MASTER OF SCIENCE
IN
CHEMISTRY

CURRICULUM AND SYLLABUS

(FOR STUDENTS ADMITTED FROM ACADEMIC YEAR 2019-2020 ONWARDS)

UNDER CHOICE BASED CREDIT SYSTEM

DEPARTMENT OF CHEMISTRY

CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)

(Nationally Re-Accredited (III Cycle) with 'A' grade (CGPA-3.41 out of 4) by NAAC)

TIRUCHIRAPPALLI -620 018

M.Sc CHEMISTRY PROGRAMME EDUCATION OBJECTIVE

- Develop firm foundation in distinct area of Chemistry.
- Impart quality education to make the students globally competite chemist by nurturing the needs.
- Inspire to pursue their doctoral research programme in reputed institutions
- Interdisciplinary approach helps in creating innovative ideas for the sustainable development.
- Develop leadership qualities in multi-disciplinary setting through ethical manner.
- Ability to identify and find the solutions to socio-economic environmental problems for the development of the country.

PROGRAMME OUTCOMES

- Curriculum imparts firm foundation in all areas of Chemistry and enhances the skills in problem solving and analytical reasoning.
- Inculcate research interest in emerging areas of chemical sciences and transform it to the benefit of society.
- Ability to use technologies and instrumentation to collect and analyse the data.
- Capable to nurture the needs of R &D laboratories and industries and make them to cope with all the competitive examinations.
- Imbibed ethical, moral and social values in personal life leading to highly cultured and civilized personality.

CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)
M.SC., CHEMISTRY PROGRAMME STRUCTURE
UNDER CHOICE BASED CREDIT SYSTEM
(For the candidates admitted from the academic year 2019-2020)

Sem	Course	Title	Subject code	Inst Hrs/Week	Credit	Exam	Marks		Total
						Hrs	Int	Ext	
I	Core course-I	Organic Chemistry-I	19PCH1CC1	6	6	3	25	75	100
	Core course-II	Inorganic Chemistry-I	19PCH1CC2	6	5	3	25	75	100
	Core course-III	Physical Chemistry-I	19PCH1CC3	6	5	3	25	75	100
	Core Practical-I	Organic Chemistry Practical-I	19PCH1CC1P	6	3	6	40	60	100
	Core Practical-II	Inorganic Chemistry Practical-I	19PCH1CC2P	6	3	6	40	60	100
	Total			**30**	**22**				**500**
II									
	Core Course-IV	Physical Methods in Chemistry-I	19PCH2CC4	6	6	3	25	75	100
	Core Course-V	Organic Chemistry – II	19PCH2CC5	6	5	3	25	75	100
	Core Practical-III	Organic Chemistry Practical-II	19PCH2CC3P	6	3	6	40	60	100
	Core Practical-IV	Inorganic Chemistry Practical-II	19PCH2CC4P	6	3	6	40	60	100
	Elective Course-I	Green Chemistry/ Forensic Chemistry	19PCH2EC1A/ 19PCH2EC1B	6	4	3	25	75	100
	Total			**30**	**21**				**500**

III	Core Course-VI	Physical Chemistry-II	19PCH3CC6	6	6	3	25	75	100
	Core Course-VII	Chemistry for Competitive Examinations	19PCH3CC7	6	5	3	-	100	100
	Core Practical V	Physical Chemistry Practical-I	19PCH3CC5P	6	3	6	40	60	100
	Elective Course-II	Pharmaceutical Chemistry /Bioorganic Chemistry	19PCH3EC2A/ 19PCH3EC2B	6	5	3	25	75	100
	Elective Course-III	Instrumentation techniques/ Intellectual Property Rights	19PCH3EC3A/ 19PCH3EC3B	6	5	3	25	75	100
	Swayam Online Course	Introduction to Polymer Science	*	*	*	*	*	*	*
	Total			**30**	**24**				**500**
IV	Core Course-VIII	Physical Methods in Chemistry-II	19PCH4CC8	6	6	3	25	75	100
	Core Practical-VI	Physical Chemistry Practical-II	19PCH4CC6P	6	3	6	40	60	100
	Elective Course-IV	Industrial Chemistry / Selected Topics in Chemistry	19PCH4EC4A/ 19PCH4EC4B	6	5	3	25	75	100
	Elective Course-V	Chemistry of Nanoscience / Bio fuels	19PCH4EC5A/ 19PCH4EC5B	6	5	3	25	75	100
	Project	Dissertation = 80 Marks Viva = 20 Marks	19PCH4PW	6	4	-			100
	Total			**30**	**23**				**500**
	Grand Total			**120**	**90**				**2000**

Core Papers - 8

Core Practical - 6

Elective Papers - 5

Swayam Online Course

Project - 1

Note :

1. Theory Internal 25 Marks External 75 Marks
2. Practical Internal 40 Marks External 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. 10 marks)
   b) The passing minimum for University Examinations shall be 40% out of 75 marks (i.e. 30 marks)
   c) The passing minimum not less than 40% in the aggregate.

Subject Code		Category	L	T	P	Credit
19PCH1CC1	Organic Chemistry-I	Core	90			6

Preamble

This course covers the basic concepts of aromaticity and stereochemistry of various organic molecules. It also includes the ideas of nucleophilic and electrophilic substitution reactions and makes to learn about the oxidizing and reducing reagents for organic synthesis.

Course Outcomes

On successful completion of the course, the student will be able to

CO	CO Statement	Knowledge level
CO 1	Classify different types of concerted reactions inorganic chemistry and orbital correlation approaches	K2
CO 2	Identify the stereocentres in a molecule and assign the configuration as R or S	K3
CO 3	Distinguish between aromatic, anti aromatic and non aromatic compounds by their structure.	K4
CO 4	Discuss the relative stability of conformational isomers of cyclohexanes,decalins and norboranes	K6
CO 5	Predict the mechanism for nucleophile substitution reaction, oxidation and reduction reactions	K6

Mapping with Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**M**	**M**	**L**	**S**
CO2	**S**	**S**	**M**	**L**	**S**
CO3	**S**	**M**	**S**	**S**	**S**
CO4	**S**	**M**	**M**	**M**	**S**
CO5	**S**	**S**	**S**	**S**	**S**

S-Strong; M-Medium

ORGANIC CHEMISTRY-I

UNIT I ELECTRONIC EFFECTS AND AROMATICITY (18 Hrs)

Electronic Effects - inductive, resonance and hyper conjugative effects and their influence - rules of resonance – tautomerism - steric effects. Aromatic character: Huckel's theory of aromaticity: three, four-, five-, six-, seven-, and eight-membered rings – other systems with aromatic sextet -concept of homo-aromaticity and anti-aromaticity - Craig's rule and its applications. Consequences of aromaticity – non-alteration in bond length- Resonance energy from heat of hydrogenation, heat of combustion and Huckel's MO calculation. Electron occupancy in MO's and aromaticity –NMR concept of aromaticity and anti aromaticity - diatropic and paratropic compounds

UNIT II STEREOCHEMISTRY AND CONFORMATIONAL ANALYSIS (18 Hrs)

Stereoisomerism – principles of symmetry - enantiomers and diastereomers – R, S and E, Z and erythro, threo nomenclature – optical activity and chirality – types of molecules exhibiting optical activity – absolute configuration – chirality in molecules with non carbon stereo centers (N, S and P) – molecules with more than one chiral centre. Stereochemistry of molecules with axial chirality.Biphenyls, allenes, spiranes and analogues -concept of atropisomerism - Helicity and chirality - Topocity and prostereoisomerism - topocity of ligands and faces - enantiotropic ligands and faces - diastereotopic ligands and faces - Resolution – methods of Resolution. Conformations of mono and disubstituted three-, four-, five and six- membered ring systems and their optical activity - conformations of decalin. Quantitative correlation between conformation and reactivity –WinsteinEliel equation and Curtin-Hammett principle.

UNITIII ALIPHATIC NUCLEOPHILIC & ELECTROPHILIC SUBSTITUTION (18 Hrs)

Aliphatic electrophilic substitution: SE1 and SE2 and SEi mechanisms – effect of substrate structure, leaving group, attacking nucleophile and solvent polarity - selected reactions - migration of double bonds - halogenation of aldehydes and ketones - Stork-Enamine reaction - decarboxylation of aliphatic acids – Haloform reaction.Aliphatic nucleophilic substitution – mechanisms – SN1, SN2, SNi – ion-pair mechanisms – neighbouring group participation, nonclassical Carbocations – substitutions at allylic and vinylic carbons. Reactivity – effect of

structure, nucleophilic, leaving group and stereo chemical factors – correlation of structure with reactivity – solvent effects- Von-Braun Reaction.Claisen and Deickmann condensation.

UNIT IV PERICYCLIC REACTIONS (18 Hrs)

Concerted reactions – orbital symmetry and concerted symmetry – Woodward and Hoffmann rules – selection rules for electrolytic 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 Claisen rearrangements – 1,3-dipolar cycloaddition reactions: types of dipoles, selectivity, scope and applications.

UNIT V REAGENTS IN ORGANIC SYNTHESIS (18 Hrs)

Oxidation: Baeyer-Villiger, Jacobsen epoxidation, Shi epoxidation, Jones reagent, PCC, PDC, IBX, DMP, CAN, TPAP, NOCl, $Mn(OAc)_3$, Cu(OAC)2, Bi_2O_3,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. Hydride transfer reagents from group III and group IV in reductions. Triacetoxyborohydride, L-selectride, K-selectride, Luche reduction, Red-Al,NaBH4 and NaCNBH3, trialkylsilanes and trialkylstannane, stereo/enantioselectivity reductions (Chiral Boranes, Corey-Bakshi-Shibata).

Text Books

S.No.	Author's Name	Year of Publication	Title of the Book	PublisherName
1.	Mukherji,S.M Singh.S.P	2015	Reaction Mechanism In Organic Chemistry (Revised Edition)	Trinity ; New Delhi
2.	Kalsi.P.S	1993	Stereochemistry	Wiley eastern limited; New Delhi

3.	Bansal.R.K	1975	Organic Reaction Mechanisms	Tata McGraw Hill.
4.	Jagdambasingh	2016	Organic synthesis	PragatiPrakashan

Reference Books

S.No.	Author's Name	Year of Publication	Title of the Book	Publishers Name
1.	Marchand Smith.M.B	2013	March's Advanced Organic chemistry Reactions, Mechanisms and Structure, 7^{th} edition.	Wiley, New York.
2.	Finar.I.R	2009	Organic Chemistry Vol.II 7^{th} edition.	Pearson, New Delhi
3.	Nasipuri.D	2002	Stereochemistry of organic compounds Principles and applications, 2^{nd}Edition.	New Age International
4.	Lowry.T.H.E and Richardson.K.S	1997	Mechanism and Theory in Organic chemistry; 3^{rd}edition.	Benjamin -Cummings Publishing, USA.
5.	Carey.FA and Sundberg.R.J	2007	Advanced Organic chemistry Part A and B; 5^{th} edition.	Springer, Germany

Pedagogy

E-content, Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion, Video/ Animation.

Course Designer

- **Mrs.A.Sharmila**,Assistant Professor, Department of Chemistry
- **Mrs.P.Pungayee Alias Amirtham**, Assistant Professor and Head, Department of Chemistry.

Subject Code 19PCH1CC2	Inorganic Chemistry-I	Category	L	T	P	Credit
		Core	90			5

Preamble

This course effectuates the advanced concepts in boron and sulphur chemistry, co-ordination chemistry and helps in identifying the mechanism of coordination reactions, and explains the basics of supramolecular chemistry and photochemistry.

Course outcomes

On the successful completion of the course, students will be able to

CO	CO Statement	Knowledge level
CO 1	Identify the chemistry of p-block Clusters	K3
CO 2	Apply the basic concepts co-ordination compounds.	K3
CO 3	Analyse the mechanism of coordination reactions.	K4
CO 4	Compare the standards of supramolecular chemistry and cationic hosts.	K5
CO 5	Explain the chemistry of photochemical reactions	K5

Mapping with Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**M**	**M**	**L**	**S**
CO2	**S**	**S**	**M**	**L**	**S**
CO3	**S**	**M**	**S**	**S**	**S**
CO4	**S**	**M**	**M**	**M**	**S**
CO5	**S**	**S**	**S**	**S**	**S**

S-Strong; M-Medium

INORGANIC CHEMISTRY- I

UNIT I CLUSTERS AND POLYNUCLEAR COMPOUNDS (18 Hrs)

Introduction- Clusters of the p-block elements, Clusters of p-block Elements in a Ligand Shell:Boron Hydrides, Clusters in a Ligand Shell of the Heavier Elements of Group 13 and 14, Bare Clusters of p-block Elements.Clusters of d-block elements, Low-valent Metal Clusters, Metal Carbonyl Clusters, Low-valent Metal Clusters Stabilized by Other $\sigma-\pi$ Ligands, Clusters of Late Transition Metals Stabilized by Phosphines: The Thin Border Between Clusters and Colloids High-valent Metal Clusters, Halide Clusters of Early Transition Metals.

UNIT IIPRINCIPLES OF COORDINATION CHEMISTRY (18 Hrs)

Studies of coordination compounds in solution – detection of complex formation in solution – stability constants – stepwise and overall formation constants.Simple methods (potentiometric, pH metric and photometric methods of determination).Factors affecting stability – statistical and chelate effects – forced configurations.

UNIT III REACTION MECHANISM IN COORDINATION COMPLEXES (18 Hrs)

Kinetics and mechanism of reactions in solution – labile and inert complexes – ligand displacement reactions in octahedral and square planar complexes – acid hydrolysis, base hydrolysis and anation reactions.Trans effect – theory and applications – electron transfer reactions – electron exchange reactions – complementary and non-complementary types – inner sphere and outer sphere processes – application of electron transfer reactions in inorganic complexes – isomerisation and racemisation reactions of complexes. Molecular rearrangements of four- and six-coordinate complexes – interconversion of stereoisomers – reactions of coordinated ligands – template effect and its applications for the synthesis of macrocyclic ligands – unique properties.

UNIT IV CONCEPTS OF SUPRAMOLECULAR CHEMISTRY (18 Hrs)

Terms, Nature of supramolecular interactions, Host-guest interaction, Molecular recognition, Types of recognition, Self-assembly. Cation-binding Hosts: Concepts, Cation receptors, Crown ethers, Cryptands, Spherands, Calixarens, Selectivity of cation complexation, Macrocyclic and template effects.

UNIT V INORGANIC PHOTOCHEMISTRY (18 Hrs)

Fundamental concepts- Electronic transitions in metal complexes, metal-centered and charge-transfer transitions – various photophysical and photochemical processes of coordination compounds. Unimolecular chargetransfer photochemistry of cobalt(III) complexes – mechanism of CTTM, photoreduction – ligandfield photochemistry of chromium(III) complexes – 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.

Text Books

S.No.	Author's Name	Year of Publication	Title of the Book	Publisher Name
1.	Earnshaw.A Greenwood. N	1997	Chemistry of the elements	Butterworth-Heinemann,
2.	Shriver.D.F.Kaesz. H.D.Adams. R. D	1989	The Chemistry of Metal Cluster Complexes	VCH, Weinheim,
3.	Puri. B.R. Sharma L. R. Day M. C., and SelbinJ..	2012	Theoretical Inorganic Chemistry	Sisler, Literary Licensing (LLC), Montana.
4.	Cotton F. A. and Wilkinson, G. Murillo C. A. and Bochmann M.	1999	Advanced Inorganic Chemistry	6th Ed., A Wiley - Interscience Publications, John Wiley and Sons, USA.
5.	Huheey J. E.	2006	Inorganic Chemistry	4th Ed.,Harper and Row publisher, Singapore.
6.	Adamson A. W.	1975	Concept of Inorganic Photochemistry	John Wiley and Sons, New York.

7.	Kettle S. F. A.	1996	Physical Inorganic Chemistry – A CoordinationChemistry approach, Spectrum	Academic Publishers, Oxford University Press, New York,.
8.	Adamson W. and Fleischaue P. D.	1984	Concepts of Inorganic photochemistry;	R. E. Krieger Pubs, Florida,

Reference Books

S.No.	Author's Name	Year of Publication	Title of the Book	Publisher Name
1.	Lee J.D.	2000	Concise Inorganic Chemistry	20th revised edition Sultan Chand & Sons
2.	Gurdeep Raj. J	2000	Advanced Inorganic Chemistry	20th revised edition Sultan Chand & Sons
3.	Ferraudi. J.	1988	Elements of Inorganic Photochemistry	Wiley, New York
4.	Basolo and Pearson R. G.	1967	Mechanism of Inorganic Reactions	2nd Ed., John Wiley, New York
5.	Sharma R. K.,	2007	Inorganic Reactions Mechanism	Discovery Publishing House, New Delhi.

Pedagogy

Chalk and Talk, power point Presentation, group discussion, seminar, Interaction, problem solving.

Course Designer

- **Dr. K. Shenbagam**, Assistant Professor, Department of Chemistry.
- **Dr.C.Rajarajeswari**, Assistant Professor, Department of Chemistry.

Subject Code 19PCH1CC3	Physical Chemistry -I	Category	L	T	P	Credit
		Core	90			5

Preamble

To grasp the concepts of group theory, quantum chemistry, fast reaction techniques and partition functions.

Course outcomes

On successful completion of the course, the student will be able to

CO	CO statement	Knowledge Level
CO1	Explain the kinetics of reactions in solution and fast reaction techniques.	K2
CO2	Apply the fundamental concepts of quantum chemistry to describe different electron correlation models.	K3
CO3	Examine the symmetry elements and symmetry operation.	K4
CO4	Differentiate the ionic and electrodic part of electrochemicalreactions and their applications.	K4
CO5	Evaluate thermodynamic probability and partition functions using statistical thermodynamics.	K5

Mapping with program outcomes

CO	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**S**	**S**	**S**
CO2	**S**	**M**	**M**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**M**	**M**	**S**	**S**
CO5	**S**	**M**	**M**	**S**	**S**

S- Strong; M-Medium

PHYSICAL CHEMISTRY-I

UNIT I QUANTUM CHEMISTRY – I (18 Hrs)

Schrodinger wave equation– eigen functions and eigen values normalization and orthogonalityprinciple of superposition postulates of quantum mechanics - particle in a box, the harmonic oscillator, the rigid rotor. Hydrogen atom. Electronic configuration, Russell – Saunders terms and coupling schemes, Slater – Condon parameters, term symbol for pn configuration, dn configuration, magnetic effects: spin – orbit coupling and Zeeman splitting, introduction to the methods of self – consistent field. Virial theorem - Huckel theory of conjugated systems, bond order and charge density calculations, Application to ethylene, butadiene, cyclobutadiene.Extended Huckel theory.

UNIT II GROUP THEORY (18 Hrs)

Symmetry elements and symmetry operations-Definitions of group, subgroups, Abelian group - isomorphic group, Properties, relation between orders of a finite group and its subgroup. Conjugation relation and classes. Similarity transformation and classes –group multiplication tables. Symmetry classification of molecules into group (Schoenflies symbol only) difference between point group and space group. Character table and its uses. Determination of characters and irreducible representation of C_2V and C_3V point group.

UNIT III CHEMICAL KINETICS (18 Hrs)

Theories of reaction rates – Arrhenius theory, Hard sphere collision theory and transition state theory of reaction rates– Comparison of collision theory and activated complex theory-Lindemann and Hinshelwood theories of unimolecular reaction rates. Reactions in solutions – comparison between gas phase and solution reactions – influence of solvent, ionic strength, and pressure on reactions in solution – Kinetic isotope effects. Kinetics of complex reactions – reversible reactions, consecutive reactions – Parallel reactions and Chain reactions –Rice Herzfeld mechanism – explosion limits. Relaxation methods-temperature and pressure jump methods - Stopped flow technique, flash photolysis and Crossed molecular beam method.

UNIT IV ELECTROCHEMISTRY –I (18 Hrs)

Electrochemical cells- types of electrodes, Electrochemical series and its applications.Thermodynamics of reversible cells and reversible electrodes, EMF of concentration cells withand without transference, liquid junction potential, applications of EMF measurementsand Fuelcells. Polarisation– Electrolytic polarization, Dissolution and Deposition potentials,Determination of anode and cathode potential, Evidence for existence of concentrationpolarization, poloarographic cell Assembly, Ilkovic equation, Fick's law of diffusion, Half waveotential, Applications of polarography.

UNIT V STATISTICAL THERMODYNAMICS (18 Hrs)

Calculation of thermodynamic probability of a system-Difference between thermodynamic and statistical probability-Ensembles, phase space-ergodic hypothesis. Definition of micro and macro states-different methods of counting macro states distinguishable and indistinguishable particles, classical statistics-derivation of Maxwell-Boltzmann distribution law. Physical significances of translational, rotational, vibrational, Electronic partition functions - application to mono atomic and diatomic molecules.Quantum statistics-Bose-Einstein and Fermi-Dirac distribution equationscomparison of B.E and F.D statistics.

Text Books

S.No	Author's Name	Year of Publication	Title of the Book	Publisher Name
1.	Chandra.A.K	1994	Introductory Quantum Chemistry	Tata Mecraw Hill, New Delhi
2.	Albert Cotton.F	2003	Chemical applications of Group Theory	John Wiley & Sons, Singapore
3.	Laidler.K.J	1975	Chemical Kinetics	Tata Mecraw Hill, New Delhi
4.	Rajaram.J& Kuriacose.J.C	1986	Thermodynamics for students of chemistry	ShobanLalNagin Chand

Reference Books

S.No	Author's Name	Year of Publication	Title of the Book	Publisher Name
1.	Atkins.P.W	1973	Molecular Quantum mechanics	Clarendon press New York
2.	Prasad.R.K	1997	Quantum Chemistry	New Age International
3.	Raman.K.V	1993	Group Theory and its Application to	Tata McGraw Hill
4.	Gupta.M.C	2003	Statistical Thermodynamics	Wiley Eastern
5.	Frost.A.A&Pearson.R.G	1986	Kinetics and Mechanism	John Wiley & Sons, New York

Pedagogy

Lecture, E-content, Assignment, Quiz, Seminar and Group discussion

Course Designer

- **Dr.V.Sangu**, Assistant Professor, Department of Chemistry.
- **Mrs.P.Thamizhini**, Assistant Professor, Department of Chemistry

Subject Code 19PCH1CC1P	Organic Chemistry Practical -I	Category	L	T	P	Credit
		Core	90			3

Preamble

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

Course outcomes

On successful completion of the course, the student will be able to

CO	CO STATEMENT	Knowledge Level
CO1	Apply the principles of separation in organic mixtures.	K3
CO2	Prepare the organic compounds by single stage method.	K3
CO3	Analyze the physical constant containing two components.	K4

Mapping with program outcomes

CO	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**M**	**S**	**M**
CO2	**S**	**M**	**M**	**S**	**M**
CO3	**S**	**S**	**S**	**S**	**S**

S- Strong; M-Medium

ORGANIC CHEMISTRY PRACTICAL – I

I QUALITATIVE ANALYSIS OF AN ORGANIC MIXTURE CONTAINING TWO COMPONENTS

Mixtures containing two components are to be separated (pilot separation) and purified (bulk separation).

II PREPARATION OF ORGANIC COMPOUNDS (SINGLE STAGE)

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

Text Books

S.No.	Author's Name	Year of Publication	Title of the Book	Publisher Name
1.	Mohan .J	2003	Organic AnalyticalChemistry: Theory andPractice	Narosa
2.	Ahluwalia .V.K Bhagat.PandAgarwal .R	2005	Laboratory Techniques in Organic Chemistry	I. K. International
3.	Gnanaprakasam, N.S and Ramamurthy.G	1987	Organic Chemistry LabManual	S.V.Printers
4.	Vogel.A.ITatchell. A.RFurniss B.SHannaford .A.J and SmithP.W.G	1989	Vogel's Textbook ofPractical OrganicChemistry	5th Ed., Prentice Hall

Course Designer

- **Mrs.P.Pungayee** A**lias Amirtham,**Assistant Professor and Head, Department of Chemistry
- **Dr.V.Sangu**, Assistant Professor , Department of Chemistry

Subject Code 19PCH1CC2P	Inorganic Chemistry Practical -I	Category	L	T	P	Credit
		Core	90			3

Preamble

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

Course outcomes

On successful completion of the course, the student will be able to

CO	CO statement	Knowledge Level
CO1	Identify the common and less common cations present in the mixture.	K1
CO2	Classify the group elements present in the mixture.	K2
CO3	Estimation of metal ions quantitative by photoelectric colorimeter.	K3

Mapping with Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**M**	**M**	**S**
CO2	**S**	**M**	**S**	**M**	**S**
CO3	**M**	**S**	**M**	**S**	**M**

S- Strong; M-Medium

INORGANIC CHEMISTRY PRACTICAL-I

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

Text Books

S.No	Author's Name	Year of Publication	Title of the Book	Publisher Name
1.	Vogel.A.I	2000	Text Book of Quantitative Inorganic Analysis	Longman
2.	RamanujamV.V	1988	Inorganic Semimicro Qualitative Analysis	National Pubs
3.	Svehla.G	1987	Text Book of Macro and Semimicro Qualitative Inorganic analysis	Longman

Course Designer

- **Dr.C.Rajarajeswari,** Assistant Professor, Department of Chemistry
- **Dr.K.Shenbagam**, **,** Assistant Professor, Department of Chemistry

Subject code 19PCH2CC4	Physical Methods In Chemistry -I	Category	L	T	P	Credit
		Core	90			5

Preamble

To enable the students to understand the fundamentals concepts of X-ray, neutron diffraction, UV, IR, NMR, ESR and Mass spectral technique to deduce the structure and to predict the conformation of the molecules using ORD and CD analysis.

Course Outcomes

On successful completion of the course, the student will be able to

CO	CO statement	Knowledge Level
CO1	Identify the fingerprint region of molecules in gas and solution phases using microwave and vibration spectroscopy.	K3
CO2	Examine the proton and ^{13}C NMR spectra of molecules	K4
CO3	Deduce the structure of molecules using UV and IR absorption pattern	K5
CO4	Evaluate the absolute configuration of organic compound using ORD and CD.	K5
CO5	Formulate the structure of compound from molecular spectral data.	K6

Mapping with programme outcomes

COS	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**M**	**M**	**S**	**S**
CO2	**S**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**M**	**S**
CO5	**S**	**S**	**S**	**S**	**S**

S- Strong; M-Medium

PHYSICAL METHODS IN CHEMISTRY-I

UNIT I FOUNDATIONS OF SPECTROSCOPIC TECHNIQUES (18 Hrs)

Fundamentals of interaction of Electromagnetic radiation with matter, spectral transitions.Resolving power.Microwave spectroscopy – rotational spectra of diatomic molecules, the spectrum of non-rigid rotator, effect of isotopic substitutions, rotational spectra of linear and symmetric top polyatomic molecules. Vibrational spectra and Vibrational – Rotational Spectra: vibrating diatomic molecule; simple harmonic vibrations, anharmonicity of vibrations, the diatomic vibrating rotator, the interaction of rotations and vibrations, the vibrations of polyatomic molecules, analysis by infrared technique. Raman spectra – rotational Raman spectra of linear and symmetric top molecules – vibrational Raman spectra – rotational fine structure – electronic spectra of diatomic molecules – vibrational coarse structure – intensity of vibrational lines in electronic spectra – rotational fine structure – fortrat diagram.

UNIT II NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY (18 Hrs)

NMR spectroscopy : interaction between nuclear spin and applied magnetic field, nuclear energy levels, population of energy levels, Larmor precession, relaxation methods, chemical shift, representation, examples of AB, AX and AMX types, exchange phenomenon, factors influencing coupling, Karplus relationship. Simplification of complex spectra – double resonance techniques, shifts reagents – chemical spin decoupling of rapidly exchangeable protons (OH, SH, COOH, NH, NH2) – an elementary treatment of NOE phenomenon. ^{13}C NMR Spectroscopy – broad band decoupling – off resonance decoupling – chemical shifts of common functional groups – FT NMR and its importance– DEPT spectra – identification of small compounds based on NMR data – 2D techniques: ^{1}H–^{1}H COSY, ^{1}H–^{13}C HETCOSY – NOESY.

UNIT III UV-VISIBLE AND IR SPECTROSCOPY (18 Hrs)

UV-Visible spectroscopy – introduction – instrumentation, sampling techniques – Woodward-Fieser and Scott's rules for conjugated dienes and polymers, ketones, aldehydes, α,β-unsaturated acids, esters, nitriles, and amides – differentiation of geometrical isomers and positional isomers, disubsitituted benzene derivatives – study of steric effect in aromaticity. Infrared spectroscopy – Introduction – instrumentation, sampling techniques – factors influencing group frequencies – quantitative studies – hydrogen bonding (intermolecular and intramolecular).

UNIT IV ESR, ORD AND MASS TECHNIQUES (18 Hrs)

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. Principles – Measurement techniques (EI, CI, FD FAB, SIMS) – Presentation of spectra data – molecular ions – isotope ions – fragment ions of odd and even electron types – rearrangement ions – factors affecting fragmentation patterns – Mc Lafferty rearrangement. – Nitrogen rule.

UNIT V X-RAY DIFFRACTION&SPECTROSCOPIC PROBLEMS (18 Hrs)

X-Ray diffraction by single crystal method – space groups – systematic absences in X-ray data and identification of lattice types, glide planes and screw axes – X-ray intensities – structure factor and its relation to intensity and electron density – 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. Application of UV, IR, NMR and Mass spectroscopy – structural elucidation of organic compounds.

Text Books

S.No.	Author's Name	Year of Publication	Title of the book	Publisher Name
1.	Banwell.C.N	1994	Fundamentals of Molecular spectroscopy	McGraw Hill Education, Noida
2.	Barrow.G.M	1964	Introduction to Molecular Spectroscopy	McGraw Hill, New York
3.	Silverstein.P.M and Western.F.X	2014	Spectroscopic Identification of Organic Compounds;	John Wiley, New York

4.	Kalsi.P.S	2004	Spectroscopy of Organic Compounds	New Age International Publishers, New Delhi
5.	Clegg.w	1998	Structure Crystal Determination	Oxford University press, UK

Reference Books

S.NO	Author's Name	Year of Publication	Title of the Book	Publisher Name
1.	Ghosh.P.K	1989	Introduction to Photoelectron Spectroscopy	John Wiley, New York
2.	Sharma.Y.R	1992	Elementary Organic Spectroscopy – Principles and Chemical applications	S. Chand, New Delhi
3.	Silverstein.P.M and Western.F.X	2014	Spectroscopic Identification of Organic Compounds	John Wiley, New York
4.	Kaur.K	2014	Spectroscopy	PragatiPrakashan Educational Publisher
5.	Web Pages: Cambridge Structural Database (CSD)- http://www.ccdc.cam.ac.uk/products/csd/Protein Data Bank (PDB)			

Pedagogy

Lecture, E-content, Assignment, Quiz, Seminar and Group discussion

Course Designer

- **Dr.V.Sangu**, Assistant professor, Department of Chemistry
- **Mrs.P.Thamizhini**, Assistant professor, Department of Chemistry

Subject Code 19PCH2CC5	Organic Chemistry – II	Category	L	T	P	Credit
		Core	90			5

Preamble

Enable the students to acquire surplus knowledge about the addition, elimination mechanism, and the chemistry behind the photolytic reactions. Guide the students to know the role of natural products and heterocyclic compounds in drug development.

Course Outcomes

On the successful completion of the course, students will be able to

CO	CO Statement	Knowledge Level
CO1	Outline the synthesis and reactivity of aromatic and non aromatic heterocycles	K2
CO2	Classify the different types of photochemical reactions	K4
CO3	Distinguish between addition and elimination reactions.	K4
CO4	Importance of Hmmette and Taft equation in structure reactivity	K5
CO5	Perceive the mechanism involved in aromatic nucleophilic, electrophilic and photolytic reactions	K5

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**S**	**S**	**S**
CO2	**S**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**M**
CO4	**S**	**M**	**S**	**S**	**M**
CO5	**S**	**S**	**S**	**S**	**S**

S- Strong; M-Medium

ORGANIC CHEMISTRY – II

UNIT I AROMATIC NUCLEOPHILIC & ELECTROPHILIC SUBSTITUTION (18 Hrs)

SN1, SNAr, Benzyne mechanism, reactivity orientation, Ullmann, Sandmeyer and Chichibabin reaction, Steven's – Sommelet Hauser and Von Richter Rearrangements. Aromatic electrophilic substitution – orientation, reactivity and mechanism based on transition state theory with suitable reactions – substitution in thiophene, pyridine – N-oxide – substituent effect- Hammett equation- principle of Hammett correlation, effect of structure on reaction mechanism, Hammett parameters – σ and ρ, modified Hammett equation, Taft equation.

UNIT II ADDITION AND ELIMINATION (18 Hrs)

Addition to carbon-carbon multiple bonds : electrophile, nucleophile and free radical addition - Addition to carbonyl and conjugated carbonyl system- mechanisms- Knoevenogel, Stobbe, Darzen'sglycidic ester condensation and Reformatsky reaction.- Elimination reaction- Mechanism of E1, E2, E1CB , stereochemistry - Hoffmann's and Zaitsev's rules. Pyrolytic - Cis-Elimination, Chugaev reaction, Hoffmann exhaustive methylation, Cope, Bredt's rule – Cis and Trans elimination.

UNIT III ORGANIC PHOTOCHEMISTRY (18Hrs)

Photochemistry- fundamental concepts–energy transfer- characteristic of photoreaction- photoreduction and photo-oxidation, photosensitization, Classification of photoreactions of Ketones and enones- Norrish type I and II – PaternoBuchi reaction- Photo- Fries rearrangement – Photochemistry of alkenes, dienes and aromatic compounds – Zimmerman's Di-pi – methane rearrangement. Reaction of unactivated centres- Photochemistry of □,□ - unsaturated carbonyl compounds- Photolytic cycloadditions and Photolytic rearrangements- Photo-addition – Barton Reaction.

UNITIV HETEROCYCLES (18 Hrs)

Nomenclature – Synthesis and reactivity of aromatic heterocycles – pyrazole –isothiazole – triazole – pyrimidine –purines –triazines- pyridazines –pyrazines. Synthesis and reactivity of non-aromatic heterocycles – tetrahydro furan, pyrrolidine – tetrahydropyrans –piperidine, oxirane –thiiranes –azzetidine –oxetane –oxazole –imidazole –isooxazole, Synthesis and reactivity of bicyclic ring compounds: Isoindoles and indolizines.

UNIT V NATURAL PRODUCTS (18 Hrs)

Alkaloids – Biosynthesis of nicotine, corey's synthesis of epibatidine – Comin's synthesis of camptothecin and Woodward's synthesis of reserpine. Terpenoids – biosynthesis of menthol, camphor, Takasago synthesis of menthol, Corey's synthesis of longifolene, Curran's synthesis of hirsutene. Steroids – classification, function – synthesis of androsterone and testosterone from cholesterol, Johnson's synthesis of progesterone and Vollhardt's synthesis of estrone.

Text Books

S.No.	Author'sName	Year of Publication	Title of the Book	PublisherName
1.	Pine S.H, Hendrickson J B, Cram And Hammond	1980	Organic Chemistry	McGraw Hill .
2.	March J, Smith M.B	2007	Advanced organic Chemistry, Reactions, mechanisms and structure	Wiley
3.	Carey F A and Sundberg R J	2007	Advanced organic Chemistry, Part A and Part B	Springer
4.	Bansal R K	1990	Reaction mechanism in Organic Chemistry	Tata McGraw Hill
5.	Finar I L	2009	Organic Chemistry	Pearson Education Ltd.,

Reference Books

S.No	Author name	Yearof publication	Title of the book	Publishers name
1.	Peter sykes	2009	A guide book to mechanism in organic Chemistry	Pearson Education
2.	Raj K Bansal	2017	Heterocyclic Chemistry	New Age International Publishers
3.	Joule J, Mills K	2010	Heterocyclic Chemistry	Wiley
4.	Agarwal O P	2006	Natural Products Volume I and Volume II	Krishna Prakasan Media

Pedagogy

E-content, Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion, Video / Animation

Course Designer

- **Mrs. P.Pungayee Alias Amirtham,**Assistant Professor and Head, Department of Chemistry
- **Mrs. A.Sharmila,** Assistant Professor, Department of Chemistry.

Subject Code 19PCH2CC3P	Organic Chemistry Practical II	Category	L	T	P	Credit
		Core	90			3

Preamble

Enable the student to carry out the qualitative analysis of an organic mixture and to perform the preparation of organic compounds.

Course outcomes

On successful completion of the course, the student will be able to

CO	CO Statement	Knowledge Level
CO1	Explain the estimation and preparation of organic compounds.	K2
CO2	Apply the methods to analyze data, and interpret results, while observing responsible and ethical scientific conduct.	K3
CO3	Analyze quantitatively organic components in the environment by hands-on experience with modern instrumentation	K4

Mapping with program outcomes

CO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	S	M	S
CO3	S	S	S	M	S

S- Strong; M-Medium

ORGANIC CHEMISTRY PRACTICAL II

1. QUANTITATIVE ANALYSIS OF ORGANIC COMPOUNDS

Estimation of phenol, aniline, ketone, glucose, nitrobenzene and iodine value of oil.

2. PREPARATION OF ORGANIC COMPOUNDS (DOUBLE STAGE)

a. p-Bromoacetanilide from aniline (acetylation and bromination)
b. Acetylsalicylic acid from methyl salicylate (hydrolysis and acetylation)
c. 1,3,5-Tribromobenzene from aniline (bromination, diazotization and hydrolysis)
d. p-Nitroaniline from acetanilide (nitration and hydrolysis)
e. Benzilic acid from benzoin (rearrangement)
f. p-Aminobenzoic acid from p-nitrotoluene (oxidation and reduction)
g. Benzanilide from benzophenone (rearrangement)
h. p-Bromoaniline from acetanilide (bromination and hydrolysis)
i. m-Nitroaniline from nitrobenzene (nitration and reduction)
j. 1,2,4-Triacetoxy benzene from hydroquinone (oxidation and acylation)

Text Books

S.No.	Author Name	Year of Publication	Title of the book	Publisher Name
1.	Mohan.J	2003	Organic Analytical Chemistry- Theory and Practice	Narosa
2.	Ahluwalia.V.K, Bhagat.P and Agarwal.R	2005	Laboratory Techniques in Organic Chemistry	I. K. Internationa
3.	Gnanaprakasam.N.S and Ramamurthy.G	1989	Vogel's Textbook of Practical Organic Chemistry	Prentice Hall

Course Designer

- **Dr.V.Sangu**, Assistant Professor, Department of Chemistry.
- **Mrs. P.Pungayee Alias Amirtham,** Assistant Professor and Head, Department of Chemistry

Subject Code 19PCH2CC4P	Inorganic Chemistry Practical-II	Category	L	T	P	Credit
		Core	90			3

Preamble

To carry out the titrimetric and gravimetric analyses of Cu, Ni, Zn and Fe and also to perform the preparation of inorganic complexes.

Course Outcomes

CO	CO Statements	Knowledge Level
CO1	Apply the principles for the separation of cations.	K3
CO2	Prepare the inorganic complexes.	K3
CO3	Estimation of metal ions by volumetric and gravimetric methods.	K5

Mapping with Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**M**	**M**	**S**
CO2	**S**	**M**	**S**	**M**	**S**
CO3	**M**	**S**	**M**	**S**	**M**

S- Strong; M-Medium

INORGANIC CHEMISTRY PRACTICAL-II

1. TITRIMETRY AND GRAVIMETRY

A mixture of solution(s) should be given for estimation

Cu (V) and Ni (G)

Cu (V) and Zn (G)

Fe (V) and Zn (G)

Fe (V) and Ni (G)

Zn (C) and Cu (G)

2. PREPARATION OF COMPLEXES

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

Text Book

S.No.	Author's Name	Year of Publication	Title of the Book	Publication Name
1	Vogel A. I	2000	Text Book of Quantitative Inorganic Analysis; 6th Ed	Longman, New Delhi,

Course Designer

- **Dr.C.Rajarajeswari,** Assistant Professor, Department of Chemistry
- **Dr.K.Shenbagam**, **,** Assistant Professor, Department of Chemistry

Subject Code 19PCH2EC1A	Green Chemistry	Category	L	T	P	Credit
		Elective	90			5

Preamble

This course introduces twelve basic principles of green chemistry. It also categorise the concepts of organic synthesis in green solvents, solid state and phase transfer catalyst.

Course Outcomes

On successful completion of this course, the student will be able to

CO	CO Statements	Knowledge Level
CO1	Explain the basic principles of green chemistry and planning a green synthesis of the reactions	K2
CO2	Apply the green technology in organic synthesis.	K3
CO3	Categorize the organic synthesis in solid state reactions.	K4
CO4	Importance of various types of green solvents in organic synthesis.	K5
CO5	Plan the method of preparation of phase transfer catalyst conditions	K6

Mapping with Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**M**	**M**	**S**
CO2	**S**	**M**	**S**	**M**	**S**
CO3	**M**	**S**	**M**	**S**	**M**
CO4	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**M**	**S**	**S**

S- Strong; M-Medium

GREEN CHEMISTRY

UNIT I INTRODUCTION TO GREEN CHEMISTRY (18Hrs)

Introduction- Need of green chemistry- twelve principles of green chemistry. Planning a green synthesis- percentage atom utilization-Evaluating the type of the reaction involved Selection of appropriate solvents-selection of starting materials- use of catalyst. International organisations promoting green chemistry

UNIT II ORGANIC SYNTHESIS IN GREEN SOLVENTS (18Hrs)

Reactions in water: Pericyclic reactions- Claisen rearrangement- Aldol condensation, Reactions in super critical carbon dioxide(SC-CO_2): Diels-Alder reaction-Kolbe-schmitt- polymerizationreactions.Reaction in ionic liquids: Knoevenagel reactions-Michael addition, Heck reaction.

UNIT III ORGANIC SYNTHESIS IN SOLID STATE (18Hrs)

Solid state reactions: Baeyer-Villiger oxidation – Grignard reaction hydrohalogenation. Reformatsky reaction in solid state- Wittig reactions in solid phase- dehydration of alcohol to alkenes. Dieckmann condensation in solid state-Michael addition- applications.

UNIT IV ALTERNATE ENERGY PROCESSES IN CHEMICAL SYNTHESIS (18Hrs)

Microwavereaction**:** Baylis –Hillman reaction- Esterification- Hofmann elimination.Sonication reaction: Strecker synthesis- Ulmann coupling reaction- Wurtz reaction, Photo chemical reaction: Paterno-buchi reaction- Barton reaction-applications, Ultrasound assisted organic synthesis-homogenous and heterogeneous reactions.

UNIT V PHASE TRANSFER CATALYSTS (18Hrs)

Phase transfer reaction- Mechanism of phase transfer reaction. Types and advantages of phase transfer catalyst- Baker –Venkataraman rearrangement. Phase transfer catalysed Williamson ether synthesis- Darzen reaction- Heck reaction –Wittig reaction under PTC condition.

Text books:

S.No	Author Name	Year of Publication	Title of the Book	Publishers Name
1.	Ahluwalia, V. K. and Kidwai, M.	2004	New trends in green chemistry	Anamaya Publishers, New Delhi.
2.	Ahluwalia, V. K.	2016	Green Chemistry, 2nd Ed.,	Ane Books Pvt Ltd., New Delhi

Reference Books

S.No.	Author Name	Year of Publication	Title of the Book	Publisher Name
1.	Anastas P. T. and Warner, J. C.	2005	Green chemistry Theory and Practice	Oxford University Press, New York.
2.	Ahluwalia, V. K. and Agarwal, K.	2007	Organic Synthesis, Special Techniques	Narosa Publishing House, New Delhi.
3.	Ahluwulia, V. K.	2007	Alternate Energy Processes in Chemical Synthesis	Alpha Science Int'l Ltd.

Pedagogy

Lecture, Lecture with discussion, Demonstrations, Group discussion, Debate, Seminar, Quiz, Mini Project and e- Content.

Course Designers

- **Mrs. P. Thamizhini,** Assistant Professor, Department of Chemistry
- **Dr. R. Subha,** Assistant Professor, Department of Chemistry

Subject Code 19PCH2EC1B	Forensic Chemistry	Category	L	T	P	Credit
		Elective	90			5

Preamble

This Course introduces fundamental principles and functions of forensic science. It covers concepts such as Physical and biological evidence. It provides various techniques involved in forensic science.

Course Outcomes

On successful completion of the course, the student will be able to

CO	CO Statement	Knowledge Level
CO 1	Identify the fundamental principles and functions of forensic science.	K3
CO 2	Apply the principles of Spectroscopy in forensic science	K3
CO 3	Analyse the techniques involved in the field of forensics	K4
CO 4	Appraise the role of chemistry and other branches in forensics.	K5
CO 5	Describe the role of DNA typing	K6

Mapping with Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**M**	**M**	**L**	**S**
CO2	**S**	**S**	**M**	**L**	**S**
CO3	**S**	**M**	**S**	**S**	**S**
CO4	**S**	**M**	**M**	**M**	**S**
CO5	**S**	**S**	**S**	**S**	**S**

S-Strong; M-Medium

FORENSIC CHEMISTRY

UNIT I INTRODUCTION TO FORENSIC SCIENCE (18 Hrs)

Functions of forensic science-Historical aspects of forensic science- definitions and concepts in forensic science-scope of forensic science-need of forensic science-basic principles of forensic science-branches of forensic science-forensic science in international perspectives.

UNIT II CHEMISTRY OF FORENSIC INVESTIGATIONS (18 Hrs) Definition of physical evidence, classification of physical evidence, types of physical evidences. Glass and soil - physical properties - comparing glass fragments - collection and preservation of glass evidence - forensic characteristics of soil - collection and preservation of soil evidence. Fingerprints -fundamental principles of fingerprints - classification of fingerprints - methods of detecting fingerprints - preservation of developed prints. Document and voice examination - collection of handwriting exemplars – typescript comparisons - inks and papers - alterations, erasures, and obliterations.

UNIT III TECHNOLOGICAL METHODS IN FORENSIC SCIENCE (18 Hrs) Chromatographic methods**:**Fundamental principles and forensic applications of thin layer chromatography, gas chromatography and liquid chromatography.Spectroscopic methods: Fundamental principles and forensic applications of Ultraviolet- visible spectroscopy, infrared spectroscopy, atomic absorption spectroscopy, atomic emission spectroscopy and mass spectroscopy. X-ray spectrometry. Colorimetric analysis and Lambert-Beer law.

U**NIT IV FORGERY AND COUNTERFEITING**

Detecting forgery in bank cheques / drafts and educational records (mark lists,certificates), using UV-light. Alloy analysis using AAS to detect counterfeit coins.Checking silverline water mark in currency notes. Jewellery : detection of gold, purity in 22 carat ornaments, detecting gold plated jewels, authenticity of diamonds, (natural, synthetic, glassy).

UNIT V STUDY OF BEVERAGES AND EXPLOSIVES

Introduction, Definition of alcohol and illicit liquor, Alcoholic and non-alcoholicbeverages and their composition, Proof spirit, absorption, detoxication andexcretion of alcohol, problems in

alcohol cases and difficulties in diagnosis,Alcohol and prohibition, Consequences of drunken driving, Analytical techniquesused for the analysis of alcohol.Classification, Comparison & characterization of explosives, Military & camp;Commercial explosives, Detection of Explosophores (anions), Detection of Blackpowder, Nitrocellulose and Dynamite and Quantitative determination.

Text Books

S.No	Author's Name	Year of Publication	Title of the Book	Publishers Name
1	Eckert G. William,	1996	Introduction to forensic sciences,	Newyork, washington, crc, Press,
2	Saferstein, Richard,	1995	An Introduction to forensic science,	Fifth edition, prentice hall.
3	W. Kemp,	1991	Organic Spectroscopy,	3rd Edition, Macmillan, Hampshire
4	J.W. Robinson,	1995	Undergraduate Instrumental Analysis,	5th Edition, Marcel Dekker, Inc., New York
5	Tessarolo, A.A. andMarignani, A.,	1996.	Forenisc Science and the Internet.	The Canadian Society of Forensic Science Journal, Vol. 29,

Reference Books

S.No.	Author's Name	Year of Publication	Title of the Book	Publisher Name
1	B.B. Nanda and R.K. Tiwari	2001	Forensic Science in India: A Vision for the Twenty First Century	Select Publishers, New Delhi
2	M.K. Bhasin and S.Nath,	2002	Role of Forensic Science in the New Millennium	University of Delhi, Delhi.

3	S.H. James and J.J.Nordby,	2005	Forensic Science: AnIntroduction to Scientificand Investigative Techniques	2nd Edition, CRC Press, Boca Raton
4	D.A. Skoog, D.M. Westand F.J. Holler,	1992	Fundamentals of Analytical Chemistry	6th Edition, Saunders College Publishing, Fort Worth
5	Jorg T. Epplen Thomas Lubjumhin,	1995	DNA Profiling and DNAFingerprinting	Birkhauser Basel, Verlag,

Pedagogy

E-content, Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion, Video / Animation

Course Designer

1.**Mrs. P.Thamizhini,** Assistant Professor, Department of Chemistry

2.**Mrs. A.Sharmila,** Assistant Professor, Department of Chemistry.

CORE COURSE-VII

CHEMISTRY FOR COMPETITIVE EXAMINATIONS

2019-2020 ONWARDS

Semester-III	**CHEMISTRY FOR COMPETITIVE EXAMINATIONS**	**Hours/Week-6**	
Core Course-VII		**Credit-5**	
Course Code-19PCH3CC7		**Internal -**	**External 100**

Objectives

- To know the types of bonds, properties of *f*-block elements, structures and functions of biomolecules.
- To study the reaction mechanism and spectroscopy techniques.
- To learn the catalytic behavior of Organometallic compounds.

Course Outcomes

On successful completion of the course, the student will be able to

CO Number	**CO Statement**	**Knowledge level**
CO 1	Describe the medicinal value of bio- inorganic compounds	K2
CO 2	Interpret the spectrum of the molecules and calculate the point group.	K3
CO 3	Explain the types of bonds and shapes of the molecules	K4
CO 4	Compare the properties of f-block elements and analyze the catalytic behavior of organometallic compound.	K4
CO 5	Choose the reagent and predict the mechanism of the reaction.	K5

Mapping with Programme Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	**S**	**S**	**M**	**S**	**S**
CO2	**S**	**M**	**M**	**S**	**S**
CO3	**S**	**M**	**M**	**S**	**S**
CO4	**S**	**M**	**M**	**S**	**S**
CO5	**S**	**M**	**M**	**S**	**S**

S-Strong; M-Medium

SEMESTER-III

CHEMISTRY FOR COMPETITIVE EXAMINATIONS

2019-2010 ONWARDS

UNIT I: CHEMICAL BONDING AND NUCLEAR CHEMISTRY (18 Hrs)

Ionic bond, lattice energy, Born-Haber cycle; covalent bond, polarities of bonds in molecules and their dipole moments; Valence bond theory, VSEPR model, shapes of molecules; Molecular orbital theory (LCAO method); bonding in H^{2+}, H^2, He^{2+} to N^2, NO, CO, HF, and CN^-; bond order, bond strength and bond length. Isotopes, isobar, nuclei stability, p/n ratio, radioactivity, radioactivity decay series, carbon dating, half life period, nuclear fission and fusion, activation analysis and isotopic dilution.

UNIT II: CHEMISTRY OF *f*-BLOCK ELEMENTS AND COORDINATION COMPLEXES. (18Hrs)

Chemistry of *f*-Block Elements**:** Lanthanides and actinides; separation, oxidation states, magnetic and spectral properties, lanthanide contraction and uses. Coordination compounds: IUPAC nomenclature, identification of No. of possible isomers, EAN rule, Valence bond theory, CFT –CFSE –calculation, John teller distortion theory. 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.

UNIT III: BIO-INORGANIC CHEMISTRY (18Hrs)

Metal ions in biological systems and their role in ion transport across the membranes (molecular mechanism), oxygen uptake proteins, Heme and non-heme proteins – hemoglobin and myoglobin – oxygen transport and storage – electron transfer and oxygen activation – cytochromes, ferredoxins and rubredoxin. 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: REACTION MECHANISMS REARRANGEMENTS AND REAGENTS (18Hrs)

Reactive Intermediates- carbonium ions and carbanions, free radicals, carbenes, benzynes and nitrenes. Substitution Reactions: SN_1, SN_2 and SN_i mechanisms; neighbouring group participation; Elimination Reactions: E_1, E_2 and E_1CB mechanisms; orientation in E_2 reactions-Saytzeff and Hoffmann; pyrolytic elimination - Chugaev and Cope eliminations. Addition Reactions: Electrophilic addition to C=C and C=C; nucleophilic addition to C=O, C=N, conjugated olefins and carbonyls. Baeyer-Villiger, Favorskii, Fries, Claisen, Cope, Stevens and Wagner-Meerwein rearrangements. Aldol condensation,

Claisen condensation, Dieckmann, Perkin, Knoevenagel, Witting,Von Richter reactions; Synthetic Uses of Reagents: OsO_4, HIO_4, $Pb(OAc)_4$, SeO_2, NBS, $LiAlH_4$, $NaBH_4$, n-BuLi and MCPBA.

UNIT V: SPECTROSCOPY AND GROUP THEORY (18Hrs)

Principle and applications in structure elucidation. Rotational: diatomic molecules; isotopic substitution and rotational constants. Vibrational: Diatomic molecules, linear triatomic molecules, specific frequencies of functional groups in polyatomic molecules. Electronic: Singlet and triplet states; $n\rightarrow\pi^*$ and $\pi\rightarrow\pi^*$ transitions; application to conjugated double bonds and conjugated carbonyls-Woodward-Fieser rules; Charge transfer spectra. Mass Spectrometry- parent peak, base peak, metastable peak, McLafferty rearrangement.

Group theory: symmetry elements, symmetry operation, point group of simple molecules like H_2O, NH_3, BF_3, C_6H_6, biphenyl, Ferrocene.

Text Books

S.No	Author name	Year of publication	Title of the book	Publishers Name
1	Puri B. R., Sharma L. R., Day M. C.,and Selbin J..	2012	Theoretical Inorganic Chemistry;	Sisler, Literary Licensing (LLC), Montana.
2	Jagdambasingh	2016	Organic synthesis	PragatiPrakashan
3	Kaim W. and Schewederski B..	2013	Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life;	2nd Ed., John Wiley and Sons, New York, USA.
4.	Finar I.R	2009	Organic chemistry vol.1	7thEdn, Pearson Education Asia
5.	Banwell C.N and McCash.E.M	2000	Fundamentals of Molecular Spectroscopy	4 th Edn,TataMcGraw Hill,New Delhi.

Reference Books

S. NO.	Author Name	Year of publication	Title of the book	Publishers Name
1.	Huheey J. E..	2006	Inorganic Chemistry;	4th Edn.,Harper and Row publisher, Singapore.
2.	Mukherji,S.MSingh.S.P	2015	Reaction Mechanism In Organic Chemistry (Revised Edition)	Trinity ; New Delhi
3.	Dargo.R.S	1977	Physical Methods in Chemistry	Saunders,Philadelphia.
4.	Carey.F.A and Sundberg R.J	2000	Advanced Chemistry Part A &B	4th Edn Kluwer Academic/Plenum Publishers.
5.	Ramam.K.V.	1990	Group Theory and its application to Chemistry	Tata McGraw Hill,New Delhi.

Pedagogy

E-content, Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion,Video / Animation

Course Designers

Ms.P.Amirtham, Assistant Professor, Department of Chemistry.

Ms.A.Sharmila, Assistant Professor, Department of Chemistry.

CORE COURSE-VI

PHYSICAL CHEMISTRY-II

2019-2020 ONWARDS

Semester-III	**PHYSICAL CHEMISTRY-II**	**Hours/Week-6**	
Core Course-VI		**Credit-5**	
Course Code-19PCH3CC6		**Internal 25**	**External 75**

Objectives

- To Learn the fundamental concepts of electrochemical reactions.
- To study the concepts of surface techniques, Kinetics and macromolecules.
- To develop the applications of wave mechanics and spectroscopy.

Course Outcomes

On successful completion of this course, the student will be able to

CO Number	**CO Statement**	**Knowledge Level**
CO1	Discuss the chemistry of macromolecules	K2
CO2	Solve the application of spectroscopy	K3
CO3	Examine the applications of wave mechanics to simple system.	K4
CO4	Compare the different techniques of surface chemistry	K4
CO5	Differentiate the ionic and electronic part of electrochemical reactions and their applications.	K4

Mapping with Programme Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO 5**
CO1	**S**	**S**	**M**	**M**	**M**
CO2	**S**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**M**	**S**	**S**
CO4	**S**	**S**	**M**	**M**	**M**
CO5	**S**	**S**	**M**	**M**	**M**

S-Strong; M-Medium

SEMESTER-III

PHYSICAL CHEMISTRY-II

2019-2010 ONWARDS

UNIT I: ELECTROCHEMISTRY-II (18Hrs)

Ion transport in solution- migration, convection and diffusion- Debye- Huckel theory- Ionic atmosphere- Debye- Huckel Onsager equation- Falkenhagen effect and wien effect, Debye-Huckel limiting law – activity coefficients and ionic strength – Bjerrum model. Structure of electrolyte interface – Types – Gouy- Chapman diffuse charge model of double layer-Stern model-Structure of semiconductor interface. Dynamics of electron transfer- Butler-Volmer equation, Taft equations, Irreversible electrode processes- Corrosion and its inhibition, electro deposition of metals in aqueous solution.

UNIT II: SURFACE TECHNIQUES, KINETICS OF ENZYMES AND PHOTOCHEMICAL REACTIONS (18Hrs)

Adsorption – surface tension, Modern techniques for investigating surfaces - Low Energy Electron Diffraction (LEED), Photo Electron Spectroscopy (PES), Scanning Tunneling Microscopy (STM), Extended X-ray Absorption Fine Structure (EXAFS) and Surface Extended X-ray Absorption Fine Structure (SEXAFS).

Marcus theory of electron transfer - application- Enzyme catalysis-Mechanism of single substrate reactions - Michaelis Menten equation. Kinetics of photochemical reactions involving HCl, HBr, and HI.

UNITIII: QUANTUM CHEMISTRY AND GROUP THEORY (18Hrs)

Applications of wave mechanics –approximation methods – methods of variation, application to hydrogen and helium atoms – perturbation method – non degenerate systems – helium atom – effective nuclear charge. Electron spin – many electron atoms – Pauli's principle – Slater determinants – atomic structure calculation

Molecular term symbol, symmetry adapted linear combinations (SALC) - calculation of CH_4, H_2O, NH_3 – vibrational spectra – symmetry properties of normal molecules – symmetry coordinates – selection rules for fundamental vibrational transition – IR and Raman activity of fundamentals in CO_2, H_2O and $N_2 F_2$.

UNIT IV: SPECTROSCOPY (18Hrs)

NMR Spectroscopy– introductory principles- Types of environmental effect, chemical shifts and shielding – effects of chemical change on spectronuclear molecules, spin-spin interactions by means of bonding electrons in an elementary study of isotopes other than proton F^{19}, P^{31}, C^{13}, B^{11}.

ESR Spectroscopy – g factor –theory and application of ESR method-interpretation of ESR

spectra of ions like Mn^{2+},Cu^{2+}, Zn^{2+},Cr^{2+} - Hyperfine interactions in *p*-benzoquinone naphthalene and anthracene- Hyperfine structure of ESR. Zero-field splitting of ESR signal Kramer's degeneracy. McConnell relation.

UNIT V: MACROMOLECULES (18Hrs)

Polymer – definition, types of polymer, electrically conducting, fire resistant, liquid crystal polymers - kinetics of polymerization- Vinyl, Cationic and Anionic polymerization. Ziglernatta catalysis. Molecular mass, number and mass average molecular mass, - poly dispersity index-molecular mass determination - Viscometer, light scattering and sedimentation methods. Biopolymer and its applications.

Text Books

S.No	Author Name	Year of Publication	Title of the book	Publishers name
1.	Samuel Glasstone	1942	Introduction to Electrochemistry	Affiliated East-West Press Pvt.Ltd., New Delhi.
2.	R.K. Prasad	2006	Quantum chemistry (6th edition)	New age International Publishers, New Delhi.
3.	K.V. Raman	2003	Group Theory and its application to chemistry	McGraw Hill Education, New Delhi.
4.	Puri B.R., Sharma L.R. and Pathania M.S.	2013	Principles of Physical Chemistry, (47^{th} edition),	Shoban Lal Nagin chand and Co., New Delhi.
5.	Atkins, P. and Paula, J. de	2009	Physical Chemistry, 9th Ed.,	W. H. Freeman Publications, New York,
6.	Banwell. C.N	1994	Fundamentals of Molecular spectroscopy	McGraw Hill Education, Noida,
7.	Gowarikar, V.R.	1978	Introduction to polymer science	Wiley Eastern Ltd., New Delhi.

Reference Books

S.No	Author Name	Year of Publication	Title of the book	Publishers name
1.	Crow D.R.	1994	Principles& Application of Electrochemistry	Chapman & Hall/CRC Tylor Francis Group, New York.
2.	Puri B.R., Sharma L.R. and Pathania M.S.	2013	Principles of Physical Chemistry, (46^{th}edition),	Shoban Lal Nagin chand and Co., New Delhi.
3.	Chandra A.K	1994	Introductory Quantum chemistry(4^{th} edition)	Tata McGraw Hill Education, Noida,
4.	Kaur. K	2014	spectroscopy	Pragati Prakashan Educational
5.	Kemp W	2011	Organic Spectroscopy	Palgrave, new york
6.	Billmeyer H	2015	Polymer chemistry	Wiley Eastern Ltd., New Delhi

Pedagogy

Lecture, Lecture with discussion, Demonstrations, Group discussion, Debate, Seminar, Quiz, Mini Project and e-Content.

Course Designers

Dr. V. Sangu Assistant Professor, Department of Chemistry

Ms. S. Jeevitha Assistant Professor, Department of Chemistry

ELECTIVE COURSE-II
PHARMACEUTICAL CHEMISTRY
2019-2020 ONWARDS

Semester-III	**PHARMACEUTICAL CHEMISTRY**	**Hours/Week-6**	
Elective Course-II		**Credit-5**	
Course Code-19PCH3EC2A		**Internal 25**	**External 75**

Objectives

- To identify the medical and pharmaceutical importance of drugs
- To asset the various system of classification of drugs and natural origin
- To diagonise treatment and prevention of common diseases .
-

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO statement	Knowledge Level
CO1	Prediction of malarial, infectious, autoimmune and celiac diseases	K3
CO2	Relate the usage of drugs for asthma and allergic	K3
CO3	Diagnosis the prevention and treatment of all diseases	K4
CO4	Assessment of antibiotics and antiseptics	K5
CO5	Critique the usage of drugs in day today life	K5

Mapping of Programme Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**M**	**M**	**M**	**L**
CO2	**S**	**M**	**M**	**S**	**M**
CO3	**M**	**M**	**S**	**M**	**M**
CO4	**M**	**S**	**M**	**M**	**M**
CO5	**S**	**M**	**M**	**L**	**M**

S-Strong; M-Medium

SEMESTER-III
PHARMACEUTICAL CHEMISTRY
2019-2020 ONWARDS

UNIT I: BASICS OF PHARMACEUTICAL CHEMISTRY (18 Hrs)

Terminologies– drugs, pharmacology, chemotherapy, therapeutics – pharmacologically active principles in plants. First aid –cuts, fractures, bleeding for blood, maintaining breathing burns and first aid box. Causes, symptoms, diagnosis, prevention and treatment- tuberculosis (T.B.), jaundice, piles, typhoid, malaria and cholera.

UNIT II: ANTIBIOTICS AND AUTOCOIDS (18 Hrs)

Antibiotic – Classification and Biological actions – Penicillin, Chloramphenicol, Streptomycin and Tetracycline- Structure, properties, therapeutic uses and pharmacological activity. Autacoids-role of histamine and antihistamine in body, Synthesis of Cetrizine and Ranitidine

UNIT III: ANALGESIC AND ANTIPYRETICS (18 Hrs)

Narcotic analgesic – Analgesic action of Morphine – Derivatives of Morphine- Nonnarcotic analgesic – Aspirin, Paracetamol- preparation, properties and uses – Antipyretics- Ibuprofen and Ketoprofen - structure and uses.

UNIT IV: DRUGS FOR CANCER TREATMENT (18 Hrs)

Cancer-Types, Causes and its Treatment-Determination of drug response by mass doubling time, growth fraction and combination chemotherapy. Cytotoxic anticancer drugs-Cisplatin, Folic acid, Mercaptopurine, Fluorouracil, Anthracyclines and Actinomycin-D.

UNIT V: PSYCHOACTIVE AND CARDIOVASCUALR DRUGS (18 Hrs)

Introduction, neurotransmitters, structure of nerve cell-synaptic transmission and synaptic excitation, chemical transmitters, CNS depressants. Synthesis, structure and effects of Barbiturates, Benzodiazepines and Non benzodiazepine hypnotics-Zopiclone. Cardiovascular drugs-classification, diseases-cardiac failure, ischemic heart disease, thromobosis. synthesis, structure and effects of Amylnitrates, Verapamil, Sorbitrates and Oxyprenolol.

Text Books

Text Books

S.NO	Author Name	Year of Publication	Title of the book	Publishers Name
1	Alkal.L.Gupta	2017	Medicinal Chemistry	8th Ed.,Pragati Prakashan.,Meerut
2	Ahluwalia, V.K and Chopra, M	2012	Medicinal Chemistry	2nd Ed., Ane books, New Delhi

Reference Books

S.No	Author Name	Year of Publication	Title of the book	Publishers Name
1	Bhagavathi Sundari	2006	Applied Chemistry	1st Ed., MJP Publishers, Chennai

Pedagogy

Lecture, Powerpoint Presentation, Videos, OHP Presentation, Seminar, Group Discussion, Assignment and Quiz.

Course Designer

Dr.R.Subha, Assistant Professor, Department of Chemistry

ELECTIVE COURSE-III
BIOORGANIC CHEMISTRY
2019-2020 ONWARDS

Semester-III	**BIOORGANIC CHEMISTRY**	**Hours/Week-6**	
Elective Course-III		**Credit-5**	
Course Code-19PCH3EC2B		**Internal 25**	**External 75**

Objectives

- To Gain the knowledge on the molecular structure and of chemical and biological properties of biomolecules such as amino acids, proteins, lipids and nucleic acids.
- To know the mechanisms of enzymatic reactions, the various role of organic molecules in living systems.
- To learn the concepts of bio energies.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statements	Knowledge level
CO 1	Describe the preparation, properties of amino acids, proteins and lipids.	K2
CO 2	Outline the mechanism of enzymes and cofactors.	K2
CO 3	Apply the concept of Bioenergetics.	K3
CO 4	Analyze the principles of disconnection approach of organic synthesis.	K4
CO 5	Distinguish between stereoselective and stereospecific reactions.	K4

Mapping with Programme Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**M**	**M**	**S**	**S**
CO2	**S**	**S**	**M**	**S**	**S**
CO3	**S**	**M**	**S**	**S**	**S**
CO4	**S**	**S**	**M**	**S**	**S**
CO5	**S**	**S**	**S**	**S**	**M**

S- Strong, M-Medium

SEMESTER-III
BIOORGANIC CHEMISTRY
2019-2020 ONWARDS

UNIT I: AMINO ACIDS AND PROTEINS (18 Hrs)

Structure, classification, synthesis and properties of amino acids - biosynthesis of aminoacids – peptides - N-terminal and C-terminal residue analysis – solid phase peptide synthesis - Proteins – classification and properties, primary, secondary, tertiary and quaternary structures of proteins – biological roles of proteins

UNIT II: ENZYMES AND COFACTORS (18 Hrs)

Chemical nature of enzymes – characteristics of enzymes. Mechanism of enzymes – Michaelis-Menten hypothesis – Fischer's lock and key model – regulation of enzyme activity. Structure and biological functions of coenzyme A, NAD+, FAD and vitamin B12. Enzyme catalyzed reactions-carboxylation, decarboxylation, condensation, addition, elimination and isomerisation reactions.

UNIT III: LIPIDS AND NUCLEIC ACIDS (18 Hrs)

Lipids – Classification– physical properties (solubility, melting point, surface tension, emulsification and geometric isomerism) – chemical properties- reaction involving -COOH group, -OH group and double bonds - Nucleic Acid – nucleosides and nucleotides – ribonucleic acid (RNA,m-RNA and t-RNA) - deoxyribonucleic acid(DNA) - Internucleotides linkages – base composition – double helical structure.

UNIT IV: BIOENERGETICS (18 Hrs)

Concept of energy – thermodynamic principles – first law, second law, combining the two laws – relationship between standard free energy change and equilibrium constant. Standard free energy values of chemical reactions – Adenosine triphosphate (ATP) as universal currency of free energy in biological systems – ATP hydrolysis and equilibria of coupled reactions – inter conversion of adenine nucleotides.

UNIT V: LEAD AND ANALOGUE SYNTHESIS (18 Hrs)

Designing organic synthesis – disconnection approach – synthons and synthetic equivalents – one group disconnections: alcohol, acids and ketone – functional group interconversions -

Asymmetric synthesis – basic principles – stereoselective and stereospecific reactions – reagents, catalysts and their applications in alkylation and hydrogenation – Jacobsen's catalyst and Evans's catalyst.

Text Books

S.No	Author Name	Year of publication	Title of the Book	Publication Name
1	Jain J. L.	2007	Fundamental of Biochemistry	S. Chand and Co., New Delhi
2	Price N. C and Stevens L	1999	Fundamental of Enzymology	Oxford University Press, UK,
3	Carey F. A and Sendberg R. J.	2008	Advanced Organic Chemistry, Part-A and Part-B; 5th Ed	Springer, Germany
4	Warren S	2008	Designing organic synthesis: The disconnection Approach; 2nd	E., Wiley, New York,
5	Kagan H. B	2009	Asymmetric Synthesis	Thieme Medical Publishers, Germany

Reference Books

S.No	Author Name	Year of publication	Title of the Book	Publication Name
1	Kalsi P. S and Kalsi J. P	2017	Bioorganic, Bioinorganic & Supramolecular Chemistry	New Age International, New Delhi
2	Sathyanarayana U & Chakrapani U	2014	Biochemistry	Elsevier Health Science
3	Harish K. Chopra, Anupama Parmar, Parmjith S. Panesar	2012	Bio-Organic Chemistry	Alpha Science International Ltd., 1 edition
4	Vinay Prabha Sharma	2018	Essentials of Bioorganic Chemistry	Pragati Prakashan, Meerut

Pedagogy

E-content, Lecture Power point presentation Seminar, Assignment, Quiz, Group Discussion, Video / Animation

Course Designer

Dr. C. Rajarajeswari, Assistant Professor, Department of Chemistry

Ms. P. Thamizhini, Assistant Professor, Department of Chemistry

ELECTIVE COURSE-III
INSTRUMENTATION TECHNIQUES
2019-2020 ONWARDS

Semester-III	**INSTRUMENTATION TECHNIQUES**	**Hours/Week-6**	
Elective Course-III		**Credit-5**	
Course Code-19PCH3EC3A		**Internal 25**	**External 75**

Objectives

- To acquire sound theoretical knowledge and understanding of the fundamental concepts, principles and processes in Analytical Chemistry.
- Quantitative Analytical Instrumentation technique learned during the course.
- To Interpret the data analysis with different samples

Course Outcomes

On successful completion of the course, the student will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Interpret the data analysis with different samples	K2
CO 2	Predict the quality of different water samples.	K2
CO 3	Identify the instruments and methods used to separate, identify, and quantify matter.	K2
CO 4	construct the Instrumental methods used to separate samples using chromatography	K3
CO 5	Point out the Classical quantitative analysis uses mass or volume changes to quantify amount.	K4

Mapping with Programme Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**S**	**S**	**S**
CO2	**S**	**M**	**S**	**M**	**S**
CO3	**M**	**S**	**M**	**S**	**M**
CO4	**M**	**S**	**S**	**M**	**M**
CO5	**S**	**S**	**S**	**S**	**S**

S-Strong; M-Medium

SEMESTER-III
INSTRUMENTATION TECHNIQUES
2019-2020 ONWARDS

UNIT I: DATA ANALYSIS (18Hrs)

Errors, Statistics and Sampling Accuracy and precision, Error, types of error, systematic and random errors, minimization of errors, mean and standard deviations, reliability of results, confidence interval, comparison of results, student T test, F test, Comparison of two samples (Paired T test), correlation and regression, correlation coefficient and liner regression, Sampling, the basis of sampling, sampling procedure, sampling statistics.

UINT II: ANALYSIS OF WATER QUALITY (18 Hrs)

Water quality field sampling QA/QC program, QA/QC documentation, QA project plan, designing a water quality monitoring plan, Site selection, sampling frequency and sample size, cost considerations, training of field personnel, field trip preparations, Water quality sampling, toxic chemicals in bottom sampling and biota, bacterial sample collection, sequential triplicate sampling, sample handling, preservation, storage and transport, chain of custody, field safety, field audit program, reporting of analytical results, data handling and data management.

UNIT III: FOOD QUALITY ANALYSIS (18 Hrs)

Food analysis: Solid, liquid and Gas, ultimate and proximate analysis heating values, grading of cool, liquid fuels, flash points, aniline point, octane number and carbon residue, gaseous fuels – producer gas and water gas – calorific value. Moisture, ash, crude protein, fat, crud fiber, carbohydrate, calcium, potassium, sodium, and phosphates, food adulteration – common adulteration in food, contamination of food stuffs, microscopic examination of foods for adulterants, Pesticide analysis in food products, Extraction and purification of sample,

UNIT IV: CHROMATOGRAPHY (18 Hrs)

Principles, instrumentation and application of ion exchange, paper chromatography, column chromatography, High Performance liquid chromatography (HPLC), gas chromatography, thin layer chromatography - GC-MS techniques.

UNIT V: ELECTROANALYTICAL TECHNIQUES (18 Hrs)

An introduction to electroanalytical methods and its types- sensors, ion-sensitive electrodes, glass – membrane electrodes, solid-liquid membrane electrodes. Potentials in electroanalytical cells – definition and nature of electrode potentials- sources of polarization in electrolytic cells - cyclic voltammetry – advantages over polarographic techniques – chronopotentiometry - chrono amperometric titrations. estimation of lead by amperometric titration.

Text Books

S. No.	Author Name	Year of publication	Title of the book	Publishers Name
1.	Skoog D. A.. West D. M	1996	Fundamental of Analytical Chemistry, 7th Edition	Saunders College Publishing, Philadelphia, Holt, London.
2.	Pecsok R. L., Shields L. D., Cairns T.,. McWilliam L.C.,	1976	Modern Methods of Chemical Analysis,	John Wiley & Sons, New York.
3.	Skoog D. A.,	1998	Principles of Instrumental Analysis, 5th Edition	Saunders College of Publishing, Philadelphia, London.
4.	Strobel H. A.,	1973	Chemical Instrumentation: A Schematic Approach, 2nd Edition	Addison Wesley, Reading, Mass.

Reference Books

S. No.	Author Name	Year of publication	Title of the book	Publishers Name
1.	Vogel A.I.	2000	Text Book of Quantitative Inorganic analysis,"	The English Language Book Society, Fourth edition.
2.	Douglas A. Skoog, Donald M. West and F. J. Holler,	1985.	Fundamentals of Analytical chemistry,	7thedition, Harcourt College Publishers
3.	Mendham J., Denny R. C., Barnes J.D., Thomas M., Vogel's.	1995	Test book of Quantitative Chemical analysis	6th edition, Pearson education

Pedagogy

E-content , Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion,Video / Animation

Course Designers

Dr. G. Sivasankari, Assistant Professor, Department of Chemistry

Ms. A. Sharmila, Assistant Professor, Department of Chemistry

ELECTIVE COURSE-III
INTELLECTUAL PROPERTY RIGHTS
2019-2020 ONWARDS

Semester-III	**INTELLECTUAL PROPERTY RIGHTS**	**Hours/Week-6**	
Elective Course-III		**Credit-5**	
Course Code-19PCH3EC3B		**Internal 25**	**External 75**

Objectives

- To know about the rights, patents and copyright of the system
- To investigate the design, protection and trademark of the system.
- To determine the rank and competitiveness of nation and corporate organizations.

Course Outcomes

On successful completion of the course, the student will be able to

CO Number	**CO statement**	**Knowledge Level**
CO1	Indentify the basic property rights in development and management of innovative projects	**K2**
CO2	Interpret the knowledge on patents, patent regime in India and abroad	**K3**
CO3	Discriminate the system with its patent, copyright and trademark	**K4**
CO4	Evaluation of design on trademarks and registration aspects	**K5**

Mapping with Programme Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	**S**	**M**	**S**	**M**	**M**
CO2	**M**	**M**	**S**	**M**	**S**
CO3	**S**	**S**	**M**	**S**	**M**
CO4	**S**	**M**	**S**	**M**	**M**

S-Strong; M-Medium

SEMESTER-III
INTELLECTUAL PROPERTY RIGHTS
2019-2020 ONWARDS

UNIT I: OVERVIEW OF IPR (18 Hrs)

Introduction and the need for intellectual property right (IPR).Kinds of IPR-Patent, Copyright, Trademark, Design, Geographical indication, Plant varieties and Layout design, IPR in India – Genesis and Development IPR in abroad. Some important examples of IPR

UNIT II: PATENTS (18 Hrs)

Patents- Elements of Patentability: Novelty, Non Obviousness and Industrial applications, Matter-Registration Procedure, Patent documentation, Granting of patent, Rights and duties of patent, Assignment and License, Surrender and Revocation of Patents, Remedies and Penalties. The different layers of the international patent system (national, regional and international options).

UNIT III: COPYRIGHT (18 Hrs)

Introduction, subject matter of copyright: original literary- Registration procedure, term of protection, Ownership of copyright, Assignment and License, Remedies and Penalties. Distinction between related rights and copyright.

UNIT IV: TRADEMARKS (18 Hrs)

Concept of trademark- Types of trademark (brand name, logos, signature, symbols, certification and service mark), non registrable trademarks- Registration, Assignment and License, Remedies and Penalties.

UNIT V: DESIGNS, GEOGRAPHICAL INFORMATION AND OTHER FORMS OF IPR (18 Hrs)

Meaning, concept of novel and original matter, Procedure and effect for registration and term of protection for design, geographical information, plant variety protection and lay out design protection, Differences between GI and trademark. India's new national policy 2016, Career opportunities and current scenario in IPR with case studies.

Text Books

S.No	Author Name	Year of Publication	Title of the book	Publishers Name
1	Nithyananda, K V	2019	Intellectual Property Rights: Protection and Management.	Cengage Learning India Private Limited.
2	Ganguli, P	2001	Intellectual property rights: Unleashing the knowledge economy	Tata Mc graw hill
3.	Neeraj, P., & Khusdeep, D	2014	Intellectual Property Right	PHI learning Private Limited. India

Reference Books

S.No	Author Name	Year of Publication	Title of the book	Publishers Name
1	Manjula Guru and Rao, M.B	2003	Understanding Trips: Managing knowledge and developing countries	Sage Publications
2	Narayanan, P	2010	Law of copyright and Industrial design	Eastern Law house

E-resources

1. Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
2. World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub _489.pdf

Pedagogy

Lecture, Powerpoint Presentation, Videos, OHP Presentation, Seminar, Group Discussion, Assignment and Quiz.

Course Designers

Dr.R.Subha, Assistant Professor, Department of Chemistry

Ms.P.Pungayee alias Amirtham, Assistant Professor, Department of Chemistry

CORE COURSE-V
PHYSICAL CHEMISTRY I (P)
2019-2020 ONWARDS

Semester-III	**PHYSICAL CHEMISTRY I (P)**	**Hours/Week-3**	
Core Course-V		**Credit-3**	
Course Code-19PCH3CC5P		**Internal 40**	**External 60**

Objectives

- To Facilitate students with understand the broad foundation in basic techniques and operations of physical chemistry and the formal reporting of experimental results
- To Construct phase diagram of two and three component system

Course Outcomes
On successful completion of the course, the student will be able to

CO Number	**CO statement**	**Knowledge Level**
CO1	Explain the techniques to carry out operation of physical chemistry.	K2
CO2	Evaluate activation energy of a reaction, CST of immiscible liquids, colligative property to determine molecular weight, Association factor.	K3
CO3	Construct phase diagram of two and three component system.	K4

Mapping with program outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	**S**	**S**	**S**	**M**	**S**
CO2	**S**	**S**	**S**	**M**	**S**
CO3	**S**	**S**	**S**	**M**	**S**

S- Strong; M-Medium

SEMESTER-III
PHYSICAL CHEMISTRY I (P)
2019-2020 ONWARDS

a. Study of kinetics of hydrolysis of methyl acetate in presence of two different concentrations of HCl/H_2SO_4 and report the relative catalytic strength
b. Determination of order of reaction for the acid hydrolysis of methyl acetate and evaluation of activation parameters.
c. Study of effect of salt (ionic strength) on the kinetics of reaction between potassium persulphate and potassium iodide (second order reaction).
d. Determination of molecular weight of substance by Transition Temperature method.
e. Determination of molecular weight of substances by Rast method.
f. Determination of Critical Solution Temperature (CST) of phenol- water system and effect of impurity on CST.
g. Study of phase diagram of two components forming a simple eutectic.
h. Study of phase diagram of two components forming a compound.
i. Study the phase diagram of three component system (Glacial acetic acid-Chloroform water system / Glacial acetic acid-Acetone-Water system).
j. Adsorption- Oxalic acid/Acetic acid on charcoal using freundlich isotherm.
k. Determination of degree of association of benzoic acid in benzene by distribution method.

Text Books

S.No	Author Name	Year of Publication	Title of the book	Publisher Name
1.	Yadhav.J.B	2001	Advanced Practical Physical Chemistry	Publishing House, Krishna Prakashan Media Ltd., Chennai,

Reference Book

S.No	Author Name	Year of Publication	Title of the book	Publisher Name
1.	Gurtur .J.R and Kapoor,R	1997	Advanced Experimental Chemistry;	S. Chand and Co. Ltd, New Delhi,

Course Designers

Dr.V.Sangu, Assistant Professor, Department of Chemistry

Mrs.P.Pungayee@Amirtham, Assistant Professor, Department of Chemistry

CORE COURSE-VIII
PHYSICAL METHODS IN CHEMISTRY-II
2019-2020 ONWARDS

Semester IV	**PHYSICAL METHODS IN CHEMISTRY- II**	**Hours/Week 6**	
		Credit 6	
Core Course VIII		**Internal 25**	**External 75**
Course code 19PCH4CC8			

Objectives

- To understand electronic spectroscopy of metal complexes
- To study in detail IR, Raman and NMR of inorganic compounds
- To learn the Mossbauer and magnetic properties of metal complexes

Course Outcomes

On successful completion of this course, the student will be able to

CO	**CO Statement**	**Knowledge Level**
CO1	Explain the principles of NMR, IR, Raman, Mossbauer and electronic spectroscopy.	K2
CO2	Identify the applications of electronic spectroscopy to study the structure of molecules.	K3
CO3	Solve Δ_0 and β for metal complexes.	K3
CO4	Analyze the spectrum of certain chemical compounds in qualitative.	K4
CO5	Assess the structure of a compound by various spectral data.	K5

Mapping with Programme Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	**S**	**S**	**M**	**M**	**M**
CO2	**S**	**S**	**M**	**M**	**M**
CO3	**S**	**S**	**S**	**M**	**M**
CO4	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**S**	**S**	**M**

S-Strong; M-Medium

SEMESTER - IV

PHYSICAL METHODS IN CHEMISTRY-II

2019-2020 ONWARDS

UNIT I ELECTRONIC SPECTROSCOPY (18Hrs)

Electronic configuration – terms and microstates of atoms and ions – term symbols (p^n and d^n) - spectroscopic terms – L-S coupling and jj coupling– effect of inter-electronic repulsion and spin-orbit coupling– selection rules – Orgel diagram - Tanabe– Sugano diagram– prediction and assignment of transitions for weak field and strong field d^n systems - calculation of β and 10 Dq for simple octahedral complexes of Co and Ni- charge transfer spectra.

UNIT II IR AND RAMAN SPECTROSCOPY (18Hrs)

Introduction to IR spectroscopy– IR active and IR inactive vibrations - compare the intensity of M-O, M-N, M-X, and M-S stretching vibrations– factors affecting metal-ligand vibrations - Raman spectroscopy– theory of Raman effect– applications of Raman spectroscopy for inorganic chemistry - combined uses of IR and Raman Spectroscopy in the structural elucidation of simple molecules like H_2O, ClF_3, $NO^{3-}$and ClO^{3-} - applications of IR to identify terminal and bridging carbonyl group.

UNIT III NMR SPECTROSCOPY (18Hrs)

Introduction to NMR spectroscopy – one dimensional NMR of ^{13}C, ^{15}N, ^{31}P, ^{19}F – structural determination of molecules by 2D NMR (Peptides-I & II) – chemical exchange – hydrogen or deuterium exchange - Diffusion ordered spectroscopy (DOSY)– use of chemical shift reagents – NMR of paramagnetic compounds (contact & pseudo-contact shift) - magnetic resonance imaging (MRI).

UNIT IV NRF AND NQR SPECTROSCOPY (18Hrs)

Basic principle of NRF spectroscopy– Mossbauer experiment– isomer shift– quadrupole splitting – magnetic interactions – applications to iron and tin compounds - NQR– basic principle– characteristics of quadrupolar nucleus- electric field gradient (EFG)– magnetic field upon

quadrupolar energy levels - NQR transitions of $_{7}N^{14}$, $_{5}B^{11}$, $_{17}Cl^{36}$, $_{13}Al^{27}$ and $_{55}Cs^{132}$ - applications of NQR spectroscopy.

UNIT V MAGNETIC PROPERTIES AND PHOTOELECTRON SPECTROSCOPY **(18 Hrs)**

Magnetic properties- types of magnetism– Magnetic domain – magnetic hysteresis – loop – variant in hysteresis – magnetic properties of free ions - determination of magnetic moments (problems) applications of magnetic material in mass spectrometer – magnetic resonance imaging- magnetic resonance angiogram - magnetic properties of lanthanides and actinides - PES– principle, instrumentation and applications of photoelectron spectroscopy.

TEXT BOOKS

S.No	Author Name	Year of Publication	Title of the book	Publishers name
1.	Wahid.U.Malik, Tuli G.D., and Madan R.D.,	2009	Selected Topics in Inorganic Chemistry	7th edition, S.Chand, New Delhi.
2.	Abdul Jameel, A.	2003	Application of Physical Methods to Inorganic compounds	JAN publication, Trichy.
3.	Pathania, V.B.	2002	Spectroscopy,	Campus Books, New Delhi.

REFERENCE BOOKS

S.No	Author Name	Year of Publication	Title of the Book	Publishers name
1	Drago, R.S.	1965	Physical Methods in Inorganic Chemistry	East West Publishers, New Delhi.
2	Ebsworth, EAV	1988	Structural Methods in Inorganic Chemistry	ELBS, Oxford.
3	Kaur, H.	2001	Spectroscopy	Pragati Publications, Meerut.
4	James Huheey, E.	1993	Inorganic Chemistry	Addison Wesely.

Pedagogy

Lecture, Lecture with discussion, Demonstrations, Group discussion, Debate, Seminar, Quiz, Mini Project and e-Content.

Course Designers

- **Mrs. P. Thamizhini,** Assistant Professor, Department of Chemistry
- **Dr. V. Sangu,** Assistant Professor, Department of Chemistry

CORE PRACTICAL - VI

PHYSICAL CHEMISTRY PRACTICALS – II

Semester-IV	PHYSICALCHEMISTRY PRACTICALS – II	Hours/Week-6	
Core Practical-VI		Credit-3	
Course Code-19PCH4CC6P		Internal	External
		40	60

2019-2020 ONWARDS

Objectives

- This course helps to perform various electrical experiments.
- To know the difference between conductometric and potentiometric titration.

Course outcomes

On the successful completion of thecourse,studentswill be able to

CO	CO Statement	Knowledge level
CO 1	Analyze the electrical data	K4
CO 2	Estimate the concentration of ions using Potentiometer	K5
CO 3	Estimate the concentration of ions using Conductometer	K5

Mapping with Programme Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	S	S	S	M	M
CO3	S	S	S	S	M

S- Strong; M-Medium

SEMESTER - IV

PHYSICAL CHEMISTRY PRACTICALS – II

2019-2020 ONWARDS

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

A) Conductometry

1)Acid-alkali titrations.

2) Precipitation titration

3) Displacement titrations.

4) Determination of dissociation constant of weak acids

5) Solubility product of sparingly soluble salts like Barium chromate and Lead sulphate.

6) Verification of Onsager equation for a strong electrolyte like NaCl and KCl.

7) Determination of relative strength of two acids.

8) Determination of degree of hydrolysis and hydrolysis constant of a substance.

B) Potentiometry

1) Acid- alkali titrations.

2) Precipitation titrations.

3) Redox titrations.

4) Determination of dissociation constant of weak acids

5) Determination of solubility product of silver salts.

6) Determination of activity and activity coefficient of ions.

C) pH-metry

1) Titration of ortho-phosphoric acid.

2) To determine the pH of a buffer solution using a quinhydrone electrode-Henderson's equation.

REFERENCES BOOKS

S.No.	Author Name	Year of publication	Title of the Book	Publishers Name
1	Yadav J. B	2001	Advanced Practical Physical Chemistry; 20th Ed.,	GOEL Publishing House
2	Levitt B. P	1985	Findlay's Practical Physical Chemistry; 9th Ed.,	Longman
3	Gurtur J. N and Kapoor R	1997	Advanced Experimental Chemistry; Vol. 1-Physical	S. Chand and Co.
4	Das R.C and Behera	1983	Experimental Physical Chemistry	Tata McGraw - Hill
5	Shoemaker and Gerland	2009	Advanced Physical Chemistry Experiments	McGraw –Hill Higher Education

Pedagogy

Hands on training

Course Designers

- **Ms. Pungayee Alias Amirtham**, Assistant Professor and Head, Department of Chemistry
- **Ms. A. Sharmila,** Assistant Professor, Department of Chemistry

Semester-IV	INDUSTRIAL CHEMISTRY	Hours/Week-6	
Elective Course-VI		Credit-5	
Course Code-19CH4EC4A		Internal	External
		25	75

Objectives

- To create an awareness of applications of industrial chemistry.
- To teach the students the essential role of petrochemicals.
- To study the applications of various industrial manufacturing processes of pulp, paper, leather, glass, ceramic industry, cosmetics, perfumes and milk products.

Course Outcomes

On successful completion of the course, the student will be able to

CO	CO Statement	Knowledge level
CO 1	Classify the fuels as saturated hydrocarbon, unsaturated hydrocarbons and aromatic hydrocarbons	K2
CO 2	Outline the steps involved in the manufacturing of pulp, paper, glass and ceramics.	K2
CO 3	Illumination the structure and properties of the materials used in the cosmetics and perfumes	K3
CO 4	Analyze the milk products, composition and processing of milk	K4

Mapping with Programme Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	M	S	S
CO 2	S	M	M	S	S
CO3	S	M	M	S	S
CO4	S	M	M	S	S

S-Strong M-Medium

SEMESTER -IV

INDUSTRIAL CHEMISTRY

2019-2020 ONWARDS

UNIT I PETROLEUM AND PETROCHEMICALS (18 Hrs)

Introduction– saturated hydrocarbons from natural gas– uses of saturated hydrocarbon– 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 II PAPER AND LEATHER INDUSTRIES (18 Hrs)

Introduction – manufacture of pulp – types of pulp – sulphate or craft pulp - soda pulp - rag pulp – beating – refining – filling - sizing and coloring - calendaring – uses – paper industries in India. Leather Industry: curing -preservation - tanning of hides and skins- process of dehairing- dyeing -treatment of tannery effluents.

UNIT III GLASS AND CERAMICS (18 Hrs)

Glass– manufacture of glass – physical and chemical properties– formation of batch – melting – chemical reaction inside furnace – shaping or forming– Foucault process of shaping sheet – window glass – shaping of plate glass– annealing– finishing – some special glass. Ceramics: Definition – basic raw materials– manufacturing of ceramics – general properties and types.

UNIT IV COSMETICS AND PERFUMES (18 Hrs)

Cosmetics and perfumes- general study including preparation and uses of the following: Hair dye- hair spray- shampoo- sun-tan lotions -face powder- lipsticks- talcum powder- nail enamel- creams (cold, vanishing and shaving creams), antiperspirants and artificial flavors. Essential oils and their importance in cosmetic industries with Eugenol- Geraniol- sandalwood oil- eucalyptus- rose oil- ethyl alcohol- Jasmone- Civetone - Muscone.

UNIT V DAIRY PRODUCTS **(18 Hrs)**

Milk and milk products -chemical composition - processing of milk- types of milk - analysis of milk and composition - uses and manufacturer of various milk products- cream – butter- ghee- cheese - condensed milk – casei- khoa- milk powder- infant milk food - malted milk powder- ice-cream - fermented milk products.

TEXT BOOKS

S.No	Author name	Year of publication	Title of the Book	Publishers Name
1	Sharma. B.K	1997	Industrial Chemistry,8th edition	Goel Publishing House, New Delhi
2	Gopala Rao. M. and Sittig. M	1997	Outlines of Chemical Technology – For the 21st Century	East-West Press Pvt Ltd
3	Shreve. R.N and Brink. J.A	1977	Chemical Process Industries,4th edition	McGraw Hill, Toronto.
4	Brain. A.C.S.	1989	Production and Properties of Industrial Chemicals	Reinhold, New York.
5	Edgar Spreer Axel Mixa	1995	Milk and dairy product technolgies	Marcel Dekker, INC.

REFERENCE BOOKS

S. NO.	Author Name	Year of Publication	Title of the book	Publisher Name
1.	Stocchi. E	1990	Industrial Chemistry, Vol-I	Ellis Horwood Ltd. UK.
2.	Felder R.M., Rousseau. R.K	2017	Elementary Principles of Chemical Processes,	Wiley Publishers, New Delhi.

3.	Kingery. W.D,. Bowen H.K Uhlmann. D.R,	1976	Introduction to Ceramics	Wiley Publishers, New Delhi
4.	Kent. J.A , Riegel's	2008	Handbook of Industrial Chemistry	CBS Publishers, New Delhi.
5.	Jain. P.C, Jain. M.	2013	Engineering Chemistry,sixth edition	Dhanpat Rai& Sons, Delhi.

Pedagogy

E-content, Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion, Video / Animation

Course Designers

- **Mrs.A.Sharmila,** Assistant Professor, Department of Chemistry
- **Dr. P. Poornima Devi,** Assistant Professor, Department of Chemistry

Semester-IV	**SELECTED TOPICS IN CHEMISTRY**	**Hours/Week-6**	
Elective Course-IV		**Credit-5**	
Course Code-19PCH4EC4B		**Internal 25**	**External 75**

Objectives

- To understand the chemistry of pesticides and leather processing.
- To know the applications of selective reactions.
- To understand the importance of clinical chemistry.
- To learn the principles of radiation chemistry.

Course Outcomes

On successful completion of the course, the student will be able to

CO	CO Statement	Knowledge level
CO 1	Discussingabout chemistry of pesticides	K2
CO 2	Discussing about the various Naming Reactions in Organic Synthesis	K3
CO 3	Appraise the essentials of clinical chemistry	K4
CO 4	Explain the different steps in leather processing and analyze the effluent problems in tanneries	K6
CO 5	Discuss about Fundamentals of Radio chemistry	K6

Mapping with Programme Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5
CO 1	**S**	**M**	**M**	**L**	**S**
CO 2	**S**	**S**	**M**	**L**	**S**
CO3	**S**	**M**	**S**	**S**	**S**
CO4	**S**	**M**	**M**	**M**	**S**
CO5	**S**	**S**	**S**	**S**	**S**

S-Strong; M-Medium

SEMESTER -IV

SELECTED TOPICS IN CHEMISTRY

2019-2020 ONWARDS

UNIT I CHEMISTRY OF PESTICIDES (18 Hrs)

Pesticides - classification in terms of chemical nature and generation wise. mode of action of insecticides- bio-accumulation- bio magnification of pesticides - fate of insecticides in environment-environmental hazards - major disasters with pesticides-herbicides - toxicity of DDT- gammexene - malathion - comparison of organochlorine-organophosphate-carbamate in secticides - detoxification of pesticides- allied chemicals - safer pesticides - IPM - environmental hazards arising from fertilisers - minimisation of environmental problems caused by fertilisers

UNIT II SELECTIVE REACTIONS IN ORGANIC SYNTHESIS (18 Hrs)

Bamford-Stevens reaction (alkene preparation) – Barton-McCombie reaction (de-oxygenation) – Baylis-Hillman reaction (C-C bond forming from alkene) – Biginelli reaction (pharmaceutical synthesis of dihydropyrimidones) – Corey-Chaykovsky reaction (carbonyl compound preparation) – Henry reaction (base catalysed C-C bond formation) – Hosomi-Sakurai reaction Lewis acid alkylation reaction) – Hunsdiecker reaction (synthesis of organic halides) – Julia olefination (preparation of alkenes).

UNIT III CLINICAL CHEMISTRY (18 Hrs)

Blood Analysis-serum electrolytes-serum proteins-blood glucose- blood urea nitrogen- uric acid-blood gas analysis- enzyme analysis- assay of alkaline phosphate- isoenzyme of acetate dehydrogenase- aldolase- metal deficiency – disease- estimation of copper-iron-calcium.

UNIT IV LEATHER CHEMISTRY (18 Hrs)

Introduction -structure of hides and skin -leather processing – process before tanning- flaying and curing (drying, salt curing and brine curing and pickling) - soaking – liming - fleshing – unhairing – deliming - bathing - tanning processes – vegetable - synthetic - chrome -aldehyde tanning -tannery effluents - byproducts – primary - secondary treatments.

UNIT V RADIATION CHEMISTRY (18 Hrs)

Alpha decay- theory of emission - alpha ray energy spectra.- beta decay - decay theory - electron capture-double beta decay - gamma ray – theory of emission - internal conversion - Auger effect-nuclear resonance absorption- principles of mossbauer spectroscopy - radio chemistry yield-applications of radio chemistry- dangers of radiation.

TEXT BOOKS

S.No.	Author's Name	Year of Publication	Title of the Book	Publishers Name
1.	AllaAppaRao	2010	Engineering Chemistry and Environmental Studies	New Age International Publishers
2.	Bansal.R.K	1975	Organic Reaction Mechanisms	Tata McGraw Hill.
3.	Jagdambasingh	2016	Organic synthesis	PragatiPrakashan
4	Skoog, West and Holler	1992	Fundamentals of analytical Chemistry	Saunders College.
5.	B.K.Sharma	2013	Industrial Chemistry	Goel Publishing House
6.	D. K. Asthana and MeeraAsthana,	2012	"Environment - Problems and Solutions",	S.Chand& Co Ltd.
7.	RashmiSanghi, M.M.Srivastava	2012	Green Chemistry: Environment Friendly Alternatives	Narosa Publishing House
8.	H.J.Arnikar	2005	Essentials of Nuclear Chemsitry	New Age International Publishers, New Delhi,

REFERENCE BOOKS

S.No.	Author's Name	Year of Publication	Title of the Book	Publishers Name
1.	V.Kumar	2007	Introduction to Green Chemistry	Vishal publishers
2.	F. A. Carey and R. J. Sundberg	2007	Advanced Organic Chemistry, Parts A and B, 5th Ed.,	Springer, Germany,
3.	V. K. Ahluwalia and R.S Varma	2009	Green Solvents	Narosa Publishers
4.	K.BagavathiSundari	2006	Applied Chemistry	MJP Publishers, Chennai
5.	A.K. Srivatsava and P. Jain	1989	Essentials of Nuclear chemistry	S. Chand, New Delhi,

Pedagogy

E-content, Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion, Video/ Animation.

Course Designers

- **Dr. K. Uma Sivakami,** Assistant Professor, Department of Chemistry.
- **Mrs. A. Sharmila,** Assistant Professor, Department of Chemistry.

Semester-IV	CHEMISTRY OF NANOSCIENCE	Hours/Week-6	
Elective Course-V		Credit-5	
Course Code-19PCH4EC5A		Internal	External
		25	75

Objectives

- To know the basic concepts of nanoscience and synthetic methods of various nano particles.
- To know the ideas of nano clusters, reactions as semiconductors and its social applications like agriculture and food technology.

Course Outcomes

On successful completion of the course, the student will be able to

CO	CO Statement	Knowledge level
CO 1	Classify different types of concerted methods of synthesis of nanomaterials.	K2
CO 2	Identify the nanoparticles by characterization.	K3
CO 3	Distinguish between clusters and naostructures.	K4
CO 4	Discuss the applications in elctrochemical field.	K6
CO 5	Predict the applications of nanosciece in the agricultural and food processing field.	K6

Mapping with Programme Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**M**	**M**	**L**	**S**
CO2	**S**	**S**	**M**	**L**	**S**
CO3	**S**	**M**	**S**	**S**	**S**
CO4	**S**	**M**	**M**	**M**	**S**
CO5	**S**	**S**	**S**	**S**	**S**

S-Strong; M-Medium

SEMESTER -IV
CHEMISTRY OF NANOSCIENCE

2019-2020 ONWARDS

UNIT I SYNTHETIC METHODS (18 HRS)

Nanodimensional materials – unique properties- quantum dots – classification-properties and applications - classification of nanomaterials - synthesis – hydrothermal synthesis- solvo thermal synthesis – microwave irradiation– sol-gel - precipitation technologies – chemical vapour condensation process – sonochemical synthesis – hydrodynamic cavitation.

UNIT II CHARACTERISATION OF NANOSCALE MATERIALS (18 Hrs)

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 Resonance spectroscopy (SPR).

UNITIII CARBON CLUSTERS AND NANOSTRUCTURES (18 Hrs)

Nature of carbon bond− new carbon structures − carbon clusters – discovery of C60−alkali doped C60−superconductivity in C60−larger - 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 - nanowires −synthetic strategies − gas phase and solution phase growth – growth control− properties.

UNIT IV CHEMICAL SENSORS AND BIOSENSORS (18 Hrs)

Biosensor and nanobiosensor - basic concepts – characterization – perception - Enzyme– metal NP hybrids for biosensing - generation of nanostructures- Biomolecule – different types of

nanobiosensors - nano biosensors for medical diagnostics -nanoprobes for analytical applications.

UNIT V NANOTECHNOLOGY IN AGRICULTURE AND FOOD TECHNOLOGY (18 Hrs)

Nanotechnology in agriculture- precision farming, smart delivery system– nanofertilizers: nanourea and mixed fertilizers - nanofertigation – nanopesticides - nanoseed science. Nanotechnology in food industry – nano packaging for enhanced shelf life - smart/intelligent packaging - food processing and food safety and biosecurity– Electrochemical sensors for food analysis and contaminant detection.

TEXT BOOKS

S.No.	Author's Name	Year of Publication	Title of the Book	PublisherName
1.	C. N. R. Rao, A. Muller and A. K. Cheetham .	2004	The Chemistry of Nanomaterials: (Eds), Vol. 1 and 2	Wiley-VCH; Germany, Weinheim
2.	C. P. Poole, Jr: and F. J. Owens	2003	Introduction to Nanotechnology; Wiley Interscience	New Jersey
3.	T. Pradeep, Nano:	2007	The Essentials in Understanding Nanoscience and Nanotechnology; 1st Ed.,	Tata McGraw Hill, New York, 2007
4.	A. A Balandin, K. L.Wang	2006	Handbook of Semiconductor Nanostructures and Nanodevices Vol 1-5.	American scientific publishers
5.	Lynn J. Frewer, Willehm Norde, R. H. Fischer and W. H. Kampers	2011	Nanotechnology in the Agri-food sector	Wiley-VCH Verlag,

REFERENCE BOOKS

S.No.	Authors Name	Year of Publication	Title of the Book	Publishers Name
1	K. J. Klabunde	2009	Nanoscale Materials in Chemistry; 2nd Ed.,	Wiley-Interscience, New York
2	H. Fujita	2003	Micromachines as Tools in Nanotechnology	Springer-Verlag, Berlin
3	W. Kain and B. Schwederski	2013	Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life; 2nd Ed.,	John-Wiley R Sons, New York
4	Q. Chaudry, L.Castle and R. Watkins	2010	Nanotechnologies in Food	RSC Publications

Websites

Home page of Prof. Ned Seeman - http://seemanlab4.chem.nyu.edu/

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

Nanotation - http://www.acsnanotation.org/

Pedagogy

E-content, Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion, Video/ Animation.

Course Designers

- **Dr. G.Sivasankari**, Assistant Professor, Department of Chemistry
- **Dr.K. Shenbagam**, Assistant Professor, Department of Chemistry

Semester-IV	BIOFUELS	Hours/Week-6	
Elective Course-V		Credit-5	
Course Code-19PCH4EC5B		Internal	External
		25	75

Objectives

- To understand basic concepts about biomass derived energy
- To acquire the concept of 1st generation, 2nd generation and advance biofuels
- To understand terminologies related to biomass conversion and biofuel production
- To describe techno-economic analyses of biofuel conversion technologies
- To apply biomass-derived energy in different applications

Course outcome

CO	CO statement	Knowledge level
CO1	Implentation of technologies for the production of biofuels by developing innovative ideas.	K2
CO2	Stabilize the knowledge on digestion and fermentation process for gaseous fuels from organic substrates of different origin	K3
CO3	Diagnose global impacts of biofuels on food and energy supplies	K4
CO4	Compile the regulations limits with Indian Standards	K5

Mapping with Programme Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**S**	**S**	**M**
CO2	**S**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**M**	**S**	**M**
CO4	**S**	**S**	**S**	**S**	**M**

S-Strong; M-Medium

SEMESTER -IV

BIOFUELS

2019-2020 ONWARDS

UNIT I BIOFUELS (18 Hrs)

Classification of biofuels- solid-liquid - gaseous fuels- production processes - raw materials – products – Generation – first – second - third - fourth generation of biofuels Concepts of biorefinery - alternative energies - environmental - economic and regulatory issues- value added processing of biofuel residues - co-products.

UNIT II SOLID BIOFUELS (18 Hrs)

Structure - properties of cellulose - isolation and applications of lignin - pretreatment/fractionation by dilute acid - steam explosion - organosolvent and ammonia fiber explosion (AFEX) methods - biochemical conversion of lignocellulosic to alcohols by separate hydrolysis and fermentation (SHF) - simulatneous sacchrification and fermentation (SSF) process - thermal conversion of biomass to liquid fuels by gasification - pyrolysis.

UNIT III LIQUID BIOFUELS (18 Hrs)

Characteristics - significance of liquid biofuels - production - refined oils as fuel hydrogenation of unsaturated lipids - Fischer-Tropsch process for the production of hydrocarbons from syngas - bioethanol- raw materials - pretreatment processes- enzymatic hydrolysis and fermentation – recovery - uses – regulations - production of Ethyl ter-butyl ether (ETBE) biodiesel- trans esterification - raw materials - pretreatment process- separation – purification - quality- uses - regulations.

UNIT IV GASEOUS BIOFUELS I (18 Hrs)

Characteristics and scope of gaseous biofuels- Energy conversion process- anaerobic digestion- acidogenesis – acetogenesis – methanogensis - disintegration – hydrolysis - environmental and optimization conditions for production of gaseous biofuels – temperature –pH – alkalinity- nutrients - organic loading rate - solid and hydraulic retention time - granulation of anaerobic biomass.

UNIT V GASEOUS BIOFUELS II **(18 Hrs)**

Composition and uses of biogas- pretreatment and post treatment to anaerobic digestion-production - batch reactor - Continous Stirrer Tank Reactor (CSTR) with recirculation of biomass - conversion of solid substrates (cattle manure, municipal organic waste, sewage sludge, industrial organic waste) into biogas - economic regulatory issues - conversion of wastewater with high organic content into biogas- environmental- energy - economic and regulation issues.

TEXTBOOKS

S.NO	Author Name	Year of Publication	Title of the book	Publishers Name
1	B.K.Sharma	2014	Environmental chemistry	Krishanan pumblications
2	Rao, M.N and Datta, A.K	2007	Wastewater treatment	Oxfod and IBH publishers
3	Robert C.Brown	2003	Biorenewable resources: Engineering new products from Agriculture	Wiley Publishers
4	Mousdale	2008	Biofuels: Biotechnology, chemistry & Sustainble development	CRC Press

REFERENCE BOOKS

S.NO	Author Name	Year of Publication	Title of the book	Publishers Name
1	Mark Hammer	1975	Water and Wastewater Technology	Pearson
2	Sharma,B.K	2001	An Introduction to Environmental pollution	Krishna Prakashan media
3	Caye Drapcho, Terry Walker	2008	Biofuels Engineering Process Technology	Mc Graw Hill

4.	Sunggyu Lee & Y.T. Shah	2013	Biofuels and Bioenergy Process Technologies	CRC Press

Pedagogy: Lecture, Powerpoint Presentation, Videos, OHP Presentation, Seminar, Group Discussion, Assignment and Quiz.

Course Designers

- **Ms. Pungayee Alias Amirtham,** Assistant Professor and Head, Department of Chemistry
- **Dr. R. Subha,** Assistant Professor, Department of Chemistry