warner, Green chemistry Theory and Practice; Oxford University Press, New York, 2005. [Unit-I]
3. V. K. Ahluwalia and K. Agarwal, Organic Synthesis, Special Techniques; 2nd Ed., Narosa Publishing House, New Delhi, 2007. [Unit-I]

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Semester: I - EC-IB **INDUSTRIAL CHEMISTRY**

Ins. Hrs. /Week : 4 **Course Credit: 4** **Course Code :20PCHE1B**

OBJECTIVES

- To know the basic ideas of an industry and industrial wastes.
- To understand the functions of petroleum, petrochemicals, portland cement, pulp and paper.
- To know the preparation of soaps, detergents and perfumes.

UNIT I:BASIC IDEAS AND INDUSTRIAL WASTES

Basics idea about unit operation – flow chart – chemical conversion – batch versus continuous processing – chemical process selection – design – chemical process control.Types of industrial wastes – treatment of wastes or effluent with organic impurities – treatment of wastes or effluent with inorganic impurities – treatment of some important chemical wastes.

UNIT II: PETROLEUM AND PETROCHEMICALS

Petroleum and Petrochemicals Introduction – saturated hydrocarbons from natural gas – uses of saturated hydrocarbons – unsaturated hydrocarbons – acetylene, ethylene, propylene, butylene – aromatic hydrocarbons – toluene and xylene. Preparation of rectified spirit from beat – methylated spirit – preparation of absolute alcohol from rectified spirit – petrochemicals in India.

UNIT III: SILICATE INDUSTRIES

Glass: Glassy state and its properties, classification (silicate and non silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, super conducting and semi conducting oxides, fullerenes carbon nanotubes and carbon fiber.

Cements : Manufacture of Cement Introduction – types of cement – high alumina cement, water proof cement, slag cement, acid resisting cement, white cement, coloured cement, Pozzolana cement. Setting of cement – properties of cement – testing of cement – uses of cement – concrete – cement industries in India.

UNIT IV: PULP AND PAPER INDUSTRY

Pulp and Paper and Manufacture of Paper Introduction – manufacture of pulp – types of pulp – sulphate or craft pulp, soda pulp, Rag pulp – beating, refining, filling, sizing and colouring. Calendaring – uses – paper industries in India.

UNIT V:SOAPS, DETERGENTS AND PERFUMES

Soaps and Detergents Introduction – types of soaps – hard and soft soaps – manufacture of soap (hot and continuous process only) – cleansing action of soap – detergents – surface active agents –

biodegradability of surfactants, amphoteric detergents.
Perfumes: Introduction – production of natural perfumes – flower perfumes – jasmine, rose and lily – production of synthetic perfumes – muscone and nitro-musks.

COURSE OUTCOME

1. To learn the basic principle and significance of Industry and industrial wastes
2. To learn the significance of petroleum and petrochemials.
3. To learn the manufacturing methods andproperties of cement.
4. To learn the manufacturing methods and properties of Pulp industry.
5. To learn the preparation, properties and significance of soaps, detergents and Perfumes.

TEXT BOOKS

1. James R. Couper, W. Roy Penney, James R. Fair, Stanley M. Walas,Chemical Process Equipment - Selection and Design**,** 2nd Edition**,** Gulf Professional Publishing, 2005.
2. John A. Tyrell, Fundamentals of Industrial Chemistry,Wiley, 2014.
    a. Kent J.A, Riegel's Handbook of Industrial Chemistry Paperback, 9th EditionJanuary 1, 1997, Kindle book.
    b. O.P. Vermani, A.K. Narula, Industrial Chemistry, Galgotia publications Pvt. Ltd., New Delhi, 2008.

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1. B. K. Sharma, Industrial Chemistry; 8th Ed., Goel Publishing House, New Delhi, 1997. (Unit–I, II, III, IV and V)
2. R. N. Shreve, and J. A. Brink Jr. Chemical Process Industries; 4th Ed., McGraw Hill, Toronto, 1977. (Unit–I, II, III, IV and V)

3.C. S. Brain, Production and Properties of Industrial Chemicals; Reinhold, New York, 1989. (Unit–I)

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SEMESTER II

SENGAMALATHAYAAREDUCATIONALTRUSTWOMEN'SCOLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2020 – 2021)

DEPARTMENT OF CHEMISTRY

M.Sc., CHEMISTRY

Semester: II - CC- V: Organic Chemistry - II

Ins. Hrs. /Week : 4 **Course Credit: 4** **Course Code :20PCH206**

OBJECTIVES

- To understand the nucleophilic aliphatic and aromatic substitution reactions.
- To learn the Electrophilic aliphatic andaromatic substitutionreactions.
- To know the chemistry of terpenoids, steroids andalkaloids.

UNIT-I: NUCLEOPHILIC ALIPHATIC SUBSTITUTION REACTIONS

Aliphatic nucleophilic substitution – mechanisms – S_N1, S_N2, S_Ni – ion-pair in S_N1 mechanisms – neighbouring group participation, non-classical carbocations – substitutions at allylic and vinyliccarbons.

Reactivity – effect of structure, nucleophile, leaving group and stereochemical factors – correlation of structure with reactivity – solvent effects – rearrangements involving carbocations – Wagner-Meerwein anddienone-phenol rearrangements.

UNIT -II :NUCLEOPHILIC AROMATIC SUBSTITUTION REACTIONS

Aromatic nucleophilic substitutions – S_N1, S_NAr, Benzyne mechanism – reactivity orientation – Ullmann, Sandmeyer and Chichibabin reaction – rearrangements involving nucleophilic substitution – Stevens – Sommelet- Hauser and von-Richter rearrangements.

UNIT- III: ELECTROPHILIC AROMATIC SUBSTITUTION REACTIONS

Aromatic electrophilic substitution reaction – orientation, reactivity and mechanisms based on transition state theory with suitable reactions – substitutions in thiophene and pyridine – N-oxide – quantitative treatment of the structural effects on reactivity. Substituent effects – origins of Hammett equation – principles of Hammett correlation – effect of structure on reaction mechanisms Hammett parameters –□and □, modified forms of Hammett equation, Taft Equation.

UNIT- IV: ELECTROPHILIC ALIPHATIC SUBSTITUTION REACTIONS

Aliphatic electrophilic substitution – S_E2, S_Ei and S_E1 mechanisms – diazoniumcoupling reactions – metals as electrophile in substitution reactions and decomposition of diazonium salts.Gomberg reaction, Japp – Klingermann reaction, Gattermann reaction.Rearrangement involving Diazoamino – aminoazo rearrangement and Wallach rearrangement.

UNIT- V: NATURAL PRODUCTS

Terpenoids: introduction – biosynthesis of menthol, camphor – total synthesis: Takasago synthesis of menthol, Corey's synthesis of longifolene, Curran's synthesis of hirsutene.

Steroids: introduction – total synthesis: Johnson's synthesis of progesterone and Vollhardt's synthesis ofestrone.

Alkaloids: introduction – biosynthesis of camptothecin – total synthesis: Corey's synthesis of epibatidine,Comin's asymmetric synthesis of Camptothecin and Woodward's synthesis of reserpine.

COURSE OUTCOME

1. Students should able to understand the Nucleophilic aliphatic Substitution reactions.
2. Students should able to learn rearrangement process.
3. Students should able to understand the Electrophilic Aromatic Substitution reactions..
4. Students should identify the Electrophilic Aliphatic Substitution reactions.
5. Students should understand the Natural Products.

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1. S. H. Pine and J. B. Hendrickson, D. J. Cram and G. S. Hammond, Organic Chemistry; 5th Ed., McGraw Hill, Noida,1987.

2. T. H. E. Lowry and K. S. Richardson, Mechanism and Theory in Organic Chemistry; 3rd Ed., Benjamin-Cummings Publishing, USA,1997.

3. S. H. Pine and J. B. Hendrickson, D. J. Cram and G. S. Hammond, Organic Chemistry; 5th Ed., McGraw Hill, Noida,1987.

4. T. H. E. Lowry and K. S. Richardson, Mechanism and Theory in Organic Chemistry; 3rd Ed., Benjamin-Cummings Publishing, USA,1997.

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10. E. J. Corey, and X-M. Cheng, The Logic of Chemical Synthesis; 1st Ed., Wiley-Interscience, New York,1995.

11. K. C. Nicolaou and E. J. Sorensen, Classics in Total Synthesis, Targets, Strategies, Methods; Wiley VCH, Germany,1996.

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Epibatidine: J. Org. Chem; 1993, 58,5600.

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Semester: II -CC- VI : Inorganic Chemistry - II

Ins. Hrs. /Week : 4 **Course Credit: 4** **Course Code : 20PCH207**

OBJECTIVES

- To understand the role of metal ions in biological process.
- To learn the basic concepts of chemotherapy.
- To learn the principle of catalysis and reaction mechanisms of organometallics.

UNIT-I: GENERAL PRINCIPLES OF BIOINORGANIC CHEMISTRY

Occurrence and availability of inorganic elements in biological systems – biomineralization – control and assembly of advanced materials in biology – nucleation and crystal growth – various biominerals – calcium phosphate – calcium carbonate – amorphous silica, iron biominerals – strontium and bariumsulphate.– ion channels – ion pumps, catalysis and regulation of bioenergetic processes by the alkaline earth metal ions – Mg^{2+} and Ca^{2+}.-Metals at the center of photosynthesis – primary processes in photosynthesis – photosystems I and II-light absorption (energy acquisition) – exciton transport (direct energy transfer) – charge separation and electron transport – manganese catalyzed oxidation of water to O_2.

UNIT-II : KINETICS AND MECHANISMS OF REACTIONS IN SOLUTIONS

Labile and inter complexes ligand displacement reactions – Acid hydrolysis, base hydrolysis SN1 CB mechanism and anationreations in octahedral and square planar complexes – Trans effect – theories and applications.

Electron transfer (ET) reactions – electron exchanger actions – complementary and non – complementary types. Types - Inner sphere and outer sphere processes – Applications of ET reactions in inorganic compleses. Isomerisation and racemisation reactions of complexes – Reactions of the coordination ligands**.**

UNIT- III: MEDICINAL BIOINORGANIC CHEMISTRY

Bioinorganic chemistry of quintessentially toxic metals – lead, cadmium, mercury, aluminium, chromium, copper and plutonium – detoxification by metal chelation – drugs that act by binding at the metal sites of metalloenzymes.

Chemotherapy – chemotherapy with compounds of certain non-essential elements – platinum complexes in cancer therapy – cisplatin and its mode of action – cytotoxic compounds of other metals.

Gold containing drugs as anti-rheumatic agents and their mode of action – lithium in psychopharmacological drugs – radiopharmaceuticals – technetium.

UNIT- IV: ORGANOMETALLICS

The 18 electron rule – applications and limitations – isolobal concept and its usefulness – uses of typical organometallics such as metal alloys and organometallic hydrides in organic synthesis.

Nitrosyl complexes – bridging and terminal nitrosyls, bent and linear nitrosyls – dinitrogen complexes – metallocene and arene complexes – metal carbenes, carbenes, carboxylate anions.

Classification based on captivity and polarity of M-C bond, organometallic compounds of lanthanides and actinides – fluxional organometallic compounds-organometallics in medicine, agriculture, horticulture anindustry.

UNIT V: REACTIONS AND CATALYSIS BY ORGANOMETALLICS

Organometallic reactions – ligand association and dissociation – oxidative addition and reductive elimination – insertion reactions.

Reactions of coordinated ligands in organometallics – hydrogenation, hydroformylation, epoxidation, metathesis.

Polymerization of olefins, olefin oxidation (Wacker process) and carbonylation of methanol.

COURSE OUTCOME:

1. Apply the principles of transition metal coordination complexes in understanding functions of biological systems.
2. Plot equations and functions representing kinetic behavior of chemical systems in ground and electronically excited states.
3. Identify the medicinal applications of inorganic compounds.
4. To find the structure and bonding aspects of simple organometallic compounds.
5. Identify the different types of organometallic reactions and apply the above concepts to explain different catalytic reactions.

TEXT BOOKS

1. Advanced Inorganic chemistry : Applications in Everyday Life, book by Narayan SadashivHosmane.
2. Text book of Inorganic chemistry,byG.S.Sodhi.

REFERENCES

1. J. E. Huheey, Inorganic Chemistry;4th Ed., Harper and Row Publishers, Singapore,2006.
2. K. F. Purcell and J. C. Kotz, Inorganic Chemistry; Thomson Learning, Boston, 1980.
3. S. J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry; Panima Publishing Company, New Delhi,1997.
4. W. Kaim and B. Schewederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life; 2ndEd., John Wiley and Sons, New York, USA,2013.
5. G. L. Eichhorn, Inorganic Biochemistry; Volumes 1 and 2, 2nd Ed., Elsevier Scientific Publishing Company, New York,1975.
6. F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry; 6th Ed., John Wiley and Sons, New York,1999.
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Wiley and Sons, New York,2001.
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10. A. J. Pearson, Advances in Metal-Organic Chemistry, Vol. 1; Jai Press, Inc., Greenwich,1989.
11. A. W. Parkins and R. C. Poller, An Introduction to Organometallic Chemistry; 1987, Oxford University Press,Chennai.
12. I. Haiduc and J. J. Zuckerman, Basic Organometallic Chemistry; Walter De GruyterInc, USA,1985.
13. P.Powell, Principles of Organometallic Chemistry;2nd Ed., Chapman and Hall, London,1988.
14. B. Douglas, D. H. McDaniel and J. J. Alexander, Concepts and Models of Inorganic Chemistry;3rd Ed., John Wiley and sons, New York,1994.
15. M. Bochmann, Organometallics 1: Complexes with transition metal-carbon bonds; Oxford Chemistry Primers Series, No. 12, and M. Bochmann, Organometallics 2: Complexes with transition metal-carbon bonds; No. 13,1994.
16. J. P. Collman, L. S. Hegedus, J. R. Norton and R. G. Finke, Principles and Applications of Organotransition Metal Chemistry, University Science Books, California,1987.

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6. **www.sciencedirect.com**

Semester :II- CC- VII : Physical Chemistry - II

Ins. Hrs. /Week : 5 **Course Credit: 5** **Course Code :20PCH208**

OBJECTIVES

- To study the applications of quantum chemistry and group theory.
- To understand the concept of electrochemistry
- To understand electrochemistry, adsorption and classical thermodynamics

UNIT I: QUANTUM CHEMISTRY - II

Applications of wave mechanics – the harmonic oscillator, rigid rotator – hydrogen and hydrogen like atoms – shapes and nodal properties of orbitals – space quantization – approximation methods – methods of variation, application to hydrogen and helium atoms – perturbation method — helium atom – effective nuclear charge.–atomic structure calculation – self consistent field method – Hartree-Fock method for atoms – angular momentum in many electron systems – spin-orbit interaction, L-S and j-j coupling schemes.

UNIT II: ELECTROCHEMISTRY – I

Ion transport in solution – migration, convection and diffusion – Fick's laws of diffusion conduction – Debye-Huckel theory – ionic atmosphere – Debye -Huckel-Onsager equation – verification and extension – Debye-Falkenhagen effect and Wien effect, Debye-Huckel limiting law – activity coefficients and ionic strength – Bjerrum model. The electrode – electrolyte interface – electrical double layer and multi layers – theories Electrokinetic phenomena – classification – Tiselius method of separation of proteins– electrocatalysis.

UNIT III: ELECTROCHEMISTRY – II

Dynamics of electron transfer – Marcus theory – tunneling – the rate of charge transfer – current density – Butler-Volmer equation – Taft equation – polarization and overvoltage – mechanism of hydrogen evolution and oxygen evolution reactions. Principles of electrodeposition of metals – corrosion– Types- Pourbaix and Evans diagrams –-methods of protection of metals from corrosion.

UNIT IV: SURFACE CHEMISTRY AND HETEROGENEOUS CATALYSIS

Surface phenomena – Gibbs adsorption isotherm – solid-liquid interfaces – contact angle and wetting – solid-gas interface – physisorption and chemisorption – Langmuir, BET isotherms – surface area determination– some interfacial aspects on micelles, reverse micelle, microemulsions and membranes.

Heterogeneous catalysis- Theory –classification of catalysis –characteristics of enzyme catalysis – mechanism and kinetics of enzyme catalyzed reaction- The acidity function –photo catalysts-photocatalytic breakdown of water and harnessing of solar energy -photocatalytic degradation of dyes- environmental applications.

UNIT V :STATISTICAL THERMODYNAMICS

Thermodynamic probability – probability theorems, Maxwell-Boltzmann distribution law– partition functions – translational, rotational, vibrational and electronic partition functions.

Quantum statistics – Bose-Einstein (B.E.) and Fermi-Dirac (F.D.) distributionequations – comparison of B.E. and F.D. statistics with Boltzmann statistics –applications of quantum statistics to liquid helium, electrons in metals andPlanck's radiation law – concept of negative Kelvin temperature.

COURSE OUTCOME:

1. Students should be able to account for the basic principles and concepts of quantum chemistry.
2. Students able to describe chemical corrosion and recognize the primary oxidation and reduction reactions from electrochemistry
3. At the end of the surface chemistry ,students should be able to design process to removal of toxic compounds from industrial waste water.
4. To Calculate the free energy change for an electrochemical cell using the measured cell potential value.
5. Students should be able to account for the physical interpretation of distribution functions and discuss and show how these can be used in calculations of basic thermodynamic properties.

TEXT BOOKS

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.
4. I. N. Levine, Quantum Chemistry; 7th Ed., Prentice Hall, New Jersey, 2013.
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7. S. Glasstone, Thermodynamics for Chemists; 3rd Ed., Narahari Press, Bangalore,
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1. F. A. Cotton, Chemical Applications of Group Theory; 3rd Ed., Wiley Eastern, New Delhi, 1990.
2. P. Atkins and J. de Paula, Physical Chemistry; 9th Ed., W. H. Freeman Publications, NeWYork, 2009.
3. S. Glasstone, Introduction to Electrochemistry; Maurice Press, Philadelphia, 2008.
4. L. Antropov, Theoretical Electrochemistry; University Press of the Pacific, USA, 2001.
5. S. Glasstone, An Introduction to Electrochemistry; Read Books, New Delhi, 2007.
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10. M. Mortimer and P. G. Taylor, Chemical Kinetics and Mechanism; 1st Ed., Royal Society of Chemistry, UK, 2002.
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12. M. Gratzel and K. Kalyanasundaram, Kinetics and Catalysis in Microheterogeneous Systems; Academic Press, New York, 1991.
13. J. Rajaram and J. C. Kuriacose, Thermodynamics for Students of Chemistry - Classical, Statistical and Irreversible; Pearson Education, New Delhi, 2013.

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Semester: II - CC- VIII : Organic Spectroscopy

Ins. Hrs. /Week : 4 **Course Credit: 4** **Course Code :20PCH209**

OBJECTIVES

- To understand the principles of NMR spectroscopy.
- To study UV, and IR spectroscopy of organic compounds.
- To learn the ESR, ORD, MASS, XRD of organic compounds.

UNIT-I: NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

1H NMR Spectroscopy –AB and AX pattern- 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.

Simplification of complex spectra – double resonance techniques, shifts reagents –an elementary treatment of NOE phenomenon.

13C NMR Spectroscopy – Factors influencing 13C chemical shifts.

broad band decoupling – off resonance decoupling –chemical shifts of common functional groups – FT NMR and its importance–2D NMR-HOMOCOSY,HETCOSY ,NOSEY and HSQC

UNIT-II: UV-VISIBLE AND INFRA RED SPECTROSCOPY

UV-Visible spectroscopy – introduction – instrumentation, sampling techniques– Factors influencing absorption positions-Woodward-Fisher 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 – disubstituted benzene derivatives – study of steric effect in aromaticity.

Infrared spectroscopy – Introduction – instrumentation, sampling techniques –factors influencing IR vibrations – quantitative studies – hydrogen bonding (intermolecular and intramolecular).

UNIT-III: ESR AND ORD

ESR – basic principles – comparison between ESR and NMR spectra – hyperfine splitting – applications to organic free radicals. 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 – applications of ORD to determine absolute configuration of monocyclic ketones – comparison between ORD and CD – their interrelationships.

UNIT-IV : MASS SPECTROSCOPY

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, Retro Diels alder reaction- McLafferty rearrangement – nitrogen rule-Mass spectra of amino acids and proteins.

UNIT-V: X-RAY DIFFRACTION

Single crystal method, Powder method – Principle -Instrumentation-Applications-space groups –glide planes and screw axes- phase problem – structure solution by heavy atom method and direct method .

Electron diffraction by gases – scattering intensity vs. scattering angle, Wierl equation – measurement techniques.

Neutron diffraction by crystals – magnetic scattering – measurement techniques – elucidation of structure of magnetically ordered unit cell.

X-Ray Photo electron spectroscopy-Principle -Instrumentation-Applications

COURSE OUTCOME:

1. Students should be able to interpretation of types of organic spectra commonly used in the research setting
2. To learn how to use spectra to elucidates structures of organic compounds
3. The ability to investigate and determine the structure of organic compounds using suitable nmr experiments
4. Students should be able to detect and characterization of bio molecules such as proteins ,peptides and oligosaccharides from mass spectroscopy.
5. To understand solid state matter interms of crystallinity and bond.

TEXT BOOKS

1. C. N. Banwell, Fundamentals of Molecular Spectroscopy; 4th Ed., McGraw Hill Education, Noida, 1994.
2. W. Kemp, Organic Spectroscopy; 3rd Ed., Palgrave, New York, 1991.
3. Y. R. Sharma, Elementary Organic Spectroscopy – Principles and Chemical applications; S. Chand, New Delhi, 1992.
4. P. S. Kalsi, Spectroscopy of Organic Compounds; 6th Ed., New Age International Publishers, New Delhi, 2004.
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2. G. M. Barrow, Introduction to Molecular Spectroscopy; McGraw Hill, New York,1964.
P. K. Ghosh, Introduction to Photoelectron Spectroscopy; John Wiley, New York,1989.
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Semester: II-CP- II : Inorganic Chemistry (P)

Ins. Hrs. /Week : 6 **Course Credit: 5** **Course Code : 20PCH210P**

OBJECTIVES

1. To perform the semi-micro qualitative analysis.
2. To separate two common cations and two less common cations
3. To estimate the metal ions using colorimeter.

SEMI-MICRO QUALITATIVE ANALYSIS

1. Semi-micro qualitative analysis of a 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).

COLORIMETRIC ESTIMATION

2. Estimation of copper, ferric, nickel, chromium and manganese ions using photoelectric colorimeter

SCHEME OF VALUATION

I Mixture Analysis	**-30 Marks**
I Cation only	-10 Marks
II Cations only	-15 Marks
III Cations Only	-20 Marks
IV Cations Only	-25 Marks
Confirmatory Test	-05 Marks
II Calorimetric Estimations	**-25 Marks**
Procedure writing	-05 Marks
<2% error	-20 Marks
2-3% error	-15 Marks
3-4% error	-10 Marks
>4% error	-05 Marks
III Viva-voce	**-05 Marks**

COURSE OUTCOME

1. Qualitative analysis of common metals are learnt

2. Qualitative analysis of rare metals are learnt
3. Beer-Lamberts' law is understood
4. Colorimetric analysis of some common metals are learnt

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. Vogel, Text Book of Quantitative Inorganic Analysis; 6th Ed., Longman, New Delhi, 2000.

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Semester: II- EC-II A:Chemistry of Nanoscience and Nanotechnology

Ins. Hrs. /Week : 4 **Course Credit: 4** **Course Code : 20PCHE2A**

OBJECTIVES

- To know the synthetic methods of nanomaterials.
- To understand the characterization of nanomaterials.
- To understand carbon clusters and nanostructures.

UNIT I:

Synthetic Methods Definition of nanodimensional materials – historical milestones – unique properties due to nanosize, quantum dots, classification of nanomaterials. 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.

UNIT II:

Characterisation of Nanoscale Materials Principles of Atomic Force Microscopy (AFM) – Transmission Electron Microscopy(TEM) Resolution and Scanning Transmission Electron Microscopy (STEM) – Scanning Tunneling Microscopy (STM) – Scanning Nearfield Optical Microscopy (SNOM). Scanning ion conductance microscope, scanning thermal microscope, scanning probe microscopes and surface plasmon spectroscopy.

UNIT III:

Reactions in Nanoparticles Reactions in nanospace – nanoconfinement – nanocapsulesCavitands, cucurbiturils, zeolites, M.O.Fs, porous silicon, nanocatalysis. Synthesis of Imidazole and synthesis of Benzimidazoles based on nanocatalyst.

UNIT IV:

Carbon Clusters and Nanostructures Nature of carbon bond − new carbon structures − carbon clusters – discovery of C60−alkali doped C60−superconductivity in C60−larger and smaller fullerenes. Carbon nanotubes – synthesis − single walled carbon nanotubes − structure and characterization − mechanism of formation − chemically modified carbon nanotubes − doping − functionalizing nanotubes − applications of carbon nanotubes.

UNIT V:

Nanotechnology and Nanodevices DNA as a nanomaterial – DNA – knots and junctions, DNA – nanomechanical device designed by Seeman. Force measurements in simple protein molecules and polymerase – DNA complexes– molecular recognition and DNA based sensor.

COURSEOUTCOME

1. Synthetic methods of nanomaterials and characterization of nanomaterials are known.
2. Carbon clusters and nanostructures are learnt.
3. nanotechnology and nanodevices are known
4. Carbon Clusters and Nanostructures are known
5. Molecular recognition and DNA based sensor is known.

REFERENCES

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., WileyInterscience, New York, 2009.
4. T. Pradeep, Nano: The Essentials in Understanding Nanoscience and Nanotechnology; 1st Ed., Tata McGraw Hill, New York, 2007.
5. H. Fujita (Ed.), Micromachines as Tools in Nanotechnology; Springer-Verlag, Berlin, 2003.
6. BengtNölting, Methods in Modern Biophysics; 3rd Ed., Springer-Verlarg, Berlin, 2009.
7. H. Gleiter, Nanostructured Materials: Basic Concepts, Microstructure and Properties, Elsevier, Chennai, 2000.
8. W. Kain and B. Schwederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life; 2nd Ed., John-Wiley R Sons, New York, 2013.
9. T. Tang and P. Sheng (Eds), Nanoscience and Technology, Novel Structures andPhenomena; Taylor andFrancis, New York, 2003.
10. A. Nabok, Organic and Inorganic Nanostructures; Artech House, Boston, 2005.
11. E. A. Rietman, Molecular Engineering of Nanosystems; Springer-Verlag, New York, 2001.
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/

E- RESOURCES

1.www.spinger.com
2.www.pdfdrive.com
3. www.sciencedirect.com
4. www.nanowork.com

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Semester: II-EC- IIB: Supramolecular Chemistry

Ins. Hrs. /Week : 4 **Course Credit: 4** **Course Code : 20PCHE2B**

OBJECTIVES

- To know the fundamentals of supramolecules.
- To learn co-receptor molecules and multiple recognition
- To study the supramolecular reactivity and catalysis.

UNIT I:

Concepts of Supramolecular Chemistry. Concepts and languages of supramolecular chemistry.Crystal engineering of organic solids – hydrogen bonded supramolecular patterns involving water / carboxyl / halide motifs – concepts of different types of synthons based on non-covalent interactions – principles of crystal engineering and non-covalent synthesis – polymorphism and pseudopolymorphism – supramolecular isomorphism / polymorphism – crystal engineering of pharmaceutical phases.

UNIT II:

Metallo Organic Frameworks M.O.F (Metallo Organic Frameworks) – organometallic systems – combinations of different interactions to design molecular rods, triangles, ladders, networks, etc. – design of nanoporous solids – interligand hydrogen bonds in metal complexes – implications for drug design – crystal engineering of NLO materials, OLED.

UNIT III:

Co-receptor Molecules and Multiple Recognition Dinuclear and polynulclear metal ion cryptates – linear recognition of molecular length by ditopic co-receptors – heterotopic co-receptors – cyclophane receptors, amphiphilic receptors and large molecular cages – multiple recognition in metalloreceptors – supramolecular dynamics.

UNIT IV:

Supramolecular Reactivity and Catalysis Catalysis by reactive macrocycliccation receptor molecules – catalysis by reactive anion receptor molecules – catalysis with cyclophane type receptors – supramolecularmetallocatalysis – cocatalysis – catalysis of synthetic reactions – biomolecular and abiotic catalysis.

UNIT V:

Supramolecular Devices Supramolecular devices and sensors – various types of supramolecular devices – an overview – supramolecular photochemistry – molecular and supramolecular photonic devices – light conversion and energy transfer devices – molecular and supramolecular electronic devices – electronic conducting devices – molecular wires, modified and switchable molecular wires.

COURSE OUTCOME

1. Fundamentals of supramolecules are known.
2. Crystal engineering of NLO materialsare known.
3. Co-receptor molecules and multiple recognitionis understood.
4. Supramolecular reactivity and catalysis are learnt.
5. Biomolecular and abiotic catalysis are known.

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1. J. M. Lehn, Supramolecular Chemistry; VCH, Weinheim, Germany, 1995.
2. G. R. Desiraju, Crystal Engineering: The Design of Organic Solids; Elsevier, United States, 1989.
3. G. R. Desiraju, and T. Steiner, The Weak Hydrogen Bond in Structural Chemistry and Biology; Oxford University Press, Oxford, 1999.
4. G. A Jeffrey, Introduction to Hydrogen Bonding; Oxford University Press: UK, 1997.
5. J. M. Lehn, Transition Metals in Supramolecular Chemistry; John Wiley and Sons: New York, 1999.
6. G. R. Desiraju, Current Science; 2001, 81, 1038.
7. Web source: (i) Crystal Growth and Design, http://www.pubs.acs.org/journals/cgdefu/index.html (ii) Crystal Engineering Communicationhttp://www.rsc.org/Publishing/Journals/ce/index.asp

E- RESOURCES

1. www.freebookcentre.net
2. www.spinger.com
3. www.buecher.com
4. Onlinelibrary.wiley.com
5. www.rachidscience.com

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Semester: II **EDC- I: Environmental Chemistry**

Ins. Hrs. /Week : 3 **Course Credit: 2** **Course Code :20PCHED1A**

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BJECTIVES:

- To the study of nature and the facts about environment.
- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.

UNIT-I : ECOSYSTEMS

Concept of an ecosystemStructure and function of an ecosystem.Producers, consumers and decomposers .Energy flow in the ecosystem structure and function of the following ecosystem:a.Forest ecosystem b.Grassland ecosystem c.Desert ecosystem d.Aquatic ecosystems, (ponds, streams, lakes, rivers,oceans, estuaries)

UNIT-II : BIODIVERSITY AND ITS CONSERVATIONS

Introduction – Definition : genetic, species and ecosystem diversity. - Biogeographical classification of India -Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels- India as a mega-diversity nation Hot-sports of biodiversity. -Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts. - Endangered and endemic species of India Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

UNIT-III: ENVIRONMENTAL POLLUTION

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution. (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution

UNIT-IV: NATURAL RESOURCES

a) Forest resources: use andover-exploitation, deforestation, casestudies. Timber extraction, mining, dams and their effectson forestsand tribal people.

b) Water resources: Useand over-utilization of surfaceandground water, floods, drought,conflictsoverwater, damsbenefits and problems.

c)Mineral resources: Use and exploitation, environmental effects of extracting and usingmineral resources,case studies.

d) Food resources: World food problems,changes caused byagriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

UNIT :V-SOCIAL ISSUES AND THE ENVIRONMENT

From Unsustainable to sustainablrdevelopment.Urbanproblemsrelated to energy.Water conservation, Rain water harvesting ,Watershed management.
EnironmentalEthics : Issues and Possible solutions .Climate change ,Global warming, Ozone Layer depletion.

COURSE OUTCOME:

1. Environmental Pollution or problems cannot be solved by mere laws.
2. Public participation is an important aspect which serves the environmental Protection.
3. One will obtain knowledge on the following after completing the course.
4. Development and improvement in standard of living has lead to serious environmentaldisasters
5. To learn the social issues in and around our environment

TEXT BOOKS:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science, 2 ndEdition ,Pearson,Education 2004.
2. BennyJoseph, 'Environmental Science and Engineering',Tata MC Graw-Hill , New Delhi,2006.

REFERENCES:

1. R.K.Trivedi."Hand Book of Environmental Las,Rules,Guidelines,CompliancesansStandard",Volume I and II, Enviro Media.
2. Cunningham, W.P.Cooper, T.H.Gorhani , 'Environmental Encyclopedia', Jaico Publications,House.Mumbai,2001.
3. Dharmendra S.Sengar,'Environmental Law', Prentice Hall of India PVT LTD, NewDelhi.2007.
4. Rajagopalan .R 'Environmental Studies – From Crisis to cure', Oxford University Press.2005.

E- RESOURCES:

1. www.ung.s
2. www.springernature.com
3. www.taxmann.com
4. www.kopykitab.com

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Semester: II-EDC-II-Medicinal Chemistry

Ins. Hrs. /Week : 3 **Course Credit: 2** **Course Code :20PCHED1B**

OBJECTIVES

- To understand the basic concepts of medicinal chemistry
- To understand the structure activity relationships of selected drug molecules
- To understand the Antihistamines, andAntiparkinson drugs

UNIT-I:BASIC CONCEPTS

Drug design - analogues and pro-drugs, factors governing drug design, rational Physical properties-factors governing drug action at active site, general anaesthetics-inhalation anaesthetics, intravenous anaesthetics and basal anaesthetics;mode of action; local anaesthetics-classification and syntheses, sedatives and hypnotics-classification, synthesis, mode of action and structure-activity relationship.

UNIT-II: ANTICONVULSANTS, STIMULANTS AND ANTIPYRETIC ANALGESICS

Anticonvulsants - classification, synthesis and mode of action; Muscle relaxants-classification, synthesis and mode of action. Central nervous system stimulants- classification, synthesis and mode of action; Antipyretic analgesics- classification, pyrazolinonessynthesis and mode of action;

UNIT-III :ANALGESICS NARCOTIC OR OPIATE ANALGESICS

Classification, preparation and mode of action; Narcotic antagonists; Cardiovascular drugs-classification, synthesis and mode of action; Autonomic drugs-synthesis and mode of action of sympathomimetic drugs, antiadrenergic drugs, cholinomimetic drugs, antimuscarinicdrugs, ganglionic blocking agents and adrenergic neurone blocking agents;

UNIT-IV :ANTIHISTAMINES, ANDANTIPARKINSON DRUGS

Antihistamines - synthesis and mode of action; prevention of histamine release;Antiparkinsonism agents-synthesis and mode of action of piperidine analogues, pyrolidine analogues and phenothiazine analogues.

UNIT-V:NOVEL DRUGS

Sulphonamides-preparation and mode of action of sulphonamides for general, urinary, intestinal and local infection; sulphonamide inhibition.Antimalarials-synthesis and mode of action of aminoquinoline analogues, aminoacridine analogues, guanidine analogues, pyrimidine analogues, sulfone and quinine analogues.

COURSE OUTCOME:

1. Basic concepts of medicinal chemistry is understood
2. Structure activity relationships of selected drug molecules are known.
3. Antihistamines, andAntiparkinson drugs are learnt
4. Sulphonamides synthesis are learnt.
5. Sulfone Mode of action are learnt

TEXT BOOKS

1. AshutoshKar, Medicinal Chemistry, New Age International, 1996.
2. W.O.Foye, Principles of medicinal chemistry, 2nd edn., Lea &Febiger, Philadelphia, 1981.

REFERENCE BOOKS

1. M.E.Wolff, Burger's medicinal chemistry, 4th Edn., John Wiley &Sons, New York, 1981.
2. F.F.Blicke and R.H.Cox, Medicinal Chemistry, John Wiley &Sons, New York, 1959.
3. D.Lednicer and L.A.Mitscher, Organic Chemistry of drug synthesis, John Wiley & Sons, New York, 1959.
4. J.E.Hoover, Remington's Pharmaceutical sciences, 15th Edn. Mack Publ.Company, Easton, 1975.

E- RESOURCES

1.www.elsevier.com
2.www.pdfdrive.com
3.www.wiley.com
4.www.pharmpress.com

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SEMESTER III

Semester:III - CC-IX: Coordination Chemistry

Ins.Hrs./Week:4 CourseCredit:3 CourseCode:21PCH311

OBJECTIVES

- To be able to use crystal field theory to understand magnetic properties of coordination compounds.
- To be able to recognize the types of isomers in coordination compounds.
- To become familiar with some application of coordination compounds.

UNIT-I:Theories of Metal –Ligand Bond (14 Hours)

Crystal field theory- splitting of d-orbitals under various geometries- factors affection splitting-CFSE and evidences for CFSE (structural and thermodynamic effects). Spectrochemical series-Jahn-Teller distortion – spectral and magnetic properties of complexes- site . Limitations of CFT- ligand field theory- MO theory – sigma and pi-bonding in complexes – Nephelauxetic effect – the angular overlap model.

UNIT-II: Inner Transition Elements and Molecular Rearrangements(12 Hours)

Inner transition elements – position in the periodic table – electronic configuration, oxidation states, solubility, color and spectra, magnetic properties – Separation of lanthanides - lanthanide contraction : Causes and consequences – Gadolinium break, shift reagents – Extraction of thorium and uranium. Comparison of actinides and lanthanides.

Molecular rearrangements of four – and six – coordinate complexes – interconversion of stereoisomers – reaction of coordinated ligands – template effect and its applications for the synthesis of macro cyclic ligands – unique properties.

UNIT-III: Amines, Proteins And Enzymes (10 Hours)

Cobalamins ; reactions of the alkyl Cobalamins – one electron reduction and oxidation – Co-C bond cleavage – coenzyme B12 – alkylation reaction of methyl cobalamin.Heme and non – heme proteins – hemoglobin and myoglobin – oxygen transport and storage – electron transfer and oxygen activation – cytochromes, ferredoxins and rubredoxin – model systems mononuclear non-heme iron enzymes. Copper containing proteins - classification and examples – electron transfer – oxygen transport- oxygenation - oxidases and reductases – cytochrome oxidase – superoxide dismutase (Cu, Zn) – nickel containing enzyme : urease.

UNIT-IV: Physical Methods in Co ordination Chemistry -I (12 Hours)

Types of magnetic behavior – magnetic susceptibility measurements – Gouy method – Orbital contribution – Spin-orbit coupling and its effects on magnetic properties – Temperature independent Para magnetism (TIP) – Electronic spectra of complexes – bandwidth and intensity –Sugano-Tanabe and Orgel Diagrams – charge transfer spectra – Infrared spectra of Coordination complexes – characteristic frequencies – mode of coordination and interpretation of IR spectra of complexes containing ClO4>, SO42>, CO32>, ester, amine, amide, DMSO ligands.

UNIT-V:Physical Methods in Co Ordination Chemistry -II (12 Hours)

NMR – Applications of NMR to inorganic compounds – NMR of metal hydrides (1H NMR),

metal carbonyls (13C NMR), 19F and 31P NMR – Applications of NQR spectroscopy to the study of complexes– ESR – zero field splitting – Kramer's degeneracy – pattern for number of lines of complexes having d1-d9 systems –bis(salicylaldimine) Cu(II), Mn(II) complexes – Mossbauer spectroscopy – quadrupole interactions – magnetic interactions – $FeSO_4$, $FeCl_3$, ferro- and ferricyanides, nitroprusside, $Fe_3(CO)_{12}$, $I2Br_2Cl_4$.

Total Lecture Hours : 60

COURSE OUTCOME

The Students will able to

1. Theories of bonding in coordination compounds.
2. Basics of organometallics and structure and bonding in organometallic compounds.
3. Mechanisms of reactions of complexes.
4. Different types of magnetic behaviors and their measurement.
5. Applications of NMR, ESR and Mossbauer spectrometric methods to the field of coordination chemistry.

TEXT BOOK(S)

1. Cotton .F. A, Wilkinson. G, Murillo. C.A , Bochmann .M. 2021.Advanced Inorganic Chemistry. A Wiley India Pvt Ltd.
2. Drago .R S.1992. Physical Methods in Chemistry, 3rd Ed., W. B. Saunders Company, London.
3. Huheey .J E. Keiter ,E.A ,Keiter. R. L.1993. Inorganic Chemistry Principles of Structure and Reactivity, 4th Ed., Harper Collins College Publishers, New York.
4. Miessler.G.L.Fischer.P.J , Tar. D.A,2014 Inorganic Chemistry, 5th Ed., Pearson Education, Inc., New York.
5. Sutton. D. 1968 . Electronic Spectra of Transition Metal Complexes, McGraw Hill, Australia.

REFERENCE BOOK(S)

1. Cotton ,F.A ,Wilkinson. G. 1972. Inorganic Chemistry A Comprehensive Text, 3rd Ed., Inter science Publishers, New York.
2. Lee ,J. D. 1998 .Concise Inorganic Chemistry, 6th Ed., ELBS, London.
3. Lewis.J,Wilkins.R.G. 1960 .Modern Coordination Chemistry, Inter science Publishers, Inc., New York.
4. Purcell.,K.FandKotz,J.C. 1977. Inorganic Chemistry, W B Saunders Company, Philadelphia,.
5. Shriver,D.Weller.M,Overton. T Rourke. J and Armstrong. F. 2014. Inorganic Chemistry, 6th Ed., W H Freeman and Company, New York.

E RESOURCES

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2. https://nptel.ac.in/content/storage2/courses/104101005/downloads/lecturenotes/chapter%2011.pdf
3. https://www.academia.edu/23549742/amines_amino_acids_proteins
4. http://www3.nd.edu/~nsl/lectures/laboratory/19_esr.pdf
5. http://scalettar.physics.ucdavis.edu/p298/squiddetectednmrandnqr.pdf

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Semester:III- CC-X : Physical Chemistry-III

Ins.Hrs./Week:5 CourseCredit:4 CourseCode:21PCH312

OBJECTIVES

- To describe the principle, instrumentation and applications of polarography, coulometry and cyclic voltammetry.
- To discuss the principle and its applications of radiation chemistry.
- To obtain the knowledge on design and the development of materials with pre required properties based on understanding the structure of solids**.**

UNIT-I:Electrochemistry – III (15 Hours)

Coulometry Principles and applications of Polarography -instrumentation-Types of cells, Advantagesofdroppingmercuryelectrode, Interpretationofcurrent voltagecurves, tests for reversibility, determination of n values (usefulness of illkovicequation),Polarographicmaxima,currenttimecurves. Oculographic polarography, ACpolarography, Cyclic voltammetry, Advantages over Polarographic techniques - test of reversibility ofelectron transfer reactions -Chronopotentiometry –apparatusused, advantagesoverpolarography-controlledpotential.

UNIT-II:Chemical Kinetics-II (16 Hours)

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 Menton law –Kinetics of processes in micellar and reverse micellar systems.

UNIT-III:Photochemistry II (15 Hours)

Photosensitization, Importance -Flash photolysis- applications- photochemistry in life processes, theory of vision, photosynthesis-mechanism of photosynthesis- photosynthesis in bacterial systems- Photoconductivity concept, importance-photopolymerization, mechanism, kinetics-Hot atom, concept, characteristics and Production.

UNIT-IV:Radiation Chemistry (14 Hours)

Sources of high energyradiation and interaction with matter – radiolysis of water, solvated electrons – Definitionof G value – Curie –Linear energy transfer LET and Rad – Scavenging techniques- useof dosimetryanddosimetersinradiationchemistry-applicationofradiationchemistry.

UNIT -V: Solid State Chemistry (15 Hours)

General principles of solid state chemistry - Experimental procedure, Coprecipitation as a precursor to solid state reaction, Other precursor methods, Kinetics of solid state reactions - Crystallizations of solutions, melts, glasses and gels, Solutions and gels: zeolite synthesis, Melts, Glasses - Vapor phase transport methods-- Electrochemical reduction methods - Preparation of thin films, Physical methods - Growth of single crystals, Czochralski method, Bridgman and stock Barger methods, Zone melting, Precipitation from solution or melt : flux

method.

Total Lecture Hours:75

TEXTBOOK(S)

1. Anthony. R. West., 2014. Solid state Chemistry and its Applications ., Wiley, 2nd Edition.
2. Bockris .J.O , Conway.2012.Modern aspects of electrochemistry, Springer.
3. Chakrabarty. D.K. 2021“ Solid state chemistry”, New Age International Publishers, 2nd Ed,.
4. John. R.W. Wiley. Sons. Solid state chemistry andits application.
5. Shubhrata .R MSHRA,2011. Text book of Photochemistry, Discovery publishing Pvt Ltd.

REFERENCE BOOK(S)

1. Dave .R.K.2000.ChemicalKinetics, CampusBook .
2. Atkins ,P.W.2002.PhysicalChemistry,7thedition,OxfordUniversitypress.
3. Mc Quarrie,D.AandSimon. D.2003.Physicalchemistry,AMolecularApproach,VivaBooksPvt.Ltd, NewDelhi.
4. Robert. J. Woods , Alexei K.Pikaev. Dec 1993. Applied radiation chemistry , 1st Ed, Wiley -Inter science .
5. Nicholas. J. Turro.,V.Ramamurthy.,J.C.Scaiano, Jan 2019. Principles of molecular photochemistry, 1st Edition, Viva books Mukesh Patel and Parimal Chatrabhuji., Fundamentals of Chemical Kinetics (volume -I)., Createspace , a DBA of on Demand Publishing (Jan 2018).

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2. https://www.askiitians.com/revision-notes/chemistry/chemical-kinetics/
3. https://www.fuadherbal.net/book/photochemistry/
4. https://www.radccore.org/files/documents/intro%2520to%2520radiation%2520chemistry.pdf
5. https://ocw.mit.edu/courses/materials-science-and-engineering/3-091sc-introduction-to-solid-state-chemistry-fall-2010/

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Semester: III -CP-III: Physical Chemistry Practical

Ins.Hrs./Week:6 CourseCredit:4 CourseCode: 21PCH313P

OBJECTIVES

- To describethemethodofdeterminationofmolecularweight,CSTandrate constant.
- To discuss the method of determination of Adsorption of Oxalic acid using freundlich isotherm and Kinetics – persulphate - Iodine reaction,
- To explain theconductometric titration andpotentiometrictitrations.

PHYSICAL–NON ELECTRICAL

1. Kinetics-acidhydrolysisofEster-Determinationof energyofactivation(Ea).
2. Determination of Critical Solution Temperature (CST) of phenol-water system and effect of impurity on CST.
3. Determination of molecular weight of a substance by Rast method.
4. Studyofphasediagram of two componentsforminga simpleeutectic.
5. Adsorption-Oxalic acid/Acetic acid on charcoal using freundlich isotherm.

PHYSICAL -ELECTRICAL

1. Conductometry-Acid-alkali titrations.
2. Conductometry-Precipitationtitrations.
3. Conductometry-Displacementtitrations.
4. Conductometry-Determinationofdissociationconstantofweak acids.
5. VerificationofOnsagerequation-conductivitymethod.
6. Potentiometrictitrations-Acidalkali titrations.
7. Potentiometrictitrations-Precipitationtitrations.
8. Potentiometrictitrations-Redox titrations.

SCHEME OF EVALUATION:

Physical Non electrical:

Execution of experiment	- 10 marks
Presentation of data	- 05 marks
Processing the data, graph and calculation	- 05 marks
Results	- 05 marks
UE	- 25 marks

Physical electrical:

Execution of experiment	- 10 marks
Presentation of data	- 05 marks
Processing the data, graph and calculation	- 05 marks
Results	- 05 marks
UE	- 25 marks
Viva voce	- 10 marks
Total Marks: IA	- 40 marks

RESULTS:

Less than 5%	- 20 marks
5-7%	- 15 marks
7-8 %	- 10 marks
8-10 %	- 8 marks
Above 10 %	- 6 marks

COURSE OUTCOME

The Students will able to

1. Understand the molecular weight, CST, andrateconstant .
2. Understand the determination of Adsorption of Oxalic acid using freundlich isotherm and Kinetics – Persulphate - Iodine reaction
3. Observe the conductometric titration andpotentiometrictitrations which can be determined.
4. Problem solving, critical thinking and analytical reasoning as applied to Scientific problems
5. Design and carryout scientific experiments as well as accurately record and analyze the results of experiments.

TEXT BOOK(S)

1. Alexander-Findlay. 2016. Practical Physical Chemistry. Wentworth Press, Sydney.
2. Amirtha Anand & Ramesh Kumari , 2020. Physical Chemistry Laboratory Manual; Dreamtech Press. India, Pvt Ltd.
3. Francis William Gray ., 2015.A Manual of Practical Physical Chemistry; Palala Press,
4. Renu gupta 2017.Practical Physical Chemistry 1 st edition,New Age international Publishers.
5. Viswanthan. B,Ragahvan. P.S.2015.Practical Physical chemistry,Viva Publishers.

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1. Khosla. B.D, V.C .Garg, Adarsh Gulati, 2008. Senior Practical Physical Chemistry, R. Chand & Co, New Delhi.
2. Gurturand. J.N& Kapoor. R. Advanced Experimental Chemistry, Vol. I. Chand & Co., Ltd., New Delhi.
3. Levitt. B.P.1985. Findlay's Practical Physical Chemistry, Revised and edited by 9th ed., Longman, London.
4. Saroj.kr Maity , Naba Kr Ghosh , 2012, Practical Physical Chemistry; I st Ed, New cental Book Agency.
5. Yadav. J.B. 2001. "Advanced Practical Physical chemistry", 20th Ed., Goel publishing House, Krishna Pakashan Media Ltd.

E- RESOURCES

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2. https://dailydialectics.com/education/textbooks/pchemlabtxt.pdf
3. https://books.google.com/books/about/practical_physical_chemistry.html
4. https://www.fpharm.uniba.sk/fileadmin/faf/pracoviska-subory/kfchl/zlozka1/ucebne_texty/laboratory_manual_for_physical_chemistry.pdf
5. http://chemistry.uohyd.ac.in/files/other/labmanual%20_cy457.pdf

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Semester: III - EC- IIIA : Analytical Chemistry

Ins.Hrs./Week:4 CourseCredit:3 CourseCode: 21PCHE3A

OBJECTIVES

- To acquire basic concepts,Principles, and Techniques of Analytical Chemistry
- To solve problems related to chemical analysis and interpret analytical results.
- To investigate and analyze substances for research and product development.

UNIT -I : Instrumental Methods of Analysis (14 Hours)

Principles and applications of extended X-ray absorption fine structure (EXAFS) – surface extended X-ray absorption (SEXAFS) – atomic absorption spectroscopy (AAS) – flame emission spectroscopy (FES) – turbidimetry – theory and applications.

UNIT -II: Data and Error Analysis (12 Hours)

Various types of error – accuracy, precision, significant figures – frequency distributions, the binomial distribution, the Poisson distribution and normal distribution – mean, variance, standard deviation, Hypothesis testing, levels of confidence and significance, – testing variances, means t-Test, paired t-Test – analysis of variance –analysis of variance (ANOVA) – correlation and regression. Curve fitting, fitting of linear equations.

UNIT -III: Chromatography (10 Hours)

Solvent extraction – principles of ion exchange, paper, thin-layer and column chromatography techniques – columns, adsorbents, methods, Rf values, McReynold's constants and their uses – HPTLC, HPLC techniques – adsorbents, columns, detection methods, estimations, preparative column – GC-MS techniques – methods, principles and uses.

UNIT-IV :Thermo analytical Methods and Fluorescence Spectroscopy (12 Hours)

Principles – instrumentations and applications of thermogravimetry analysis (TGA), Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry (DSC) – thermometric titrations – types – advantages. Basic aspects of synchronous fluorescence spectroscopy – spectral hole burning – flow cytometry – fluorometers (quantization) – instrumentation – applications.

UNIT -V :Electroanalytical Techniques (12 Hours)

Electrochemical sensors, ion-sensitive electrodes, glass – membrane electrodes, solid-liquid membrane electrodes – ion-selective field effect transistors (ISFETs) – sensors for the analysis of gases in solution. Polarography – principles and instrumentation – dropping mercury electrode – advantages – Ilkovic equation – applications of polarography – polarographic maxima – oscillographic polarography, AC polarography – amperometric titrations: principles – techniques – applications – estimation of lead.

Total Lecture Hours :60

COURSE OUTCOME

The Students will able to

1. Understand the principles, instrumentation and applications of various instruments.
2. Learn the statistical tools behind analytical chemistry.
3. Learn the principles, instrumentation and applications of chromatographic techniques.
4. Understand the principles, instrumentation and applications of thermo analytical techniques.
5. Understand the principles, instrumentation and applications of electroanalytical techniques.

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1. Banwell .C.N , McCash .E.M 1994. Fundamentals of Molecular Spectroscopy; 4th Ed., Tata McGraw-Hill, New Delhi.
2. Braithwaite ,A, Smith .J.F 1995. Chromatographic Methods, 5th Ed., Springer, Germany.
3. Gary .D ,Christian 2013. Analytical Chemistry, John Wiley & Sons, 7th edition.
4. Gupta. S.C 2018. Fundamentals of Statistics, 6th Ed., Himalaya Publications, Delhi,
5. Harris. D.C 1995. Quantitative Chemical Analysis, 4th Ed., W. H. Freeman Publications, New York.
6. Hibbert, D. Band Gooding .J.J 2006. Data Analysis for Chemistry, Oxford University Press, UK.
7. Sharma. A, Schulman. S.G , 1999. Introductionto Fluorescence Spectroscopy, Wiley Inter Science, New York.
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9. Srivastava. V.K andSrivastava .K.K 1985. Introduction to Chromatography, 2nd, Ed., Holden Day, New York.
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12. Willard. H.H, Merritt. L.L , Dean. J.A and Settle. F.A , 1986. Instrumental Methods of Analysis, 6th Ed., CBS Publishers and Distributors, Chennai.

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1. Gopalan ,R.2004. Elements of Analytical Chemistry, 3rd edition, Sultan Chand and Co, New Delhi.
2. Heftmann. E .2004. Chromatography, Volume 69A, 6th edition, Elsevier.
3. Sergey .V. yazovkin , Nobuyoshi KogaChristoph Schick2018, Handbook of Thermal Analysis and Calorimetry, v.6, Recent Advances, Techniques and Applications, Elsevier.
4. Skoog. D.A, West. D.M and Holler. D.J 2004. Fundamentals of Analytical Chemistry, 7th Ed., Harcourt College Publishers, Singapore.
5. Valcarcel CasesMiguel LópezLorenteÀngela I López JiménezM Àngeles Foundations of Analytical Chemistry, A Teaching–Learning Approach, Springer. DOI 10.1007/978-3-642-57157-2

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1. https://pubs.acs.org/doi/10.1021/ac60112a013
2. https://web.pa.msu.edu/courses/2014summer/phy451/lectures/lecture_data_error_analysis.pdf
3. https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod5.pdf
4. https://www.currenta.com/analytics/methods/thermoanalytical-methods.html
5. http://www.umich.edu/~chem241/lecture13final.pdf

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SENGAMALATHAYAAREDUCATIONALTRUSTWOMEN'SCOLLEGE
(AUTONOMOUS)
SUNDARAKKOTTAI, MANNARGUDI- 614016
(For the Candidates admitted in the academic year 2020 – 2021)
DEPARTMENT OF CHEMISTRY
M.Sc., CHEMISTRY

Semester: III - EC- IIIB : Pharmaceutical Chemistry

Ins.Hrs./Week:4 **CourseCredit:3** **CourseCode:21PCHE3B**

OBJECTIVES

- It is focused on quality aspects of medicines
- Aims to assure fitness for purpose of medicinal products by analyzing & evaluating them
- To design and production of compounds that can be used in medicine for prevention , treatment and cure of human disease.

UNIT -I :Basics of Pharmaceutical Chemistry (14 Hours)

Definitions – the terms – drugs, pharmacology, pharmacy, chemotherapy, therapeutics – pharmacologically active principles in plants – first aid – important rules of first aids, cuts, fractures, bleeding for blood, maintaining breathing burns and first aid box – tuberculosis (T.B.), jaundice, piles, typhoid, malaria, cholera – causes – symptoms, diagnosis – prevention and treatment.

UNIT -II : Antibiotics (12 Hours)

Definition – introduction – classification and biological actions – penicillin, chloramphenicol, streptomycin and tetracycline – structure, properties and therapeutic uses – chemical structure and pharmacological activity – effect of unsaturation, chain length, isomerism, halogens, amino groups, hydroxyl groups and acid groups.

UNIT -III :Analgesic and Antipyretics (10 Hours)

Narcotic analgesic – analgesic action of morphine – derivatives of morphine – heroin and apomorphine – synthetic analgesics – pethidine, methadone – nonnarcotic analgesic – aspirin, paracetamol and phenacetin – analgin – preparation, properties and uses – ibuprofen and ketoprofen – structure and uses.

UNIT - IV :Anesthetics and Local Anesthetics (12 Hours)

Characteristics of anesthetics – classification of anesthetics – general anesthetics – volatile anesthetics – ether, chloroform and halothane – advantages and disadvantages – non-volatile anesthetics (intravenous anesthetics) – methohexitone and propanidid – structure and uses – cocaine and amethocaine – structure and uses – benzocaine and procaine – structure, synthesis and uses.

UNIT -V :Clinical Chemistry (12 Hours)

Determination of sugar (glucose) in serum – o-toluidine method – diagnostic test for sugar in urine – Benedict's test – detection of diabetes – detection of cholesterol in urine – detection of anemia – estimation of hemoglobin (Hb concentration) – red cell count.

Total Lecture Hours : 60

COURSE OUTCOME

The Students will able to

1. Deals with properties of drugs to their pharmacological activity.
2. Understand the various mechanism of action of drug.
3. Understand the medicinal and pharmaceutical importance of chemical compounds.
4. Understand the importance of metabolism of substrates.
5. Describe various routes of administration and significances of drugs.

TEXT BOOK(S)

1. Alagarsamy. V, 2020, Text Book of Medicinal Chemistry, 3rd Ed, vol I, CBS Publisher.
2. Bhagavathi Sundari,(2006), Applied Chemistry, 1st Ed., MJP Publishers, Chennai.
3. Jayashree Ghosh, A Text Book of Pharmaceutical Chemistry, 5th Ed., S. Chand and Company Ltd., New Delhi, 2014.
4. Lakshmi..S,(1995), Pharmaceutical Chemistry, 1st Ed., S. Chand and Company Ltd., New Delhi.
5. Mathew George & Lincey Joseph, 2009 , A Text Book of Pharmacetical Chemistry, Viva Books

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1. Cairns Donald, 2012.Essentials of Pharmaceutical Chemistry, The Robert Gordon University, Aberdeen, UK ,Fourth edition.
2. David ,G., Watson, Pharmaceutical Chemistry, Elsevier.2011. International Edition, 1st Edition.
3. Sambath kumar..S., Murugesh. N. Dr, 2018. Pharmaceutical Chemistry-I, Sathya publishers.
4. Shaquiquzzaman. M, Mumtaz Alam Mymoona .M, Pharmaceutical Chemistry, Akhter Books.2019. SR Pharmacy series. 1st Edition.
5. Virupaxappa, Shekarappa, Betageri, Latha Shiva shankar Mugalehali, 2019, Pharmaceutical Chemistry, LAP Lambert Academic Publishing.

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2. https://www.researchgate.net/publication/281405283_antibiotics_introduction_to_classification
3. http://ifna.site/ifna/e107_files/downloads/lectures/h1localane.pdf
4. http://fac.ksu.edu.sa/sites/default/files/analgesics.pdf
5. https://archive.org/details/chapter01clinicalchemistry

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Semester: III- EDC- IIA: Food Chemistry

Ins.Hrs./Week:3 CourseCredit:2 CourseCode:21PCHED2A

OBJECTIVES

- Appraisethefunctions,sources,deficiencydiseases,dailyallowancesofmajornutrients.
- Categorizeandsummarizethevarioustechniquesoffoodpreparationandrecommend Stepstoretainthenutritivevalue.
- Identifythedifferenttypesoffoodadulterationandsuggestfewtestsfortheirdetectionand relateschemicalstructureofingredientswithtaste.

UNIT -I:Nutrients–I (10 Hours)

Protein–functions, sources, deficiency diseases, daily allowances.
Carbohydrates–functions, sources,deficiency diseases, daily allowances.
Fats and oils–functions, sources, deficiency diseases, daily allowances, disorders due to excess of fat.

UNIT -II :Nutrients–II (9 Hours)

Vitamins – H_2O soluble and fatsoluble vitamins – sources, functions, deficiency and disorders of taking excess of vitamins.H_2O–functions, sources, deficiency diseases

UNIT - III :Food Preparation (9 Hours)

Food preparation-Effect of cooking and heat processing on the nutritive value of foods. Food faddism and faulty food habits.Cooking methods: Moist heat methods and dry heat methods–merits and demerits.

UNIT -IV : Food Preservation (9 Hours)

Food preservation: Importance of food preservation, causes of food spoilage. Principles of food preservation. Home scale methods of food preservation.
Methods of food preservation: Low temperature, high temperature, preservatives, osmotic pressure, dehydration, irradiation–merits and demerits.

UNIT - V :Food Adulteration (8 Hours)

Food Adulteration–Types, international, Metallic, incidental adulteration and their ill effects. Simple physical and chemicaltests for detection of food adulterants, consumer protection.

Total Lecture Hours : 45

COURSE OUTCOME

The Students will able to,

1. Discuss the functions, sources, deficiency diseases and daily allowances of major nutrients.
2. Summarize the various techniques of food preparation.
3. Discus the recommend Steps to retain the nutritive value.
4. Describe the different types of food adulteration.
5. Relates chemical structure of ingredients with taste.

TEXT BOOK(S)

1. Belitz. W. Grosch, P.Schieberle,2009, Food Chemistry, 4th Edition .
2. Deman. J.M.(et al), 2018, Principles of Food Chemistry.
3. Hamilton. R.J, 1998, Lipid Analysis in Oils and Fats.
4. Srilakshmi.B, 2003, Food Sceince, Third Edition, New Age international publishers.
5. Swaminathan. Dr. M, 2008, Handbookof foodandNutrition'Reprint,publishedbyTheBangalorepringandpublishingco. ltd.

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1. Lakshmi, 2000. Food Science, Second Edition, New Age international publishers.
2. Sumathi. R. Mudambi,1983. 'Fundamentals of food and Nutrition', Second edition, Wiley Eastern Limited.

3. Swaminathan.M. Dr.1987. Food Science Chemistry and Experimental foods, second enlarged edition, Published by Bangalore press.

4. Swaminathan. M.Dr. 'Advanced test Book on Food and Nutrition Volume I and II second edition, The Bangalore printing and publishing co. ltd.

5. Swaminathan .M. Dr.'Advanced test Book on Food and Nutrition Volume III secondedition, The Bangalore printing and publishing co. ltd.

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3. https://nios.ac.in/media/documents/srsec321newe/321-e-lesson-8.pdf
4. http://www.eagri.org/eagri50/ambe101/pdf/lec23.pdf
5. http://ijsit.com/admin/ijsit_files/food%20adulteration_1.2.4.pdf

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Semester::III - EDC - IIB : Bioinorganic Chemistry

Ins.Hrs./Week:3 **CourseCredit:2** **CourseCode:21PCHED2B**

OBJECTIVES

- Toacquirebasicknowledgeaboutthestructureandfunctionsofcertainmetallo-enzymes.
- Togain insightinto thesmallmoleculesbindingand transportmechanisminvolvingmetalloenzymes
- Toknowaboutthemechanismofbindinginteractionsofmetalcomplexeswithbio-moleculesandmetal-baseddrugaction.

UNIT -I: MetalsinBiology (10 Hours)

Metals and Non-metals in biological systems - Essential and trace elements - Role of different metal ions in biological systems - Sodium-Potassium pump Chlorophyll-Photosystem-I(PS-I) &II(PS-II)-Structure-function relationship.

UNIT -II : StructureandFunctionOfVariousMetalloenzymes (9 Hours)

Metalloenzymes -Definition-Examples -Active site structure and mechanism of action of-Carboxypeptidase-AandCarbonic Anhydrase-StructureandfunctionofSuperoxidedismutase(SOD), Peroxidaseandcatalaseenzymes

UNIT -III : HemeandNon-HemeMetalloenzymes (9 Hours)

Porphyrin system-Structure and functions of Hemoglobin and Myoglobin-Dioxygen binding, transportandutilization-Hemocyanin-Hemerythrin-Syntheticoxygencarriers-Vitamin B12 co-enzyme-Non-heme iron-sulfur proteins-Ferredoxins–Rubredoxins.

UNIT - IV : MetalsinMedicine (9 Hours)

Chemotherapy - Radio diagnostic agents - MRI scanning - Chelating Agents - EDTAandtherapybasedonin vivo chelationofradionucleotides-Dosage and toxicity.

UNIT - V : DrugDiscoveryandDesign (8 Hours)

Cancerchemotherapy-Bioinorganicchemistryofplatinumandruthenium anticancer drugs-Mechanismofactionofcisplatin-Clinicaltrialsandtheirsignificance-ApplicationsofCoordinationcomplexes in medicine.

Total Lecture Hours : 45

COURSE OUTCOME

The Students will able to

1. Understand the key function of metal ions such as manganese, iron
2. Describe the acquire intense knowledge about various biological roles such as metal ion, transport and storage.
3. Dicuss the different types of imaging used in medicine and describe how x-rays are exploited in anatomical imaging.
4. Classify each drug used in the treatment of cancer and compare and contrast the mechanism of action, uses and adverse effects.
5. Obtain gain knowledge about the Cancer chemotherapy.

TEXT BOOK(S)

1. Asim, K, Dass, BioinorganicChemistry .2007.Books and Allied(P) Limited.
2. Dieter Rehder, 2014, Bioinorganic Chemistry; Oxford University Press, USA
3. Heinz- Bernhard Kraatz and Nils Metzler-Nolte.,2006, Concepts and Models in Bioinorganic Chemistry. 1 st Ed., Wiley – VCH.
4. Monal Singh Neerja Gupta, 2014, Essentials of Bioinorganic Chemistry;
5. WolfgangKaim, Brigitteschwederski,Axelklein Bioinorganic chemistry.InorganicElementsinthechemistryoflife, 2nd edition.

REFERENCE BOOK(S)

1. Bertini. H.B, Gray.S, Lippard.LandJ.S.Valentine, Bioinorganic ChemistryUniversity Science Books.
2. Huheey. J.E,. Kieter E.A, andKeiter. R.L,Inorganic Chemistry,4thEdition,AddisionWeselyPublishing Company.
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2. https://www.scribd.com/doc/86711687/4-metalloenzymes
3. https://biologydictionary.net/heme/
4. https://pubmed.ncbi.nlm.nih.gov/16053118/
5. https://www.nebiolab.com/drug-discovery-and-development-process/

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SEMESTER IV

Semester:IV - **CC- XI: Organic Chemistry – III**

Ins.Hrs./Week:4 **CourseCredit:4** **CourseCode:21PCH414**

OBJECTIVE

1. To describe the elimination, heterocycles and phase transfer catalyst reaction in a broad perspective.
2. To describe the properties and function of lipids and nucleic acid.
3. To analyze the Lead and Analogue Synthesis.

UNIT-I : Elimination Reaction (14 Hours)

Elimination reactions mechanisms; E1, E2, E1CB – stereochemistry of elimination, Hofmann's and Zaitsev's rules – competition between elimination and substitution – pyrolytic cis-elimination, Chagaev reaction – examples such as dehydration, dehydrohalogenation, Hofmann degradation, Cope elimination, Berdt's rule with examples.

UNIT -II:Heterocycles (12 Hours)

Heterocycles -Nomenclature: Trivial, systematic and replacement nomenclature -non-aromatic heterocycles - synthesis of tetrahydro furans - pyrrolidines - tetrahydropyrans - piperidines. Synthesis and reactivity of aromatic heterocycles: pyrazoles - isothiazoles - triazoles - pyrimidines - purines - triazines - pyridazines -pyrazines.

UNIT-III : Phase-Transfer Catalyst Reactions (10 Hours)

Phase-transfer catalyst reactions – Heck reaction – Michael addition reaction – oxidation of toluene to benzoic acid – Reimer-Tieman reaction – Baker-Venkataraman synthesis – Williamson ether synthesis – Dozen reaction.

UNIT -IV:Lipids and Nucleic Acids(12 Hours)

Lipids – definition – simple lipids – fats and oils – compound lipids – phospholipids, glycolipids – physical properties – solubility, melting point, surface tension, emulsification and geometric isomerism – chemical properties - reaction involving -COOH group, -OH group and double bonds. Types of RNA.

Nucleic Acid – definition – nucleosides and nucleotides – deoxyribonucleic acid (DNA) – inter nucleotides linkages – base composition – double helical structure.

UNIT-V:Lead and Analogue Synthesis (12 Hours)

Designing organic synthesis – disconnection approach – synthons and synthetic equivalents – one group disconnections: alcohol, acid and ketone – functional group inter conversions. Asymmetric synthesis – basic principles – stereoselective and stereospecific reactions – reagents, catalysts and their applications (wherever applicable) in alkylation and hydrogenation – Jacobsen's catalyst – Evan's catalyst.

Total Lecture Hours : 60

COURSE OUTCOME

The Students will able to

1. Know the important method to prepare for the alkenes
2. Observe the fundamental theoretical understanding of heterocyclic systems.
3. Describe the mechanism of phase transfer reactions.
4. Explain the synthesis of lipids and nucleic acids.
5. The Lead and Analogue Synthesis are analyzed.

TEXT BOOK(S)

1. Kagan,H.B. 2003. Asymmetric Synthesis by Thieme Medical Publishers.
2. Michael Blackburn .G , Martin Egli Michael .J. gait , Jonathan .K. watts, 2021.Nucleic Acids in Chemistry and Biology. 4th Ed, Royal Society of Chemistry,
3. Pine. S.H.1987. Organic Chemistry, (5th Edition), McGraw–Hill International Book Company, New Delhi.
4. Seyhan, N. Ege .2005. Organic Chemistry, (5th Edition), Houghton Mifflin Co, New B.F.A. ,Sundberg, R.J.2002.York.
5. Sundberg. 2007.Advanced Organic Chemistry. Part-A and Part-B, Springer, 5th Ed.
6. Wiley ,1984.Designing Organic Synthesis. The Disconnection Approach by Stuart Warren, 2nd edition.

REFERENCE BOOK(S)

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2. Carey. Advanced Organic Chemistry, Parts A & B, Plenum.
3. Kagan, H.B.2003.Asymmetric Synthesis, Thieme Medical Publishers.
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5. March.J.2000.AdvancedOrganic Chemistry, Reactions, MechanismsandStructure, 5th Ed., Willey.
6. Penny.C. Bioorganic Chemistry, A Chemical approach to Enzyme action, Hermann Dugas and Springer – Verlag.
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2. http://www.wiley-vch.de/books/sample/3527332014_c01.pdf
3. https://chem.pg.edu.pl/documents/614792/2c6c0579-c52b-400e-a396-07a03363f4e0
4. http://mrsgiegler.weebly.com/uploads/5/8/4/0/5840155/bio_-_macromolecules_giegler.pdf
5. https://www.groove3.com/tutorials/analog-synths-explained

Semester:IV-CC-X I I : Spectral Techniques in Inorganic Compounds
Ins.Hrs./Week:4 CourseCredit:3 CourseCode: 21PCH415

OBJECTIVES

1. To describe the term symbols of diatomic molecule through electronic spectroscopy**.**
2. To explain the important role of IR spectroscopy in the study of structure of organic compounds, NMR Spectrum of compound given its structure.
3. To discuss some properties of a simple microwave reflection spectrometer and to detect chemically different species.

UNIT-I :ElectronicSpectroscopy (14 Hours)

Microstates, terms– Intensity of bands –group theoretical approach to selection rules - Effect of distortion and spin-orbit coupling on spectra –Evaluation of 10Dq and β for octahedral complexes of cobalt and nickel–applications to simple coordination compounds–charge transfer spectra–Optical rotatory dispersion and circular dichroism and Magnetic circular dichroism – applications to metal complexes.

UNIT-II: InfraredSpectroscopy (12 Hours)

Vibrations in simple molecules (H2O, CO2) and their symmetry notation for molecular vibrations – Group vibrations and the limitations- combined uses of IR and Raman Spectroscopy in the structural elucidationof simple molecules like N2O, Cl F3, NO3-, ClO-4 - effect of coordination on ligand vibrations – uses of groups vibrations in the structural elucidation of metal complexes of urea, thiourea ,cyanide,thiocyanate, nitrate, sulphate and di methyl sulfoxide- vibrational spectra of metal carbonyls with reference to the nature of bonding, geometry and number of C-O stretching vibrations (group theoretical treatment) .

UNIT-III :NMR Spectroscopy (12 Hours)

Examples for different spin systems – chemical shifts and coupling constants (spin-spin coupling)involving different nuclei (1H, 19F, 31P, 13C) interpretation and applications to inorganic compounds – Effect of quadrupolar nuclei (2H,10B,11B) on the1HNMR spectra,- Systems with chemical exchange - evaluation of thermodynamic parameters in simple systems – study of fluxional behavior of molecules– NMR of paramagnetic molecules–isotropic shifts contact and pseudo-contact interactions–Lanthanide shift reagents.

UNIT - IV: EPR Spectroscopyand Magnetic properties (10 Hours)

Theory of EPR spectroscopy- Spin densities and McConnell relationship –Factors affecting the magnitude of g and A tensors in metal species- Zero-field splitting and Kramer's degeneracy– Applications of EPR to a few biological molecules containing Cu (II) and Fe (III)ions.

Types of magnetism – Día –para – ferro and anti-ferro magnetism. Magnetic properties of free ions – first order Zeeman effect – Second order Zeeman effect – states KT – states<<KT. Determination of Magnetic moments –temperature independent Para magnetism. Magnetic properties of lanthanides and actinides.

UNIT - V:Mossbauer &NQR Spectroscopy (12 Hours)

Mossbauer Spectroscopy - Isomer shifts–Magneticinteractions–Mossbaueremissionspectroscopyapplications toironandtincompounds.

NQRSpectroscopy - Characteristicsof quadrupolar nucleus–effectsof fieldgradientandmagneticfielduponquadrupolarenergy levels –NQR transitions –applications of NQR Spectroscopy.

Total Lecture Hours : 60

COURSE OUTCOME

The Students will able to

1. Construct electronic configurations and term symbols for atoms and molecule**.**
2. Study of vibrating diatomic molecule, energy levels of diatomic molecule.
3. The ability to investigate and determine the structure of typical inorganic chemical compounds.
4. Make students aware of the fine structure of ESR absorption
5. Understand principles and applications of Mossbauer spectroscopy**.**

TEXTBOOK(S)

1. Banwell.C.N,Elaine.M,.Mc.Cash,July 2017.Fundamentals of molecular spectroscopy, (4th Ed), Mc Graw Hill Education.
2. Drago..R.S. PhysicalMethodsinChemistry,Saunders W.B.Company,Philadelphia,London.
3. Jurgen .H. Gross., 2014, A Text of Mass Spectrometry. 2nd Ed, Springer. USA.
4. Sathya Narayana.Nov 2013.D.N. Introduction to Magnetic Resonance Spectroscopy (ESR, NMR, NQR), 2nd Ed, I K International Publishing house Pvt Ltd.
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1. Cotton .F.A and Wilkinson.G, Carlos A. Murillo and Manfred Bochmann, (March 2021) AdvancedInorganic Chemistry,Wiley-EasternCompany,New Delhi.
2. Ebsworth ,E.A.Vand David W H Rankin Stephen Cradock,Sep 1991. StructuralMethodsinInorganicChemistry,2nd Ed., Blackwell.
3. Helmet Gunzler and Herbert M. Heise. August 2021.IR spectroscopy an introduction, 2nd Ed, Wiley VCH.
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3. https://global.oup.com/ukhe/product/nmr-spectroscopy-in-inorganic-chemistry-9780198794851
4. http://chemistry.du.ac.in/study_material/4101-b/epr%20spectroscopy.pdf
5. https://www.lehigh.edu/~kjs0/carey-13.pdf