KONGUNADU ARTS AND SCIENCE COLLEGE

(Autonomous)
Re-accredited by NAAC with 'A' Grade 3.64 CGPA (3rd Cycle)
College of Excellence (UGC)
Co-Educational Institution Approved by UGC, New Delhi

G.N.Mills Post, Coimbatore - 641029, Tamilnadu, INDIA

DEPARTMENT OF CHEMISTRY (PG & RESEARCH)

CURRICULUM AND SCHEME OF EXAMINATIONS (CBCS)

(2019 – 2020 AND ONWARDS)

KONGUNADU ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

COIMBATORE – 641 029

VISION OF THE COLLEGE

Developing the total personality of every student in a holistic way by adhering to the principles of **Swami Vivekananda** and **Mahatma Gandhi**.

MISSION OF THE COLLEGE

- Imparting holistic and man-making education with emphasis on character, culture and value - moral and ethical.
- Designing the curriculum and offering courses that transform its students into value added skilled human resources.
- Constantly updating academic and management practices towards total quality management and promotion of quality in all spheres.
- Extending the best student support services by making them comprehensive and by evolving a curriculum relevant to student community and society at large.
- Taking steps to make education affordable and accessible by extending scholarships to the meritorious and economically disadvantaged students.
- Moulding the teachers in such a way that they become the role models in promoting Higher Education.

DEPARTMENT OF CHEMISTRY (PG & RESEARCH)

VISION AND MISSION OF THE DEPARTMENT

The Department of Chemistry (PG & Research) aims at holistic development through academic excellence, employability, acquisition of scientific skills and higher research.

PROGRAMME OUTCOMES (PO)

PO 1 : Assimilate advanced knowledge in the core subject with relevant practical inputs.

PO 2 : Incorporate a more significant and superior knowledge in the major areas of chemistry – Organic chemistry, Inorganic Chemistry and Physical Chemistry.

PO 3 : Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practice.

PO 4 : Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 5 : Comprehend and write effective reports, design documentation and make effective presentations.

PO 6: Demonstrate attitude, skills and knowledge of a well - groomed personality at work and social environment.

PO 7: Broaden professional foundation through activities such as teaching (seminars), internships, industrial visits and projects.

PO 8 : Build up problem solving, decision-making and communication skills with the educated community.

PROGRAMME SPECIFIC OUTCOMES (PSO)

Upon completion of the programme,

PSO 1 : The students are enabled to integrate the chemistry of many natural products, organic compounds, inorganic compounds, intermediate compounds, drugs and biologically important compounds.

PSO 2 : The students will be proficient in the advanced level understanding of all the areas of chemistry, for facing competitive exams like NET, SET, GATE, etc.,

PSO 3 : The students will be able to clearly articulate scientific information in oral, written and electronic formats.

PSO 4 : The students will be skilled in examining specific phenomena theoretically and /or experimentally, and the graduate is able to contribute to the generation of new scientific insights or to the innovation of new applications of chemical research.

PSO 5 : The students will appreciate the central role of chemistry in our society and use this as a basis for ethical behavior in issues facing chemistry including an understanding of safe handling of chemicals, environmental issues and key issues of our society in energy, health and medicine.

KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)
COIMBATORE – 641 029
Course Name: M.Sc., Chemistry
Curriculum and Scheme of Examination under CBCS
(Applicable to students admitted during the academic year 2019 – 2020)

Semester	Course code / Q.P.Code	Title of the Course	Instruction hours/cycle	Exam. Marks			Duration of Exam (Hrs)	Credits
				CIA	ESE	Total		
I	19PCH101	C.P.-1- Organic Chemistry - I	5	25	75	100	3	5
	19PCH102	C.P. 2 - Inorganic Chemistry - I	5	25	75	100	3	5
	19PCH103	C.P. 3 - Physical Chemistry - I	5	25	75	100	3	5
	19PCH1E1	ME-1 Major Elective - I	5	25	75	100	3	5
		C.Pr.1 - Organic Chemistry Practical - I	3	-	-	-	-	-
		C.Pr.2 - Inorganic Chemistry Practical-I	3	-	-	-	-	-
		C.Pr.3 - Physical Chemistry Practical-I	4	-	-	-	-	-
		Total	**30**			**400**		**20**
II	19PCH204	C.P. 4 - Organic Chemistry - II	5	25	75	100	3	5
	19PCH205	C.P. 5 - Inorganic Chemistry - II	5	25	75	100	3	5
	19PCH2E2	ME-2 - Major Elective - II	5	25	75	100	3	5
	19PCH2CL	C.Pr.1 - Organic Chemistry Practical - I	5	40	60	100	6	3
	19PCH2CM	C.Pr.2 - Inorganic Chemistry Practical-I	5	40	60	100	6	3
	19PCH2CN	C.Pr.3 - Physical Chemistry Practical-I	5	40	60	100	6	2
		Total	**30**			**600**		**23**
III	19PCH306	C.P. 6 - Physical Chemistry - II	5	25	75	100	3	5
	19PCH307	C.P.7 - Organic Chemistry - III	5	25	75	100	3	5
	19PCH308	C.P.8- Inorganic Chemistry-III	5	25	75	100	3	5
	19PCH3N1	NME- 2 - Non-Major Elective - I	5	25	75	100	3	5
	19PCH3CO	C.Pr.4 - Physical Chemistry Practical - II	4	40	60	100	6	2
		C.Pr.5 - Organic Chemistry Practical - II	3	-	-	-	-	-
		C.Pr.6 - Inorganic Chemistry Practical- II	3	-	-	-	-	-
		Total	**30**			**500**		**22**
IV	19PCH409	C.P.9 - Physical Chemistry - III	5	25	75	100	3	5
	19PCH410	C.P. 10 - Spectroscopy	5	25	75	100	3	5
	19PCH4N2	NME- 2 - Non-Major Elective - II	5	25	75	100	3	5
	19PCH4CP	C.Pr.5 - Organic Chemistry Practical - II	5	40	60	100	6	2
	19PCH4CQ	C.Pr.6 - Inorganic Chemistry Practical-II	5	40	60	100	6	2
	19PCH4Z1	Project Work & Viva -Voce	5	40	160	200	-	6
		Total	**30**			**700**		**25**
Total						**2200**		**90**

Major Electives papers

(2 papers are to be chosen from the following 4 papers)

1. Analytical Techniques in Chemistry
2. Green and Nano Chemistry
3. Bioinorganic chemistry
4. Selected topics in chemistry

Non-Major Electives papers

(2 papers are to be chosen from the following 4 papers)

1. Chemistry of Environment
2. Scientific thesis writing
3. Textile and Dye Chemistry
4. Industrial Chemistry

Tally Table

S.No	Subject	No. of Subjects	Marks	Credits	Total	
					Marks	Credits
01	**Core**				1800	70
	i. Theory	10	1000	47		
	ii. Practicals	06	600	17		
	iii. Project work	01	200	06		
02	Major Electives	02	200	10	200	10
03	Non-Major Electives	02	200	10	200	10
		Total			**2200**	**90**

- 25 % CIA is applicable to all subjects except JOC, COP and SWAYAM courses which are considered as extra credit courses.

- The students are advised to complete a **SWAYAM-MOOC** before the completion of the 3rd semester and the course completed certificate should be submitted to the HOD. Two credits will be given to the candidates who have successfully completed.

- A **Field Trip** preferably relevant to the course should be undertaken every year.

Note :

CBCS – Choice Based Credit system

CIA – Continuous Internal Assessment

ESE – End of Semester Examinations

Extra credit courses

JOB ORIENTED COURSE								
Semester	**Course code / Q.P.Code**	**Title of the Course**	**Instruction hours/cycle**	**Exam. Marks**			**Duration of Exam (Hrs)**	**Credits**
				CIA	**ESE**	**Total**		
	19PCH0J1	JOC - Pharmaceutical Chemistry	6	-	100	100	3	2
ADVANCED LEARNER COURSES ***(UNDER SELF STUDY SCHEME)***								
	19PCH0D1	ALC- 1 Chemistry of Corrosion and its Prevention	-	-	100	100	3	2
	19PCH0D2	ALC- 2 Chemistry of Drugs	-	-	100	100	3	2
	19PCH0D3	ALC- 3 Food Chemistry	-	-	100	100	3	2

JOC is conducted for 6 hours per cycle outside the college hours.

Components of Continuous Internal Assessment

Components		**Marks**	**Total**
Theory			
CIA I	75	(75+75 = 150/10)	25
CIA II	75	15	
Assignment/Seminar		5	
Attendance		5	
Practical			
CIA Practical		25	40
Observation Notebook		10	
Attendance		5	
Project			
Review		30	40
Regularity		10	

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remembering;**K2**-Understanding;**K3**-Applying;**K4**-Analyzing;**K5**-Evaluating

1. Theory Examination

CIA I & II and ESE: 75 Marks

Knowledge Level	Section	Marks	Description	Total
K1 Q1 to 10	A (Answer all)	10 x 1 = 10	MCQ	75
K2 Q11 to 15	B (Either or pattern)	5 x 5 = 25	Short Answers	
K3 & K4 Q16 to 20	C (Either or pattern)	5 x 8 = 40	Descriptive / Detailed	

2. Practical Examination:

Knowledge Level	Section	Marks	Total
K3	Experiments	50	60
K4	Record Work	10	
K5			

3. Project Viva Voce:

Knowledge Level	Section	Marks	Total
K3	Project Report	120	160
K4	Viva voce	40	
K5			

QUESTION PAPER PATTERN FOR ESE

JOC and ALC

Maximum marks: 100

Section	Marks	Description	Total
A (Answer all) Q.No.1 to 10	10 X 1 = 10	**MCQ**	**100**
B (Either or pattern) Q.No.11 to 15	5 X 6 = 30	**Short Answers**	
C (Either or pattern) Q.No.16 to 20	5 X 12 = 60	**Descriptive / Detailed answers**	

19PCH101

Programme Code: 04		**M.Sc., Chemistry**		
Course Code: 19PCH101		**C.P.1 – Organic Chemistry I**		
Batch	Semester	Hours / Week	Total Hours	Credits
2019-2021	I	5	75	5

Course Objectives

1. To motivate the students to comprehend a knowledge on aromaticity and reaction mechanism.
2. To gain understanding in addition reactions, electrophilic and nucleophilic substitution reactions and disconnection approach.
3. To enable the students to elucidate the structure of some terpenoids compounds.

Course Outcomes (CO)

K1	**CO1**	Remember the rules of aromaticity, postulates of different types of reaction mechanism and retain information about some intermediate compounds
K2	**CO2**	Understand the mechanisms of electrophilic and nucleophilic substitution reactions
K3	**CO3**	Apply the guidelines of retro synthetic approach in solving problems in the planning of organic synthesis
K4	**CO4**	Sketch and analyze the synthesis of some terpenoid compounds

Syllabus

UNIT – I: AROMATICITY (15 hrs)

Huckel's rule – aromaticity in 5 and 6 membered rings (recall). Aromatic systems with electron numbers other than six – systems of two electrons, four electrons (anti aromaticity), eight electrons, ten electrons and more than ten electrons- homo and heteroaromatic compounds – annulenes.

INTERMEDIATES

Generation, Structure and stability of carbocations, carbanions, free radicals, carbenes, nitrenes. Reaction mechanism: – study of intermediates, isotopic labeling, stereo chemical studies and cross over experiments – Hammonds postulate – Hammett equation –Taft equation.

UNIT – II: ELECTROPHILIC SUBSTITUTION REACTIONS (15 hrs)

Aliphatic electrophilic substitution: SE1 and SE2 reactions - mechanisms and reactivity - keto-enol tautomerism - halogenation of carbonyl compounds - Stork enamine reactions.

Aromatic electrophilic substitution – Arenium ion mechanism – Orientation and reactivity of mono and di substituted benzene - nitration - halogenation and sulphonation - Friedel Crafts alkylation - Friedel Crafts arylation (Scholl reaction) and Friedel Crafts acylation - Jacobsen reaction - formylation with (i) disubstituted formamides (Vilsmeyer- Haack reaction) (ii) zinc cyanide and HCl (Gattermann reaction) (iii) chloroform (Reimer - Tiemann reaction) - carboxylation with (i) carbonyl halides (ii) carbon dioxide (Kolbe Schmidt reaction) - cyanodehydration of aldehydes and ketones (Bradsher reaction) - acylation with nitriles (Hoesch reaction).

UNIT – III NUCLEOPHILIC SUBSTITUTION REACTIONS (15 hrs)

Aliphatic nucleophilic substitution- SN1, SN2, SNi and neighbouring group mechanisms - kinetics - effects of structure, solvent and leaving and entering group - stereochemistry - hydrolysis of esters - Wurtz reaction - Claisen and Dieckmann condensation - Williamson reactions.

Aromatic nucleophilic substitution- SNAr and Benzyne mechanisms - Ziegler alkylation - Chichibabin reaction - Cine substitution.

UNIT– IV: SYNTHETIC METHODOLOGY (15 hrs)

Retrosynthetic approach - synthons and synthetic equivalents– guidelines for disconnections - functional group interconversion- one group c-x disconnection –1,1- 1,2 and- 1,3-two group c-x disconnections- one group disconnection C-C, alcohols, carbonyl – regio selectivity – use of acetylenes, aliphatic nitro compounds in organic synthesis- reversal of polarity- order of events, protecting groups.

UNIT – V: TERPENOIDS (15 hrs)

Isoprene rule, isolation, classification and biogenesis of terpenoids*, structural elucidation and synthesis of Caryophyline, Zingiberene, β-Eudesmol, Abeitic acid.

*Denotes self study portion

Teaching methodology

Chalk & talk, power point presentation, e-content, numerical exercises, assignment, quiz, seminar.

Text Books

1. Jerry March (2007) Advanced Organic Chemistry, Wiley eastern limited, Sixth Edition, New Delhi.
2. Jagdamba Singh, L. D. S. Yadav (2006) Advanced Organic Chemistry, Second Revised edition, Pragati Prakashan Educational publications, Meerut, India.
3. Jagdamba Singh, L. D. S. Yadav (2006) Organic Synthesis, Pragati Prakashan Educational Publications, Meerut, India.
4. I.L. Finar (2014) Organic Chemistry, Vol.I, 6th ,Vol. II, 5th Edition, Addison Wesley Longman Ltd.
5. O. P. Agarwal (2007) Natural product Chemistry, 20th Edition, Goel Publishing house.
6. Janice Gorzynski Smith (2007) Organic chemistry, 2nd edition, McGrawHill Publishing.

Reference Books

1. Clayden, Greeves, Warren (2001) Organic Chemistry, Oxford University Press.
2. P.S. Kalsi (2000) Organic Reaction Mechanism, New Age international publishers, India.
3. V.K.Ahluwalia and Rakesh kumar Parashar (2016) Organic reaction mechanisms, Fourth edition, Narosa publishing house.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	M	M	H
CO2	S	H	M	S	M
CO3	H	M	L	H	S
CO4	S	M	H	M	L

S-Strong H-High M-Medium L-Low

19PCH102

Programme Code: 04		**M.Sc., Chemistry**		
Course Code : 19PCH102		**C.P.2 – Inorganic Chemistry I**		
Batch 2019-2021	Semester I	Hours/Week 6	Total Hours 75	Credits 5

Course Objectives

1. To introduce the principles and applications of solid state and nuclear chemistry.
2. To learn about inorganic crystals and structural determination methods
3. To acquire the knowledge of periodic properties and f-block elements, nuclear model, modes of decay and detection, measurement of radio activity, nuclear reactors and applications.

Course Outcomes (CO)

K1	CO1	Take into account the periodic properties of atoms and theories of acids and bases
K2	CO2	Appreciate the structures of some ionic solids and spinels
K3	CO3	Apply the theory of X-Ray Diffraction to solve the structure of a cubic system
K4	CO4	Analyze the properties of *f*-block elements and applications of radioisotopes

Syllabus

UNIT – I: PERIODIC PROPERTIES AND ACID-BASE CONCEPTS (15 hrs)

Periodic properties of atoms – ionic radii, ionization energy, electron affinity, electronegativity – Pauling's and modern scales of electronegativity, Acid-base concept – Arrhenius concept, Bronsted-Lowry concept, Lux-Flood concept, Usanovich concept and Lewis concept, measurement of acid and base strength, HSAB – principle, theory and applications.

UNIT – II: STRUCTURE AND BONDING (15 hrs)

Introduction, close packing of atoms and ions – bcc, fcc and hcc voids –radius ratio rule – derivation – its influence on structures – structures of NaCl, CsCl, rutile, fluorite, antifluorite, zinc blende, wurtzite,– spinels – normal and inverse spinels and perovskite – lattice energy of ionic crystals – Born Haber cycle and its applications, VSEPR theory with applications to inorganic compounds.

Solid state defects - Stoichiometric and non-stoichiometric defects- electrical properties of solids – insulators –intrinsic and extrinsic semiconductors (n and p type), band theory - superconductors.

UNIT – III: SOLID STATE AND CRYSTALLOGRAPY (15 hrs)

Lattices and unit cells- the crystal systems and Bravais lattices – Miller indices and labeling of planes – symmetry properties – crystallographic point groups and space groups. Fundamentals of X-ray diffraction – powder and rotating crystal methods – systematic absences and determination of lattice type – analysis of X-ray data for cubic system – electron and neutron diffraction.

UNIT – IV: NUCLEAR CHEMISTRY (15 hrs)

Radioactivity – decay constant – half-life period – artificial transmutation – G.M. Counter – Scintillation counter – nuclear forces – nuclear fission and fusion reactions – nuclear models-single particle –liquid drop – nuclear accelerators – linear accelerators – cyclotron, synchrocyclotron, betatron – nuclear reactors – fast breeder reactors – power reactors - radioisotopes and their applications-radioactive isotopes as tracers, analytical, medicinal, agriculture, nuclear power projects in India.

UNIT – V: CHEMISTRY OF LANTHANIDES AND ACTINIDES (15 hrs)

Lanthanide series – electronic configuration – oxidation states – magnetic properties – colour – ionic radii – lanthanide contraction – chemical reactivity and complex formation – extraction of a mixture of lanthanides from monazite sand – separation of lanthanides – ion exchange method. Actinide series – sources of actinide – preparation of transuranic elements – electronic configurations – oxidation state – colour and complex formation – extraction of thorium from monazite sand and isolation of uranium from pitchblende- comparison of lanthanides and actinides, uses of lanthanides and actinides*.

***** Denotes self study

Teaching methods

Lecture by chalk & talk, Power point Presentations, Group discussions, Seminar, Quiz, Assignment, create models.

Text Books

1. Lee J. D (2009) Concise Inorganic Chemistry, Fifth edition, S.P. Printers, Delhi.
2. J.E. Huheey, E.A. Keiter (2013) Inorganic chemistry principles of structure and reactivity, 16th Edn, Pearson Noida.
3. Gary L. Miessler, Donald A. Tarr (2003) Inorganic Chemistry, 3rd edition, Prentice Hall.
4. H. J. Arnikar (2007) Essential of Nuclear chemistry 4th Edition, New Age International Publishers.

Reference Books

1. U. N. Dash (1971) Nuclear Chemistry 1st Edition.
2. Cotton F. A.and G. Wilkinson (2007) Advanced Inorganic Chemistry**,** Sixth edition, John Wiley & Sons, Inc.
3. Keith F. Purcell and John C. Kotz (2012) Inorganic Chemistry, W.B.Saunders Company.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	S	H	S
CO2	S	S	S	M	H
CO3	S	H	M	S	S
CO4	S	S	S	S	S

S-Strong H-High M-Medium L-Low

19PCH103

Programme Code: 04		**M.Sc., Chemistry**		
Course Code : 19PCH103		**C.P.3 – Physical Chemistry I**		
Batch 2019-2021	Semester I	Hours/Week 5	Total Hours 75	Credits 5

Course Objectives

1. To make the students to comprehend knowledge on symmetry elements, symmetry operations and rate of the reactions
2. To illustrate symmetry concepts and to demonstrate the scope of the symmetry and group theory to inorganic chemistry
3. To know the principles of chemical kinetics to allow exploration of gas-phase and liquid-phase reactions.

Course Outcomes (CO)

K1	CO1	Keep in mind different symmetry operations and recollect rate of chemical reactions
K2	CO2	Realize the relationship between symmetry and point groups and differences between homogenous and heterogeneous catalysis, and polymer kinetics
K3	CO3	Predict degeneracy, to classify vibrational modes and determine rate of different reactions
K4	CO4	Investigate various adsorption isotherms and evaluate kinetics of polymerization reaction

Syllabus

UNIT – I: GROUP THEORY-I **(15 hrs)**

Symmetry elements and symmetry operations, identity element, centre of symmetry, plane of symmetry, proper and improper axes of symmetry, groups – definition, properties, types of groups- Abelian group, non-abelian group, sub group, isomorphic group – similarity transformation and classes – group multiplication table for C_{2v} and C_{3v} point groups – symmetry classification of molecules into point groups (Schoenflies symbol only), Group theory and dipole moment.

Matrices: definition of matrix, types -square, diagonal, null, unit, row, column, symmetric and skew symmetric- addition and subtraction of matrices – matrix representations of symmetry operations.

UNIT – II: GROUP THEORY-II (15 hrs)

Representation of point groups - definition, types (reducible and irreducible representations), the Great orthogonality theorem, significance and its consequences (proof not needed), character tables-construction of the character table for C_{2v} and C_{3v} point groups, reduction of reducible representations.

Application of group theory to bonding: hybridization scheme for orbital in AB_3 (planar), $AB_4(T_d)$, $AB_5(D_{3h})$ and $AB_6(O_h)$ type of molecules.

Group theory and vibrational spectroscopy – direct product representation, vibrational modes as basis for group representation, symmetry selection rule for IR and Raman spectra (mutual exclusion principle), classification of vibrational modes.

UNIT – III: CHEMICAL KINETICS I (15 hrs)

Theories of reaction rates – Arrhenius theory, collision theory- classical collision theory - modified collision theory - weaknesses of collision theory, Absolute reaction rate or Transition state theory – Statistical mechanical derivation of rate equation - thermodynamical formulation of reaction rate - comparison of collision theory and absolute reaction rate theory.

Kinetics of fast reactions - relaxation methods - temperature jump method - flow method* - pulse method - flash photolysis.

Reactions in solutions: collision in solution - Cage effect, salt effect- primary and secondary salt effects - significance of salt effect.

UNIT – IV: CHEMICAL KINETICS II (15 hrs)

Homogenous catalysis – specific and general acid - base catalysis - kinetics of acid -base catalysed reactions. Enzyme catalysis – Michaelis - Menton equation – influence of pH and temperature on enzyme catalysis.

Heterogenous catalysis: surface reactions – kinetics of surface reactions - unimolecular surface reactions - bimolecular surface reaction - Langmuir-Hinshelwood mechanism. pH-dependence of rate constant of catalyzed reactions.

Auto catalysis - oscillating reactions - mechanisms of oscillating reactions (Lotko -Volterra, Brusselator and Oregonator).

UNIT –V: POLYMER KINETICS (15 hrs)

Classification of polymers-kinetics and mechanism of polymerization-free radical, ionic and co-ordination, Ziegler-Natta polymerization-degree of polymerization-molecular weights and their determination-average molecular weight –number average and weight average molecular weight-sedimentation and viscosity average molecular weights – kinetics of free radical chain polymerization (derivation of rate equation, kinetic chain length and degree of polymerization), process of polymerization – bulk, solution, suspension and emulsion.

***** Denotes self study

Teaching methods

Lecture by chalk & talk, Power point Presentations, Group discussions, Seminar, Quiz, Assignment, create models.

Text Books

1. K. V. Raman (2004) Group Theory and its applications to chemistry, Tata McGraw Hill publishing company Ltd.
2. F. A. Cotton (2009) Chemical applications of group theory, 3rd Edition, A Wiley Interscience Publication.
3. S. Swarnalakshmi, T. Saroja, R. M. Ezhilarasi (2009) A Simple approach to group theory in chemistry, University press.
4. V. R. Gowariker & N. V. Viswanathan (2010) Polymer Science, New Age International Pvt Ltd publishers.
5. K. J. Laidler (2011) Chemical kinetics, 3rd Edition, Tata McGraw Hill Ltd.
6. Steinfeld, Francisco and Hase, Chemical Kinetics and Dynamics, 2ndedition, Prentice HallInternational . Inc
7. Santhosh K. Upadhyay, Chemical Kinetics and Reaction Dynamics,Springer, 2006.
8. Richard I. Masel, Chemical Kinetics and Catalysis , Wiley Interscience, 2001.

Reference Books

1. Veera Reddy (2009) Symmetry and Spectroscopy of molecules, New Age International.
2. Gurdeep Raj (2014) Chemical kinetics, 6th Edition, Goel Publishing House.
3. P. W. Atkins (2009) Physical Chemistry, 8th Edition, Oxford University Press.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	M	M
CO2	H	M	S	M	S
CO3	M	S	H	S	S
CO4	H	S	H	S	M

S-Strong H-High M-Medium L-Low

19PCH204

Programme Code: 04		**M.Sc., Chemistry**		
Course Code: 19PCH204		**C.P.4 – Organic Chemistry II**		
Batch 2019-2021	Semester II	Hours/Week 5	Total Hours 75	Credits 5

Course Objectives

1. To gain knowledge about mechanism of elimination and addition reactions.
2. To enable a comprehensive knowledge on conformational analysis and stereochemistry, concerted reactions and pericyclic reactions of organic compounds to the students.
3. To give a thorough introduction to the study of organic photochemistry and isolation, general structural elucidation of alkaloids.

Course Outcomes (CO)

K1	**CO1**	Recollect the basic mechanism of addition and elimination reactions.
K2	**CO2**	Comprehend different types of notations in stereochemistry
K3	**CO3**	Relate correlation and FMO approach for electrocyclic, cycloaddition and Sigmatropic reactions.
K4	**CO4**	Analyze the structural elucidations of some alkaloids

Syllabus

UNIT – I: ADDITION AND ELIMINATION REACTIONS (15 hrs)

Addition to C-C and C-O multiple bonds - electrophilic, nucleophilic and free-radical additions - additions to conjugated systems - orientation - Birch reduction - Hydroboration - Michael condensation - carbene addition to double bonds - hydration of olefins. Mannich reaction - Meerwein-Pondorf reduction - Grignard reactions - Aldol - Claisen - Stobbe - Wittig and Benzoin condensations - Cannizarro reaction.

Elimination reactions - E1 and E2 mechanisms - orientations – E1CB mechanism - Hofmann and Saytzeff rules - Chaugav reaction - Hofmann degradation and Cope elimination.

UNIT – II: CONFORMATIONAL ANALYSIS AND STEREOCHEMISTRY (15 hrs)

Fischer- Newman and Sawhorse projection-R and S notation: stereochemistry of sulphur and nitrogen compounds, geometrical isomerism – E & Z configuration – Enantiotopic and diastereotopic atoms, groups and faces, Stereospecific and stereoselective syntheses -

asymmetric synthesis -conformation of cyclic systems – cyclohexane derivatives (mono,di-substituted), decalins, perhydrophenanthrene, effect of conformation and reactivity in cyclic systems- conformations of biphenyls, allenes and spiranes.

UNIT – III: CONCERTED REACTIONS (15 hrs)

Conservation of orbital symmetry – Woodward-Hoffman selection rule for electrocyclic reaction, cycloaddition reaction, sigmatropic rearrangement.

Electrocyclic reactions – 1,3-diene and 1,3,5-triene, analysis of stereochemistry using correlation diagram and FMO method.

Cycloadditions: (π2s + π2s) Correlation and FMO approach, (π2s + π4s) - Diels-Alder reactions – analysis of stereochemistry by correlation diagram and FMO methods.

Sigmatropic rearrangements – analysis of sigmatropic rearrangements by FMO method-1,3&1,5-sigmatropic rearrangements – other sigmatropic shifts- Cope and Claisen rearrangements, the perturbation theory of pericyclic reactions. (Basic ideas only), 1,3 dipolar addition.

UNIT – IV: ORGANIC PHOTOCHEMISTRY (15 hrs)

Laws of photochemistry*, quantum yield, physical and chemical actinometry, Jablonski diagram, photophysical processes – Fluorescence, phosphorescence, internal conversion and intersystem crossing, photosensitization and quenching, Typical photochemical reactions – Norrish type I and type II reactions, Patterno-Buchi reaction, photoreduction, photo oxidation, Cis-trans isomerization, photochemistry of arenes, di-π methane rearrangement.

UNIT – V: ALKALOIDS (15 hrs)

Isolation and general structural methods of elucidation of alkaloids, structural elucidation and synthesis of Morphine, Reserpine, Atropine and Quinine.

*Denotes self study portion

Teaching methodology

Chalk & talk, power point presentation, e-content, numerical exercises, assignment, quiz, seminar.

Text Books

1. Jagdamba Singh, L. D. S. Yadav (2006) Organic Synthesis, Pragati Prakashan Educational Publications, Meerut, India.
2. P. S. Kalsi (2005) Stereochemistry, Conformation and Mechanism (6th edn.), New age international publishers.
3. Jagdamba Singh and Jaya Singh (2014) Photo Chemistry and Pericyclic reactions, 3rd Revised Edition, New Age International Publisher.
4. Rastogi.K.K, Mukherjee (2002) Fundamentals of photochemistry, Revised edition, New age international publications.
5. O. P. Agarwal (2012) Natural product Chemistry, 20th Edition, Goel Publishing house.

Reference Books

1. Jerry March (2014) Advanced organic chemistry, 6th Edition, A Wiley eastern limited, New Delhi.
2. D. Nasipuri (2012) Stereochemistry of organic compounds, Publisher, New Age International.
3. Ernest. L. Eliel (2008) Stereochemistry of carbon compounds, McGraw-Hill, New York.
4. I.L. Finar (2014) Organic Chemistry, Vol.I, 6th ,Vol.II, 5th Edition, Addison Wesley Longman Ltd.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	M	H	M
CO2	H	S	S	M	S
CO3	H	S	M	H	H
CO4	M	H	H	H	M

S-Strong H-High M-Medium L-Low

19PCH205

Programme Code: 04		**M.Sc., Chemistry**		
Course Code : 19PCH205		**C.P.5 – Inorganic Chemistry II**		
Batch 2019-2021	Semester II	Hours/Week 5	Total Hours 75	Credits 5

Course Objectives

1. To promote an awareness about bonding in coordination complexes to the students.
2. To gain knowledge in term symbols and electronic spectra of complexes.
3. On successful completion of the syllabus, the students should have known about theories of bonding in inorganic complexes and application, substitution reaction mechanism of coordination complexes, electron transfer mechanism of coordination complexes and magnetic behavior.

Course Outcomes (CO)

K1	CO1	Bear in mind the nomenclature of coordination compounds and geometries of complexes with different coordination numbers
K2	CO2	Understand the postulates of Crystal Field Theory and Molecular Orbital Theory and compare them
K3	CO3	Evaluate Term symbols, study and analyse Orgel and Tanabe-Sugano diagrams of coordination complexes
K4	CO4	Formulate the mechanism of reactions of transition metal complexes

Syllabus

UNIT – I: CO-ORDINATION CHEMISTRY I (15 hrs)

Recall the nomenclature of coordination compounds - types of ligands - coordination number- Structure of coordination compounds with reference to the existence of various coordination numbers - complexes with coordination number two - complexes with coordination number three - complexes with coordination number four - tetrahedral and square planar complexes - complexes with coordination number five - regular trigonal bipyramidal and square pyramidal - coordination number six - distortion from perfect octahedral symmetry - trigonal prism - geometrical isomerism in octahedral complexes - coordination number seven and eight.

UNIT – II: COORDINATION CHEMISTRY II (15 hrs)

Theories of bonding - valence bond theory - principle and limitations – crystal field splitting in octahedral, square planar, tetrahedral complexes – CFSE- factors influencing the magnitude of Δ_0 – applications of CFSE, applications of CFT – Jahn-Teller distortions - limitations - LFT and MOT- applications to octahedral complexes – (σ - bonding) – tetrahedral, square planar complexes – comparison of different theories.

UNIT – III: COORDINATION CHEMISTRY III (15 hrs)

Magnetic properties of tetrahedral and octahedral complexes- spin cross over rule - microstates of electron configuration in free atoms and ions –term symbols for equivalent and non-equivalent electrons- possible term symbols for given configuration – p^2 - d^2 – splitting of terms in square planar, tetrahedral , octahedral fields- Electronic spectra of d^1, d^2 , d^8 d^9 complexes – selection rules - spin orbit coupling -assignment and intensities of transitions – Orgel (d^1 to d^9 octahedral and tetrahedral complexes) and Tanabe Sugano diagrams(d^1 ,d^6 complexes and its applications)- calculation of Δ_0 and β and Racah parameters – examples from d^2 , d^3 d^7, d^8 octahedral complexes- CT spectra of metal complexes.

UNIT IV: REACTION MECHANISM OF METAL COMPLEXES I (15 hrs)

Ligand substitution reactions in octahedral, square planar complexes- labile and inert complexes– dissociation, association mechanism – Mechanism of hydrolysis reactions – acid hydrolysis – base hydrolysis – anation reactions – trans effect – theories and application - Thermodynamic and kinetic stability of complexes – factors affecting stability of metal complexes – experimental determination of stability constant of complexes.

UNIT V: REACTION MECHANISM OF METAL COMPLEXES II (15 hrs)

Electron transfer reactions – one electron transfer reactions – inner sphere mechanism – outer sphere mechanism - two electron transfer reactions – complementary and non – complementary electron transfer reactions – synthesis of complexes using electron transfer reactions-metal assisted reactions – Aldol condensation – ester hydrolysis –amide hydrolysis – template effect – synthesis of macrocyclic ligands – reaction of coordinated ligand .

***** Denotes self study

Teaching methods

Lecture by chalk & talk , Power point Presentations, Group discussions, Seminar, e-notes, Assignment and activity.

Text Books

1. J.E. Huheey, E.A. Keiter (2013) Inorganic chemistry principles of structure and reactivity, 16th Edn, Pearson Noida.
2. Lee J. D (2009) Concise Inorganic Chemistry, Fifth edition, ELBS.
3. Keith F. Purcell and John C.Kotz (2012) Inorganic Chemistry, W.B.Saunders Company.
4. Malik, Wahid U, Tuli G.D and Madan R.D, Selected Topics in Inorganic Chemistry, (2006) S. Chand Limited.

Reference Books

1. Basolo and Pearson, Ralph. G (1984) Mechanism of Inorganic Reactions- A study of metal complexes in solution. Wiley Eastern, New Delhi.
2. Cotton F.A. and G.Wilkinson (2007) Advanced Inorganic Chemistry, Sixth edition, John Wiley & Sons, Inc.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	S	S	S
CO2	H	H	M	S	M
CO3	S	M	S	M	S
CO4	M	S	M	S	H

S-Strong H-High M-Medium L-Low

19PCH2CL

Programme Code: 04		**M.Sc., Chemistry**		
Course Code : 19PCH2CL		**C.Pr.1 – Organic Chemistry Practical I**		
Batch 2019-2021	Semester I & II	Hours/Week 5	Total Hours 120	Credits 3

Course Objectives

1. To make the students aware about separation of mixture of organic compounds and analyzing the unknown compounds.
2. To allow the students to know and practice the techniques of preparation of some organic compounds.

Course Outcomes (CO)

K3	CO1	Pertain the principle of separation for separating two organic compounds in a given mixture
K4	CO2	Analyze the components present in the organic mixture and report the same
K5	CO3	Evaluate the crude and recrystallised form of the given organic compound

Syllabus

A. Analysis of two component organic mixtures

(Separation and characterization of individual compounds)

Note: Each student has to complete the analysis of minimum of **FIVE** Mixtures

B. Single stage Preparations (minimum 6)

1. Hydrolysis:

Preparation of Salicylic acid from Methyl Salicylate.

2. Acetylation:

Preparation of Acetanilide from Aniline.

3. Bromination:

Preparation of p-Bromoacetanilide from Acetanilide.

4. Nitration:

Preparation of m-dinitrobenzene from nitrobenzene.

5. Benzoylation:

Preparation of Benzanilide from Aniline.

6. Oxidation:

Preparation of Benzoic acid from Benzaldehyde.

7. Preparation of Glucose penta acetate.
8. Preparation of Diphenyl hydantoin from Benzil and urea.
9. Microwave synthesis (NOT for ESE)

Reference books

1. Gnanprakasam and Ramamurthy (2000) Organic Chemistry Laboratory Manual, Ananda Book Depot, Chennai.
2. NK Vishnoi (2014) Advanced Practical Organic Chemistry, Vikas Publishing House.
3. R. Jagmohan (2002) Advanced Practical Organic Chemistry, Vol. I & II.

Distribution of Marks

Internal (Maximum 40)	ESE (Maximum 60)
1. CIA Practical exam – 25 2. Observation note book – 10 3. Attendance – 5	1. Qualitative analysis – 30 2. Preparation of an organic compound – 10 3. Record – 10 4. Viva-Voce - 10

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	M	H	S
CO2	S	M	H	M	S
CO3	H	S	M	S	H

S-Strong H-High M-Medium L-Low

19PCH2CM

Programme Code: 04		**M.Sc., Chemistry**		
Course Code : 19PCH2CM		**C.Pr.2 – Inorganic Chemistry Practical I**		
Batch 2019-2021	Semester I and II	Hours / Cycle 5	Total Hours 120	Credits 3

Course Objectives

1. To give an idea to the students about the separation and analysis of cations from the given mixture.
2. To allow the students to know and practice the techniques in preparation of some inorganic complexes.
3. To know about the colorimetric principle in estimation of metal ions.

Course Outcomes (CO)

K3	CO1	Exert the methods of preparation of some inorganic complexes
K4	CO2	Analyze and report two familiar metal cations and two less familiar metal cations
K5	CO3	Assess the amount of metal ions present in the whole of the given solution by colorimetric method

Syllabus

A. Semi micro Qualitative Analysis:

Analysis of mixtures of common metal cations and the following less familiar metal cations - Tungsten, Selenium, Tellurium, Molybdenum, Cerium, Thorium, Vanadium and Lithium.

Note: A minimum of **FIVE** inorganic mixtures, each containing of two common and two less familiar metal cations have to be analyzed by each student during the course.

B. Preparation of complexes

Any Five preparations selected from the following list:

Tris(thiourea)Copper(I)chloride

Potassiumtrioxalatoaluminate(III)

Potassiumtrioxalatochromate (III)

Tetramminecopper (II) sulphate

Tris(thiourea) copper(II) sulphate

Nickelammoniumsulphatehexahydrate

Hexaminecobalt (III) chloride

Potassiumtrioxalatoferrate (III).

C. Colorimetric Estimations (using photoelectric colorimeter)

Estimation of Copper, Iron, Nickel and Manganese

Text Books

1.V.V.Ramanajum (1971) Semimicro Qualitative Inorganic Analysis, National Publishing Co.

2. V.Venkateswaran, R.Veeraswamy and A.R. Kulandaivelu (2004) Principles of Practical Chemistry, Sultan Chand & Sons. 2 nd Edition.

3. S.Giri. D.N. Bajpai.and O.P. Panday (2005) Practical Chemistry Vol.I & II, S.Chand & Co.

Distribution of Marks

Internal (Maximum 40)	ESE (Maximum 60)
4. CIA Practical exam – 25 5. Observation note book – 10 6. Attendance – 5	4. Qualitative analysis – 30 5. Preparation of an organic compound – 10 6. Record – 10 4. Viva-Voce - 10

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	S	M	M
CO2	S	M	H	S	H
CO3	M	S	H	M	S

S-Strong H-High M-Medium L-Low

19PCH2CN

Programme Code: 04		**M.Sc., Chemistry**		
Course Code : 19PCH2CN		**C.Pr.3 – Physical Chemistry Practical I**		
Batch 2018 - 2020	Semester I & II	Hours / Cycle 5	Total Hours 120	Credits 2

Course Objectives

1. To promote an awareness about potentiometric titrations to the students.
2. To arm the future chemist with the knowledge of electrical conductance measurement and conductometric titrations.
3. On successful completion of the syllabus, the students should have known to interpret, evaluate and report upon observations and experimental results of determination of molecular weight, partition coefficient, unknown composition in Simple Eutectic System and acid-base, precipitation and redox titrations.

Course Outcomes (CO)

K3	**CO1**	Relate the principle of potentiometric titrations for estimating the strength of solutions
K4	**CO2**	Determine the molecular weight of a compound by Rast's method
K5	**CO3**	Appraise the properties of matter by Simple Eutectic System

Syllabus

<u>Non Electrical Experiments</u>

1. Properties of Matter

Simple Eutectic System- determination of unknown compositions

2. Molecular weight determination

Determination of Molecular weight by Rast's method

3. Partition coefficient

Determination of Distribution Coefficient and Equilibrium Constant for the reaction

$$KI + I_2 \leftrightarrow KI_3$$

<u>Electrical Experiments</u> – Potentiometric Titrations

A. Acid-Base titrations *(using quinhydrone electrode)*

4. Titration of Strong acid against Strong base

5. Titration of Weak acid against Strong base
6. Titration of mixture of (strong & weak) acids against Strong base
7. Determination of pH (acidic solutions)
8. Determination of pKa of weak acid

B. Precipitation titrations *(using silver electrode)*

9. Titration of Potassium chloride against Silver nitrate
10. Titration of mixture of halides (chloride and iodide) against Silver nitrate

C. Redox titrations

11. Titration of Potassium Iodide against Potassium Permanganate
12. Titration of Ferrous Ammonium sulphate against Potassium dichromate

Teaching Methods

Demonstration and hands-on practicals

Reference Books

1. S.R. Palit and S.K. De (2003) Practical Physical Chemistry, Science Book Agency, Calcutta.
2. P.C. Sharma and Agarwal (1998) Practical Chemistry, Goel Publishing House, Meerut.
3. V. Venkateswaran and A.R. Kulaindaivelu (2005) Practical Physical Chemistry, S.Chand & Co.
4. J.B.Yadav (2010) Advanced Practical Physical Chemistry, Goel Publishing House, 29th edition.

Distribution of Marks

Internal (Maximum 40 marks)	**ESE (Maximum 60 marks)**
1. CIA Practical exam – 25 2. Observation note book – 10 3. Attendance – 5	1. Experiment – 40 2. Record – 10 3. Viva-Voce - 10

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	H	S	M
CO2	H	H	M	S	H
CO3	H	S	H	H	M

S – Strong **H –** High **M –** Medium **L –** Low

19PCH306

Programme Code: 04		**M.Sc., Chemistry**		
Course Code : 19PCH306		**C.P.6 – Physical Chemistry II**		
Batch 2019-2021	Semester III	Hours/Week 6	Total Hours 75	Credits 5

Course Objectives

1. To enable a comprehensive knowledge on quantum mechanics and students will be able to remember concepts of electrochemistry and surface chemistry
2. To understand electrochemical systems of electric energy production
3. To know the electrochemical processes of surface treatment and production of materials

Course Outcomes (CO)

K1	CO1	Recall the postulates of quantum mechanics and compare classical and quantum mechanical principles
K2	CO2	Realize and derive Schrodinger wave equation for harmonic oscillators
K3	CO3	Employ perturbation and variation method to Helium atom
K4	CO4	Probe different electrochemical theories and examine the methods of coulometry, voltametry and polarography

Syllabus

UNIT – I: QUANTUM CHEMISTRY I (15 hrs)

Success of quantum theory and the failure of classical mechanics in explaining black-body radiation, photo-electric effect and the H-atom spectrum, de Broglie's matter waves, Heisenberg's uncertainty principle. Schrodinger wave equation for particle waves, postulates of quantum mechanics, Time-dependent and Time - independent Schrodinger equations. Wave function (ψ) and its physical meaning, Conditions for acceptable wave function. Operators-algebra of operators, commutator, linear, Hermitian, Hamiltonian and angular momentum- eigen functions and eigen values, correspondence between physical quantities in classical mechanics and operators in quantum mechanics.

UNIT – II: QUANTUM CHEMISTRY II (15 hrs)

Particle in a 1-D box with infinite potential barrier - quantization of energy, normality and orthogonality of wave function. Particle in a 3-D box – a cubical box: a case of degenarcy. 1-D

Harmonic oscillator – classical and quantum mechanical treatment - solving of Schrodinger equation – complete eigen functions and eigen values – comparison of classical and quantum results. Rigid rotor model of a diatomic molecule – planar rigid rotor (or particle on a ring), the Phi-equation and its solution - non planar rigid rotator (or particle on a sphere) - complete wave function (spherical harmonics).

UNIT – III: QUANTUM CHEMISTRY III (15 hrs)

Schrodinger equation for H atom (H – like atoms) - separation of variables (solving of radial equation is not needed but nature of solution is given). Approximation methods - variation method - application of variation method to He atom, perturbation theory (first order only) - application of perturbation method to He atom, symmetric and antisymmetric wave functions, electron spin, Pauli principle of antisymmetric wave functions, Slater determinants. Born – Oppenheimer approximation, treatment of H_2^+ ground state by LCAO–MO method.

UNIT – IV: ELECTROCHEMISTRY-I (15 hrs)

Interionic attraction theory, Debye-Huckel-Onsager equation, derivation, verification and validity of DHO equation, Falkenhagen effect, Wien effect, activity and activity co-efficient, ionic strength, Debye-Huckel limiting law and its applications.

Electrokinetic phenomena: theories of double layer - Helmoltz-Perrin, Gouy-Chapmann & Stern theories - Butler-Volmer equation.

UNIT – V: ELECTROCHEMISTRY-II (15 hrs)

Electrolytic oxidation and reduction, voltametry, cyclic voltametry and polarography, current-voltage relationship, dropping mercury electrode, diffusion current, factors affecting diffusion current, Ilkovic equation (derivation not necessary), half-wave potentials, applications of polarography, amperometric titrations.

Fundamental principles of coulometric methods, constant current and controlled – potential methods, primary and secondary titrations – simple applications.

Solar cells***** – introduction, principle and working.

***** Denotes self study

Teaching methods

Lecture by chalk & talk, Power point Presentations, Group discussions, Seminar, Quiz, Assignment, create models.

Text Books

1. R. K. Prasad (2006) Quantum Chemistry, New Age International Publishers.
2. A.K. Chandra (2002) Quantum chemistry, 4th edition, Tata McGraw-Hill.
3. B.R. Puri & L R. Sharma (2013) Advanced Physical Chemistry, Milestone Publishers & Distributors.
4. F.L. Pilar, Elementary Quantum Chemistry ,McGraw-Hill, 1968
5. S. Glasstone (2005) Introduction to electrochemistry, 10th Edition, East West Press Private Ltd.

Reference Books

1. Ira. N. Levine (1999) Quantum Chemistry, Prentice Hall; 5th edition.
2. P. W. Atkins (2009) Physical Chemistry, 6th Edition, Oxford University Press.
3. L. I. Andropov (1977) Theoretical Electrochemistry, Mir Publishers, Moscow.
4. Horia Metiu, Physical Chemistry –Quantum Mechanics, Taylor& Francis, 2006.
5. M.W. Hanna, Quantum Mechanics in Chemistry, 2nd Edition, W.A. Benjamin Inc., 1969.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	S	M	M
CO2	S	M	H	M	H
CO3	H	S	H	H	S
CO4	S	H	S	S	M

S-Strong H-High M-Medium L-Low

19PCH307

Programme Code: 04		**M.Sc., Chemistry**		
Course Code: 19PCH307		**C.P.7 – Organic Chemistry III**		
Batch 2019-2021	Semester III	Hours/Week 5	Total Hours 75	Credits 5

Course Objectives

1. To foster an awareness in the student the ideas of molecular rearrangement and oxidation and reduction reactions of organic compounds.
2. To introduce steroids and to enable the students to elucidate their structures.
3. To gain knowledge about the classification, characterization of proteins, vitamins and some heterocyclic compounds.

Course Outcomes (CO)

K1	**CO1**	Remember the various types of molecular rearrangements
K2	**CO2**	Understand the synthetic utility of different reagents in oxidation and reduction reactions
K3	**CO3**	Elucidate the structure of selected steroids and vitamins
K4	**CO4**	Appraise the chemistry of some important reagents for organic synthesis

Syllabus

UNIT – I: MOLECULAR REARRANGEMENTS (15 hrs)

Introduction, nucleophilic, free radical and electrophilic rearrangements, 1, 2 – rearrangement - Wagner Meerwein, Acid catalysed rearrangement - Arndt-Eistert synthesis Wolff rearrangement - Base catalysed rearrangement – Favorskii, Carbon to Carbon migration of other groups - Neber rearrangement - Carbon to Nitrogen migration - Hofmann rearrangement, Curtius rearrangement, Lossen rearrangement, Schmidt rearrangement, Beckmann rearrangement -nitrogen to carbon (Stevens rearrangement), oxygen to carbon (Wittig rearrangement).

Unit – II: REAGENTS FOR OXIDATION AND REDUCTION (15 hrs)

Oxidation: Selenium dioxide, periodic acid, aluminium-t-butoxide, peroxides and peroxyacids, PCC (Corey's reagent), MnO_2, OsO_4, Jones reagent, copper chromite, Ozonolysis, Oppenauer oxidation, Lead tetraacetate, Mercuric acetate, Thallium acetate, DMSO.

Reduction: Complex metal hydrides such as $LiAlH_4$, $NaBH_4$, and trialkyl tin hydride-BH_3 / THF, 9-BBN- Dissolving metal reduction – Clemenson and Wolff-Kishner reduction.

UNIT – III: STEROIDS (15 hrs)

Introduction, structural elucidation of Cholesterol (synthesis not necessary), structural elucidation and synthesis of Estrone (Anner-Miescher synthesis), Testosterone and Progesterone (synthesis from Cholesterol), introduction and structures of Bile acids, biosynthesis of steroids (General principles only).

UNIT – IV: PROTEINS AND VITAMINS (15 hrs)

Classification and characteristics of proteins – General methods of synthesis of polypeptides (any four), solid phase peptide synthesis, structure and their biological importance of nucleic acids-RNA and DNA.

Vitamins-Introduction-structure, sources, functions and deficiency diseases*, Structural elucidation of Vitamins- A, B1, B2, C.

UNIT– V: PLANT PIGMENTS AND CO-PIGMENTS (15 hrs)

Structure and synthesis of flavone, flavanols, isoflavone, coumarins, chromones and anthocyanins (cyanin and pelargonin).

REAGENTS FOR ORGANIC SYNTHESIS

Reagents: Gilman`s reagent, lithium diisoprpylamide (LDA), dicyclohexylcarbodiimide (DCC), 1, 3-Dithiane, Woodward and Prevost hydroxylation, DDQ, DBU, PPA, NBS, m-chloroperbenzoic acid, Baker's yeast.

*Denotes self study portion

Teaching methodology

Chalk & talk, power point presentation, e-content, numerical exercises, assignment, quiz, seminar.

Text Books

1. V.K.Ahluwalia and Rakesh kumar Parashar (2016) Organic reaction mechanisms, 3rd edition, Narosa publishing house.
2. Jagdamba Singh, L. D. S. Yadav (2014) Organic Synthesis, 10th edition, Pragati Prakashan Educational Publications, Meerut, India.
3. I. L Finar (2014) Organic Chemistry Vol. I 6th ,Vol. II 5th edition, Pearson education, Ltd.

4. O. P. Agarwal (2010) Organic Chemistry- Natural products Vol II, 38th Edition, Goel Publishing house.
5. R K Bansal (2005) Heterocyclic Chemistry, 3rd edition New age international (P.) Ltd.

Reference Books

1. O.P.Agarwal (2014) Organic Chemistry Reaction and Reagents, 51st edition, Goel Pub. House.
2. Jerry March (2014) Advanced Organic Chemistry, Wiley eastern limited, 6th edition, New Delhi.
3. F.A.Carey (2008) Organic Chemistry-Part-B-Reactions and synthesis, Springer, 5th edition.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	M	H	M
CO2	M	S	M	S	M
CO3	H	M	H	M	M
CO4	S	S	M	H	S

S-Strong H-High M-Medium L-Low

19PCH308

Programme Code: 04		**M.Sc., Chemistry**		
Course Code : 19PCH308		**C.P.8 – Inorganic Chemistry III**		
Batch 2019-2021	Semester III	Hours/Week 6	Total Hours 75	Credits 5

Course Objectives

1. To create an awareness in the student the fundamental concepts of inorganic photochemistry and bioinorganic chemistry.
2. To allow the students to get introduced to the study of organometallic complexes and their applications as catalysts for chemical reactions.
3. On successful completion of the syllabus, the students should have acquired knowledge in the nature, preparation and properties of metal carbonyl complexes, photochemistry of metal complexes and various applications and the role metals in biological systems.

Course Outcomes (CO)

K1	CO1	Reminisce about the rules for classifying organometallic compounds
K2	CO2	Apprehend the structure and reaction mechanism of various organometallic complexes
K3	CO3	Explore the role of metals in biology and study about several bioinorganic compounds
K4	CO4	Inquest the formation and structures of various inorganic polymeric compounds

Syllabus

UNIT – I: ORGANOMETALLIC COMPOUNDS I (15 hrs)

Definition of organometallic compound – 18 electron rule – EAN rule– classification of organometallic compound – the metal carbon bond types – ionic bond – sigma covalent bond – electron deficient bond – dative bond. Metal carbonyls - methods of preparation, structure, reactions-metal carbonyl bonding- IR spectroscopy of metal carbonyls. Carbonylate ions, carbonyl hydrides, carbonyl halides, Vaska's complex.

UNIT – II : ORGANOMETALLIC COMPOUNDS II (15 hrs)

Synthesis, reactions, bonding and structure in metal alkyl, alkene, alkyne, allyl and dienyls complexes. Carbene, carbyne and carbide complexes. carbocyclic pi compounds-synthesis, reactions, bonding and structure of cyclopentadienyl complexes-Ferrocene-structure and bonding, arene complexes, complexes formed by 7 and 8 member aromatic rings.

UNIT – III: ORGANOMETALLIC COMPOUNDS III (15 hrs)

Organometallic compounds in catalysis – coordinative unsaturation – acid base behaviour reaction – migration of atoms or groups from metal to ligand – insertion reaction – Olefin metathesis– isomerisation of alkenes – hydrogenation (Wilkinson's catalyst) – hydroformylation (Oxo process) and hydrosilylation of alkenes – Wacker process-carbonylation of methanol and methyl acetate (Monsonto acetic acid process), Zeigler-Natta catalyst, Synthesis gas.

UNIT – IV: BIOINORGANIC CHEMISTRY (15 hrs)

Bioinorganic chemistry – metal ions in biology* – metalloporphyrins (heme and non-heme proteins) – cytochromes, heomoglobin, myoglobin, chlorophyll, ferridoxins, rubredoxins, blue copper proteins, enzymes- Vitamin B_{12} and B_{12} coenzymes (structure and functions) – nitrogen fixation (invitro and invivo) – chelate therapy, antitumour agents - cis-platin.

UNIT – V: INORGANIC POLYMERS (15 hrs)

Chains – catenation, silicones, silicates, isopoly and heteropoly anions, sulphur-nitrogen chains, Rings – Borazine, Cyclophosphazenes (synthesis, structure, bonding and properties) – sulphur, nitrogen ring compounds, Homocyclic rings – sulphur rings and cyclophosphines, Cages – phosphorus cage compounds, Boron Cage Compounds – Diborane – Wade's theory – closo, nido and arachno structures of boranes and carboranes, Clusters - dinuclear, trinuclear, tetranuclear, hexanuclear and organometallic clusters (structure only).

***** Denotes self study

Teaching methods

Lecture by chalk & talk, Power point Presentations, Group discussions, Seminar, Assignment and activity.

Text Books

1. J. D. Lee (2006) Concise Inorganic Chemistry, Fifth edition, Chapman & Hall Ltd.
2. J.E. Huheey (2009) Inorganic chemistry, 4th Edition, Pearson Education.
3. Dr. Asim K. Dass (2007) Bioinorganic Chemistry, Books and Allied (P) Limited.

Reference Books

1. D.F. Shriver, P.W. Atkins and C.H. Longford (2010) Inorganic chemistry, Oxford University Press, 5th edition.

2. I. Bertini, H.B.Gray, S.J. Lippard and J.S. Nalentine, (2007) Bioinorganic Chemistry; University Science Books.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	H	S
CO2	H	S	H	S	M
CO3	S	H	S	H	S
CO4	S	S	M	S	H

S-Strong H-High M-Medium L-Low

19PCH3CO

Programme Code: 04		**M.Sc., Chemistry**		
Course Code: 19PCH3CO		**C. Pr.4 – Physical Chemistry Practical II**		
Batch 2019-2021	Semester III	Hours/Week 4	Total Hours 60	Credits 2

Course Objectives

1. To arm the future chemist with the knowledge of electrical conductance measurements and conductometric titrations.
2. To gain knowledge in making and recording observations in conductometric titrations and chemical kinetics.

Course Outcomes (CO)

K3	**CO1**	Apply Freundlich adsorption isotherm for the adsorption of oxalic acid on charcoal
K4	**CO2**	Examine the reaction kinetics of two different solutions
K5	**CO3**	Evaluate the electrical properties of solution and estimate the strength of the given solution

Syllabus

Electrical Conductance measurements

1. Determination of cell constant & Verification of Ostwald's dilution law
2. Verification of Kohlrausch's law

Conductometric Titrations

3. $BaCl_2$ Vs $MgSO_4$
4. Buffer Vs Strong acid

Chemical Kinetics

5. Acid hydrolysis of an ester – Relative strength of acids
6. Reaction kinetics of KI and $K_2S_2O_8$
7. Iodination of acetone

Adsorption

8. Adsorption of oxalic acid on charcoal

Reference Books

1. S.R. Palit and S.K. De (2003) Practical Physical Chemistry, Science Book Agency, Calcutta.
2. P.C. Sharma and Agarwal (1998) Practical Chemistry, Goel Publishing House, Meerut.
3. V. Venkateswaran and A.R. Kulaindaivelu (2005) Practical Physical Chemistry, S.Chand & Co.,.
4. J.B.Yadav (2010) Advanced Practical Physical Chemistry, Goel Publishing House, 29th edition.

Distribution of Marks

Internal (Maximum 40 marks)	**ESE (Maximum 60 marks)**
1. CIA Practical exam – 25 2. Observation note book – 10 3. Attendance – 5	1. Experiment – 40 2. Record – 10 3. Viva-Voce - 10

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	M	M	S	S	H
CO2	M	H	S	H	M
CO3	H	M	H	S	M

S-Strong H-High M-Medium L-Low

19PCH409

Programme Code: 04		**M.Sc., Chemistry**		
Course Code : 19PCH409		**C.P.9 – Physical Chemistry III**		
Batch 2019-2021	Semester IV	Hours/Week 5	Total Hours 75	Credits 5

Course Objectives

1. To enable a complete knowledge on chemical and statistical thermodynamics
2. To make the students understand the third law of thermodynamics, probability theorems, distribution laws, partition functions
3. To foster an awareness in the student the fundamental concepts of photochemistry

Course Outcomes (CO)

K1	CO1	Place in mind the second and third law of thermodynamics
K2	CO2	Appreciate the theories of probability and thermodynamic probability
K3	CO3	Apply thermodynamic quantities for deriving distribution laws and partition functions
K4	CO4	Review the various photophysical processes taking place in excited molecules

Syllabus

UNIT – I: CHEMICAL THERMODYNAMICS (15 hrs)

Second law of thermodynamics- Concept of entropy , entropy change in reversible and irreversible processes, work and free energy functions, Maxwell's relations, Criteria for reversible and irreversible process, Gibs-Helmholtz equation, Thermodynamics of open system- Partial molar properties, chemical potential, Gibbs-Duhem equation and its applications.

Fugacity and Activity- Determination of fugacity of gas in a gaseous mixture, Concept of activity, activity co-efficient, Standard states and experimental determination of activity and activity coefficient of electrolytes.

UNIT – II: STATISTICAL THERMODYNAMICS-I (15 hrs)

Third law of thermodynamics, probability and third law, Nernst heat theorem and other forms stating third law, thermodynamic quantities at absolute zero, statistical meaning of third law and apparent exceptions.

Theories of probability, theories of permutations and combinations, thermodynamic probability, thermodynamic probabilities of systems in equilibrium, Boltzmann expression for entropy, Stirling's approximation, States of maximum thermodynamic probability, thermodynamic probabilities of systems involving energy levels.

UNIT – III: STATISTICAL THERMODYNAMICS-II (15 hrs)

Quantum statistics: Distribution laws - Maxwell-Boltzmann distribution law - Evaluation of alpha and beta in M.B. distribution law, Bose-Einstein distribution law, Entropy of Bose-Einstein gas, Bose-Einstein Condensation, Fermi-Dirac distribution law, Entropy of a Fermi-Dirac gas, Plank distribution law for black-body radiation, Heat capacities of solids - Einstein's and Debye's theories of heat capacities of solids.

UNIT – IV: STATISTICAL THERMODYNAMICS-III (15 hrs)

Partition function – definition, Ensembles - micro canonical and canonical ensembles, Equipartition principle, relation between molecular partition function and canonical partition functions, relation between the total partition function of a molecule and the separate partition function, Translational partition function, Rotational partition function – effect of molecular symmetry on rotational partition function- ortho and para hydrogen, Vibrational partition function and Electronic partition function, Evaluation of thermodynamic properties E, H, S, A, G, C_p and C_v from monoatomic and diatomic ideal gas molecule partition functions.

UNIT – V: PHOTOCHEMISTRY (15 hrs)

Physical properties of the electronically excited molecules- Excited state acidity constants- pK* values-Geometry of some electronically excited molecules-Types of photophysical pathways-Fluorescence emission-Phosphorescence- Photophysical kinetics of unimolecular processes- Stern-Volmer equation- quenching- Delayed fluorescence -study of excited states –Flash photolysis- chemiluminescence*, Photosynthesis – PS I and PS II.

***** Denotes self study

Teaching methods

Lecture by chalk & talk, Power point Presentations, Group discussions, Seminar, Quiz, Assignment, create models.

Text Books

1. Puri, Sharma, Pathania (2013) Principles of physical chemistry, 46th Edition, Vishal Publishing Co.
2. Rajaram, Kuriacose (2006) Thermodynamics, Shoban lal & Co, 4th edition.
3. K.K.Rohatgi, Mukherjee (2006) Fundamentals of Photochemistry, New Age International.
4. Nicholas J. Turro (1991) Modern Molecular Photochemistry, 2nd edition, University Science Books.

Reference Books

1. Glasstone (2013) Thermodynamics for chemists, Van Nostrands.
2. M.C. Gupta (2003) Statistical thermodynamics, New Age International.
3. Gurdeep Raj (2009) Advanced Physical Chemistry, Goel Publishing House.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	H	M	M
CO2	S	M	S	M	S
CO3	H	S	H	S	H
CO4	M	S	S	S	M

S-Strong H-High M-Medium L-Low

19PCH310

Programme Code: 04		**M.Sc., Chemistry**		
Course Code : 19PCH410		**C.P.10 – Spectroscopy**		
Batch 2019-2021	Semester IV	Hours/Week 5	Total Hours 75	Credits 5

Course Objectives

1. To understand the principles and instrumentation of various spectroscopic techniques.
2. To gain knowledge of the applications of IR, UV and NMR spectra.
3. To identify the structure of compounds using various spectral techniques.

Course Outcomes (CO)

K1	CO1	Recur the selection rules in IR spectroscopy
K2	CO2	Know the rules for solving UV spectrum of a compound
K3	CO3	Investigate the fragmentation pattern in a mass spectrum and determine the structural information of some compounds
K4	CO4	Scrutinize the ^{1}H and ^{13}C NMR spectra of simple organic molecules

Syllabus

UNIT - I: IR SPECTROSCOPY (15 hrs)

The vibrating diatomic molecule-the simple harmonic oscillator- selection rules-the diatomic rotator-vibration of polyatomic molecule (fundamental vibrations and their symmetry)-overtone and combination frequencies - Molecular vibrations -factors influencing vibrational frequencies- - force constant-identification of functional groups, hydrogen bonding and IR spectra, finger print region - Fermi Resonance -applications of infrared to organic compounds.

UNIT – II: UV-VISIBLE SPECTROSCOPY (15 hrs)

Theory- Beer-Lambert's law of photochemistry - principle- electronic spectra of diatomic molecules-Born-Oppenheimer approximation- intensity of vibrational electronic spectra– Franck-Condon principle-selection rules–dissociation energy- Fortrat diagram- predissociation-types of transition*-auxochromes and chromophores, Woodward-Fieser rules for calculating absorption maxima of dienes, polyenes and α, β-unsaturated ketones. Applications to organic compounds.

UNIT – III: MASS SPECTROMETRY (15 hrs)

Presentation of mass spectrum-instrumentation-double focusing mass spectrometer-ion source-mass analyzers-ion detectors, types of ions-molecular ion, fragment ion, rearrangement ion, metastable ion, odd and even electron ions, molecular ion peak, base peak and metastable ion peak, determination of molecular formula-Nitrogen Rule, isotopic abundance, Retro-Diels Alder Reaction, McLafferty rearrangement, Ortho elimination- double hydrogen rearrangement, double bond and ring equivalence.

Fragmentation associated with functional groups (aliphatic and aromatic) – hydrocarbons, unsaturated hydrocarbons, aldehydes, ketones, carboxylic acids, esters, amides, alcohols, thiols, amines, ethers.

UNIT – IV: NUCLEAR MAGNETIC RESONANCE -^{1}H NMR (15 hrs)

Magnetic properties of nuclei – theory of nuclear resonance, Instrumentation, Relaxation mechanisms(spin-spin & spin-lattice)- Chemical shifts- Electronegative effect, shielding and deshielding effects, Hydrogen bonding effect, Anisotropy, spin-spin coupling, geminal, vicinal, Long range, deuterium exchange – solvents used in NMR, First order and non-first order NMR spectra- AB, ABC, A_2B_2, and ABX spectra, simplification of complex spectra-chemical shift reagents, double resonance –INDOR- Spin tickling- magnetic field strength, Nuclear Overhauser Effect (NOE), dynamic NMR Applications of NMR to organic compounds.

UNIT – V: ^{13}C NMR (15 hrs)

Sensitivity, differences between ^{13}C NMR and ^{1}H NMR, measurement of ^{13}C NMR spectra, solvents, Types of ^{13}C NMR spectra - fully coupled, proton noise decoupled (fully decoupled), off resonance decoupled spectrum, DEPT, intensity of signals, carbon chemical shift- inductive effect, resonance effect, hydrogen bonding, heavy atom effect, substituent effects γ-gauche effect, γ-Anti effect.

2D NMR spectroscopy: Theory, basic components of two-dimensional experiment, Homonuclear Correlation Spectroscopy (H, H-COSY), Heteronuclear correlation (C,H-COSY) spectrum.

Solving problems using IR, UV, NMR and mass spectra for simple organic molecules not exceeding C_{12} units.

***** Denotes self study

Teaching methods

Lecture by chalk & talk, Power point Presentations, Group discussions, Seminar, Assignments and Solving the problems.

Text Books

1. Jagmohan (2005) Organic Spectroscopy Principles and Applications, second edition, Narosa publishing house.
2. Y.R.Sharma (2013) Elementary Organic Spectroscopy, 5th Edition, S. Chand & Co. Ltd.
3. W. Kemp (2011) Organic Spectroscopy, 3rd Edition, Mc Millan Press Ltd.
4. C.N. Banwell, E.M. McCash, Fundamentals of Molecular Spectroscopy, 4th Edition, (2008), Tata McGraw-Hill.

Reference Books

1. D.L. Pavia, G.M. Lampman, George S. Kriz (2009) Introduction to spectroscopy, Brooks Cole; 4th Edition.
2. Silverstien, Bassler and Morril (2014) Spectrometric identification of organic compounds, 8th Edition, John Wiley and Sons.
3. P.S. Kalsi (2009) Spectroscopy of organic compounds, 6th edition, Wiley Eastern Ltd.,

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	H	S	H
CO2	H	H	S	M	S
CO3	S	M	H	H	M
CO4	H	S	M	S	S

S-Strong H-High M-Medium L-Low

19PCH4CP

Programme Code: 04		**M.Sc., Chemistry**		
Course Code : 19PCH4CP		**C.Pr.5 - Organic Chemistry Practical- II**		
Batch 2019-2021	Semester III and IV	Hours/Cycle 5	Total Hours 120	Credits 3

Course Objectives

1. To attain knowledge in estimating organic compounds quantitatively.
2. To learn and practice the methods of preparation of some organic compounds.

Course Outcomes (CO)

K3	CO1	Exert the principle involved in double stage preparation of some organic compounds and prepare the compounds
K4	CO2	Analyze Reichert-Meisel value, saponification value and iodine value in the given oil or fat
K5	CO3	Evaluate quantitatively the amount of organic compounds present in the whole of the given solution

Syllabus

A. Quantitative estimations:

Estimation of phenol, aniline, ethyl methyl ketone, Glucose (Fehling's method and Bertrand's method).

B. Two stage Preparations:

1. Benzanilide from benzophenone
2. Acetyl salicylic acid from methyl salicylate
3. Preparation of m- nirtrobenzoic acid from methyl benzoate
4. Preparation of p- nitroaniline from acetanilide
5. Preparation of p-bromo acetanilide from aniline

C. Extraction and estimations: (Not for ESE examination**)**

1. Lactose from milk
2. Caffeine from tea
3. Nicotine from tobacco extract
4. Citric acid or ascorbic acid from a tablet or from a natural source.

D. Analysis of oil: (Not for ESE examination)

Reichart – Meisel value, soponification value and iodine value.

Text Books

1. Gnanprakasam and Ramamurthy (2000) Organic Chemistry Laboratory Manual, Anand Book Depot, Chennai.

2. R. Jagmohan (2002) Advanced Practical Organic Chemis, Vol. I & II.

Distribution of Marks

Internal (Maximum 40 marks)	**ESE (Maximum 60 marks)**
1. CIA Practical exam – 25 2. Observation note book – 10 3. Attendance – 5	1. Experiment – 40 2. Record – 10 3. Viva-Voce - 10

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	M	H	S	M	M
CO2	S	S	H	S	S
CO3	H	M	S	H	S

S-Strong H-High M-Medium L-Low

19PCH4CQ

Programme Code: 04		**M.Sc., Chemistry**		
Course Code : 19PCH4CQ		**C.Pr.6 – Inorganic Chemistry Practical II**		
Batch 2019-2021	Semester III & IV	Hours/Week 5	Total Hours 120	Credits 2

Course Objectives

1. To make the students aware about separation of mixture of inorganic compounds and quantifying them using volumetric and gravimetric principles
2. To know and apply the principle of complexometric titration using EDTA method
3. To learn about the preparation and properties of inorganic complexes

Course Outcomes (CO)

K3	CO1	Apply the principle of complexometric titrations in estimating metals
K4	CO2	Study the physical properties such as melting point, etc., of the prepared inorganic complexes
K5	CO3	Estimate the amount of cations present in a solution mixture

Syllabus

A. Titrimetry: Complexometric titration involving EDTA.

Estimation of Calcium, Magnesium, Nickel, Zinc and Hardness of water

B. Chromatography: Column, Paper, thin layer (Demonstration only)

C. Preparation:

Analysis and study of the properties of at least five coordination complexes.

(single stage preparations)

Hexathiourea Lead (II) Nitrate, Potassium trioxalato Ferrate (III), Penta thiourea Dicopper (I) Nitrate, Potassium trioxalato Chromate (III), Tris(thiourea) copper (I) chloride, Bis(glycinato) copper (II) monohydrate, Bis(acetyl acetanato) copper (II) monohydrate.

D. Quantitative estimation:

Mixture of cations involving volumetric and gravimetric estimation:

Copper & Nickel, Iron & Nickel, Iron & Magnesium and Calcium & Barium

Reference books

1. V.Venkateswaran, R.Veeraswamy and A.R. Kulandaivelu (2004) Principles of Practical Chemistry, Sultan Chand & Sons. 2 nd Edition.
2. Giri. S, Bajpai. D.N. and O.P Panday (1972) Practical Chemistry Vol. I & II, S.Chand & Co.
3. J. Bassart, R.C. Dennay, G.H. Jeffery and Mendham (2000) Vogel's text book of qualitative Inorganic Analysis, 6th Edn. Pearson Education.

Distribution of marks

Internal (Maximum 40 marks)	**ESE (Maximum 60 marks)**
1. CIA Practical exam – 25 2. Observation note book – 10 3. Attendance – 5	1. Quantitative analysis (volumetric and gravimetric estimations –15+15)- 30 2. Preparation - 10 3. Record – 10 4. Viva-Voce – 10

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	M	S	M	S	H
CO2	S	M	S	H	S
CO3	H	S	M	S	S

S-Strong H-High M-Medium L-Low

19PCH4Z1

Programme Code: 04		**M.Sc., Chemistry**
Course Code : 19PCH4Z1		**Project work &viva-voce**
Batch 2019-2021	Semester III & IV	Credits 6

Course Objectives

1. To make the students acquire the basic tools needed to carry out independent chemical research.
2. On successful completion of the course, the students will be able to be proficient in their specialized area of chemistry and successfully complete the project.

Course Outcomes (CO)

K3	CO1	Use foundational knowledge to carry out research in the specified area
K4	CO2	Examine the results of the research using some basic tools
K5	CO3	Evaluate the research findings and present them in written and oral

COMPONENT FOR PROJECT

CIA / ESE	**Particulars**	**Project Out of 200 Marks**
CIA	Project Review	30
	Regularity	10
	Total Internal Marks	**40**
***ESE**	Project Report Present	120
	Viva Voce	40
	Total External Marks	**160**
Total Marks(CIA+ESE)		**200**

Note: The Project work dissertation evaluation and viva-voce examination will be conducted jointly by the Internal and External Examiners

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	M	S	S
CO2	S	M	S	H	H
CO3	S	S	M	H	S

S-Strong H-High M-Medium L-Low

Programme Code: 04		**M.Sc., Chemistry**
Batch : 2019-2021		**ME – Analytical Chemistry**
Hours/Cycle 5	Total Hours 75	Credits 5

Course Objectives

1. To introduce the ideas of error analysis to the students.
2. To enable the students to attain knowledge on various chromatographic techniques and thermoanalytical methods.
3. To gain knowledge in ESR and Mossbauer spectroscopy, AAS and polarimetry.

Course Outcomes (CO)

K1	CO1	Keep in mind the concepts of mean, median, standard deviation, etc.,
K2	CO2	Comprehend the principles and instrumentation of chromatographic methods and various thermoanalytical methods
K3	CO3	Relate ESR and Mossbauer spectroscopy for the identification of metal complexes
K4	CO4	Probe the principle and applications of ORD and CD

Syllabus

UNIT – I: ERROR ANALYSIS (15 hrs)

Errors – determinate and indeterminate errors, accuracy and precision, mean, median, average deviation, standard deviation , relative standard deviation , standard deviation for 'Sample' and 'Population of data'-rejection of measurements- Quotient test -confidence limits, confidence interval, tests of significance - t-test and f-test -minimization of errors* - significant figures, rounding off the numerical expressions, reporting of analytical data.

UNIT– II: CHROMATOGRAPHIC METHODS (15 hrs)

Basic principles, theories, instrumentation, experimental procedures and application of following chromatographic techniques – Paper (PC), Thin Layer (TLC), Column (CC), Gel Permeation (GPC), Gas (GC) and High Performance Liquid Chromatography (HPLC), Ion-exchange chromatography.

UNIT – III: THERMAL ANALYSIS (15 hrs)

Introduction - different types of thermo analytical methods. Thermo gravimetric analysis (TGA) - principle – factors influencing thermograms. Derivative thermogravimetry

(DTG) - principle – factors influencing thermograms. TGA instruments – precautions in the use of thermo balance. Differential thermal analysis (DTA) – principle – instrumentation – applications – thermometric titrations-principle-instrumentation and applications. Differential scanning calorimetry (DSC) - principle - instrumentation and applications.

UNIT –IV: ESR & MOSSBAUER (15 hrs)

Electron spin resonance- Theory – derivative curves-'g' values, Kramer's degeneracy-zero field splitting – hyperfine splitting – isotropic and anisotropic systems – identification of free radicals – applications to copper complexes.

Mossbauer spectroscopy-Principle and theory-Isomer shift – quadruple interactions – magnetic interactions – applications to Iron complexes

UNIT– V: ATOMIC ABSORPTION SPECTROMETRY& POLARIMETRY (15 hrs)

AAS-Principle- instrumentation – detection of metals & non-metals, interference, detection limit & sensitivity and applications. Flame Emission spectrometry- Principle, instrumentation, methodology and applications. Comparison between AAS and FES.
Polarimetry – Plane polarized light – optical activity of molecules – polarimeter and its uses. ORD and CD spectrometry, circular birefringence, circular dichroism, optical rotatory dispersion, Plain curves, anomalous curves - cotton effect – axial haloketone rule and octant rule – application.

***** Denotes self study portion

Teaching methods

Lecture by chalk & talk, Power point Presentations, Group discussions, Seminar , Quiz and Assignment.

Text Books

1. B. K. Sharma (2013) Instrumental methods of Chemical analysis, Goel Publishing house, 29th edition.
2. V K Srivastava and K K Srivastava (1981) Introduction to chromatography-Theory and Practice, S.Chand& Company LTD, 2nd edition.
3. R.S. DragO (1996) Physical methods in Inorganic chemistry, 1st Edition, W. B. Saunders Company.
4. H. Kaur (2013) Instrumental methods of chemical analysis, Pragathi Prakashan Publishers, 9th edition.

Reference Books

1. Gurdeep R. Chatwal & S.K. Anand (2003) Instrumental Methods of Chemical Analysis, Himalaya Publishing House.
2. Gary D. Christian (2014) Analytical Chemistry**,** 6th edition, John Wiley & Sons, Inc.
3. D.A. Skoog, D.M. West, F.J. Holder and S.R. Grouch (2014) Analytical chemistry an Introduction 9th Edition, Saunders College publishing.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	H	S	M
CO2	S	M	S	M	H
CO3	H	S	M	M	S
CO4	S	S	H	S	H

S-Strong H-High M-Medium L-Low

Programme Code: 04		**M.Sc., Chemistry**
Batch: 2019-2021		**ME – Green and Nano Chemistry**
Hours/Cycle 5	Total Hours 75	Credits 5

Course Objectives

1. To introduce the concepts of green chemistry.
2. To stimulate the students to know about green synthesis.
3. To acquire a clear idea about various synthesis of nanomaterials and techniques.
4. To gain knowledge on principles of green chemistry, microwave assisted reactions and ultrasound assisted reactions.

Course Outcomes (CO)

K1	CO1	Memorize the twelve basic principles of green chemistry
K2	CO2	Appreciate the concept of green chemistry
K3	CO3	Appraise the chemistry of nanomaterials
K4	CO4	Examine the applications and environmental hazards of nanomaterials

Syllabus

UNIT – I: GREEN CHEMISTRY I (15 hrs)

Definition, need for green chemistry, twelve basic principles of green chemistry-planning a green synthesis in a chemical laboratory - concept of atom economy – rearrangement reaction– addition reaction – substitution reaction – elimination reaction - concept of selectivity – chemo selectivity - regio selectivity – enantioselectivity – diastereoselectivity

UNIT – II: GREEN CHEMISTRY II (15 hrs)

Green solvents – super critical carbondioxide, Water as greener solvent- reactions in ionic-liquid, solvent free reaction- solid supported organic synthesis, phase transfer catalyst (PTC), Synthesis involving basic principles of green chemistry – synthesis of adipic acid, catechol, BHT, citral, Ibuprofen and paracetamol.

UNIT – III: GREEN CHEMISTRY III (15 hrs)

Microwave assisted reactions – introduction- reactions in water – Hofmann elimination – Hydrolysis reactions – oxidation reactions – reactions in organic solvents – Esterification – Claisen rearrangement – Diels Alder reaction – Decarboxylation – solvent free reactions – deprotections – saponification. Ultrasound assisted reactions – Esterification – saponification – cannizaro reaction – strecker synthesis – Reformatsky reaction, Future trends in green chemistry, green chemistry in sustainable development.

UNIT – IV: NANOCHEMISTRY I (15 hrs)

Introduction- definition of nanoscience, nanotechnology, nanochemistry, nanomaterials, nanoscale, Classification of nanomaterials – 0D, 1D, 2D and 3D nanomaterials, quantum dots, fullerenes, carbon nanotubes - types, nanocomposites - types, Properties of nanomaterials – electrical, magnetic, optical and mechanical properties, Bottom-up and Top-down approaches, Physical methods of preparation of nanomaterials – plasma arching, chemical vapour deposition, electrodeposition, sol-gel synthesis, ball-milling, Nanoparticles in nature*.

UNIT –V: NANOCHEMISTRY II (15 hrs)

Chemical methods of preparation of nanomaterials – Chemical reduction – borohydride, citrate and polyol reduction, high temperature thermal decomposition, liquid-liquid interface reaction, solution state polymerization, Characterization Techniques – principle, instrumentation, and applications of Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Powder X-Ray Diffraction (XRD), Applications of Nanomaterials - catalysis, environmental and biomedical (drug delivery) applications, Environmental hazards of nanomaterials.

*Denotes self study portion

Teaching methods

Lecture by chalk & talk, Power point Presentations, Group discussions, Seminar, Quiz.

Text Books

1. V. Kumar (2007) An Introduction to Green Chemistry, Vishal Publishing Co.
2. V S. Muralidharan, A. Subramania (2010) Nanoscience and technology, Ane books pvt. Ltd.,

Reference Books

1. V.K. Ahluwalia (2009) Green Chemistry, Ane Books Pvt. Ltd.

2. B.S. Murty, P. Shankar, Baldev Raj, B.B. Rath, James Murday (2013) Text book of nanoscience and nanotechnology, Universities Press.

3. S. Shanmugam (2010) Nanotechnology, MJP Publishers.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	M	M
CO2	S	H	S	S	S
CO3	H	S	H	M	S
CO4	S	M	H	S	M

S-Strong H-High M-Medium L-Low

Programme Code: 04		**M.Sc., Chemistry**
Batch: 2019-2021		**ME – Bioinorganic Chemistry**
Hours/Cycle 5	Total Hours 75	Credits 5

Course Objectives

1. To introduce the role of metal ions in biological systems.
2. To enable the students to know the structure, function and physiology of Haemoglobin and myoglobin.
3. To recognize electron transfer, respiration, photosynthesis, function of metalloenzymes and the applications of metals in medicine.

Course Outcomes (CO)

K1	CO1	Revive the role of metal ions in biological systems.
K2	CO2	Realize the physiology and functions of haemoglobin and myoglobin
K3	CO3	Integrate the structure and functions of metalloenzymes
K4	CO4	Study the functions and toxicity of elements in biological systems

Syllabus

UNIT –I: METAL STORAGE, TRANSPORT AND BIOMINERALISATION (15 hrs)

Metals in biological systems-trace and ultra trace metals - the roles of metal ions in biological systems- the entatic state- iron storage - ferritin- haemosiderin - iron transport- transferrin- siderophores, hemerythrin, hemocyanin.

UNIT– II: DIOXYGEN MANAGEMENT (15 hrs)

Hemoglobin and myoglobin – dioxygen binding, transport and utilization – the binding of dioxygen to myoglobin – the physiology of myoglobin and hemoglobin – structure and functions of hemoglobin – other biological dismutases – oxidases and oxygenases – tyrosinase – methane monooxygenase – dioxygenases.

UNIT –III: ELECTRON TRANSFER, RESPIRATION AND PHOTOSYNTHESIS(15 hrs)

Ferredoxins – rubredoxins – synthetic models e-s proteins – blue copper proteins – cytochromes – photosynthesis – chlorophyll and photosynthetic reaction center – photosynthetic pathway – manganese and photosystem II.

UNIT –IV: METALLOENZYMES (15 hrs)

Enzymes – structure and function – zinc enzyme – carboxypeptiase and carbonic anhydrase – iron enzymes – catalase, peroxidase and cytochrome P-450 – copper enzymes – Enzymes – structure and function – zinc enzyme – carboxypeptiase and carbonic anhydrase – iron enzymes – catalase, peroxidase and cytochrome P-450 – copper enzymes – superoxide dismutase – molybdenum oxatransferase enzymes – xanthine oxidase – vitamin B_{12} and the coenzyme – nitrogenase.

UNIT– V: METALS IN MEDICINE (15 hrs)

Metal deficiency and disease – metals used for diagnosis and chemotherapy with reference to anticancer drugs – toxic effects of metals* – function and toxicity of the elements in biological systems – antibiotics and related compounds – chelate therapy – metal complexes as probes of nucleic acids.

***** Denotes self study portion

Teaching methods

Lecture by chalk & talk, power point presentation, e-content, assignment, discussions and seminar.

Text Books

1. Dr. Asim K. Dass (2007) Bioinorganic Chemistry, Books and Allied (P) Limited.
2. J.E.Huheey, E.A.Kieter, R.L.Keiter (2009) Inorganic Chemistry 4th Edition, Addision Wesely Publishing Company.

Reference Books

1. Bertini, H.B.Gray, S.J. Lippard and J.S. Nalentine (2007) Bioinorganic Chemistry; University Science Books.
2. P.S. Kalsi and J.P. Kalsi (2011) Bioorganic, Bioinorganic and Supramolecular chemistry, New Age International Publishers.
3. K. Hussain Reddy (2007) Bioinorganic Chemistry, New Age International.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	M	M
CO2	S	H	S	M	S
CO3	S	S	H	M	H
CO4	S	M	S	S	S

S-Strong H-High M-Medium L-Low

Programme Code: 04		**M.Sc., Chemistry**
Batch: 2019-2021		**ME – Selected Topics in Chemistry**
Hours/Cycle 5	Total Hours 75	Credits 5

Course Objectives

1. To understand about non-aqueous solvents.
2. To stimulate the students to know about supramolecular chemistry.
3. To acquire a clear idea about Raman and Photoelectron spectroscopic techniques.
4. To gain knowledge on principle and applications of Nuclear Quadrupole Resonance.

Course Outcomes (CO)

K1	CO1	Understand the chemical reactions of some non-aqueous solvents
K2	CO2	Realize the concept of Supramolecular chemistry
K3	CO3	Apply some spectroscopic techniques for solving the structures of inorganic compounds
K4	CO4	Relate the technique of NQR for structure solving

Syllabus

UNIT I: NON-AQUEOUS SOLVENTS (15 hrs)

Classification of solvents, General properties of ionizing solvents, Chemical reactions – Liquid NH_3, Liquid H_2SO_4, Liquid HF, Liquid N_2O_4, Liquid SO_2, Liquid H_2S, Liquid HCN, Acetic acid, Liquid BrF_3, superacids*.

UNIT II: SUPRAMOLECULAR CHEMISTRY (15 hrs)

Definition: Host guest compounds, coordination, lock and key analogy, chelate and macrocyclic effects, Preorganisation and complementarity, Nature of supramolecular interactions: Ion-Ion interactions, Ion-dipole interactions, Dipole-dipole interactions, Hydrogen bonding, cation-π interactions, π-π stacking, Van der waals force, Close packing in the solid state, Hydrophobic effects. Supramolecular host design. Template and self-assembly: Biochemical, Coordination compounds Catananes and rotaxanes.

UNIT III: CHARACTERIZATION OF INORGANIC COMPOUNDS (15 hrs)

Photoelectron spectroscopy- Theory of XPS and UPS-determination of ionization potential- chemical identification of elements- ESCA- chemical shift. F^{19} and P^{31} NMR, IR applications in the structural problem solving of inorganic compounds.

UNIT IV: RAMAN SPECTROSCOPY AND PHOTOELECTRON SPECTROSCOPY (15 hrs)

Pure rotational Raman spectra – Vibrational Raman spectra – selection rule - Polarization of light and the Raman effect – Structural determination from Raman spectroscopy – Techniques and Instrumentation.

Photoelectron spectroscopy- Theory of XPS and UPS-determination of ionization potential- chemical identification of elements- ESCA- chemical shift. F^{19} and P^{31} NMR, IR applications in the structural problem solving of inorganic compounds.

UNIT V: NQR (15 hrs)

NQR - Principles – Introduction - Nuclear Quadrupole Energy Levels - Energy Levels and transition frequencies – Effect of a magnetic field - The Zeeman effect - Factors affecting the line width - Solid State Effects. Applications of NQR: Bonding in Boron trichloride and its adducts – Calculation of percentage of ionic character of a bond.

Text Books

1.E. A. V. Ebsworth, David W. H. Rankin, Stephan Cradock (1991) Structural methods in inorganic chemistry, 2nd edition, Taylor and Francis.

2. R.S. Drago (1996) Physical methods in Inorganic chemistry, 2nd Edition, W. B. Saunders Company.

3. Jonathan W. Steed, Jerry L. Atwood (2009) Supramolecular Chemistry, Wiley and Sons.

Reference Books

1. J. Michael Hollas (2005) Modern Spectroscopy, 4th Edition, Wiley and Sons.
2. Malik, Wahid U, Tuli G.D and Madan R.D, (2006) Selected Topics in Inorganic Chemistry, S. Chand Limited.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	M	M
CO2	S	H	S	M	S
CO3	S	S	H	M	H
CO4	S	M	S	S	S

S-Strong H-High M-Medium L-Low

Programme Code: 04		**M.Sc., Chemistry**
Batch: 2019 – 2021		**NME – Chemistry of Environment**
Hours / Week 5	Total Hours 75	Credits 5

Course Objectives

1. To create awareness among the students about various environmental issues like pollution of air, water and soil which threaten the mankind.
2. To motivate the students to know the measures to prevent and control pollution.
3. On successful completion of the syllabus, the students should have learnt about various pollution, their sources, effects and control measures.

Course Outcomes (CO)

K1	**CO1**	Retain information about the composition of air and the concepts of green house effect and global warming
K2	**CO2**	Know the different sources of water pollutants and to understand the effects of water pollution
K3	**CO3**	Recognize the types and consequences of soil and radioactive pollutants
K4	**CO4**	Scrutinize the causes and harmful effects of thermal and soil pollution

Syllabus

UNIT– I : AIR POLLUTION (15 hrs)

Composition of air, Classification of pollutants-monitoring and control of air pollution-CO sensor-Green house effect-definition-major sources of green house gases – consequences of green house effect, Global warming- Ozone layer depletion – mechanism – Chloro fluoro carbons (CFC), Smog-photochemical smog, Acid rain-theory of acid rain-effects of acid rain-prevention and control.

UNIT – II: WATER POLLUTION (15 hrs)

Sources of water pollution sewage & domestic wastes, industrial effluents, agricultural discharges, fertilizers, detergents, toxic metals, siltation, thermal and radioactive materials. Types of water pollution -ground water, surface water, lake water, river water and sea water

pollution and their harmful effects. Effects of oil pollution in marine water. Eutrophication – types, effects and its control measures. Control measures of water pollution.

UNIT – III : SOIL POLLUTION (15 hrs)

Types of soil and their characteristics. Sources of soil pollutants and their deterimental effects-industrial, urban wastes, radioactive materials, agricultural products, chemical & metallic wastes and biological agents. Diseases caused by soil pollution*. Remedial measures for soil pollution.

UNIT – IV: RADIOACTIVE POLLUTION (15 hrs)

Radio activity and kinds of radiation. Natural and anthropogenic sources of radiation. Harmful biological effects of ionizing, non-ionizing (unit of measurement REM), micro wave, radio frequency, x-ray etc. radiation. Disposal methods of radioactive wastes from nuclear power plants, low level and high level nuclear waste - biomedical waste.

UNIT – V: THERMAL AND NOISE POLLUTION (15 hrs)

Thermal Pollution – definition-sources-nuclear power plants, thermal power plants, industrial effluents, domestic & municipal sewage. Harmful effects of thermal pollution.

Noise Pollution – definition. Sources, effects and control. Units of sound-dB

Teaching methodology

Lecture by chalk & talk, power point presentation, e-content, numerical exercises, group discussion, assignment, quiz, seminar.

Text Books

1. B.K.Sharma (2010) Environmental Chemistry, GOEL Publishing Company.
2. A.K De (2005) Environmental Chemistry, Wiley Eastern Ltd, 5th edition.

Reference Books

1. G.S.Sodhi (2005) Fundamentals of Environmental Chemistry, Alpha science.
2. E. Lichtfouse, J. S. Bauer, D. Robert (2009) Environmental Chemistry, Springer.
3. Balram Pani (2007) Text book of environmental chemistry, I.K. International Pvt., Ltd.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	S	H	S
CO2	H	S	S	M	H
CO3	S	H	H	M	H
CO4	H	H	H	S	S

S – Strong **H –** High **M –** Medium **L –** Low

Programme Code: 04	**M.Sc., Chemistry**	
Batch: 2019 – 2021	**NME – Scientific Thesis Writing**	
Hours / Week 5	Total Hours 75	Credits 5

Course Objectives

1. To introduce students the research prospectus and thesis/dissertation writing process with the focus on both the rhetorical framework and grammatical patterns germane to these tasks and the purpose of the research project.
2. To focus on the communication problems encountered in research and writing a thesis.
3. On successful completion of the syllabus, the students should have trained themselves how to write a thesis.

Course Outcomes (CO)

K1	**CO1**	Know how to write the Introduction chapter of a thesis or dissertation
K2	**CO2**	Understand the guidelines for writing 'Materials and Methods' and 'Results' of a thesis
K3	**CO3**	Apply the strategies specified for writing 'Discussion' and 'Abstract'
K4	**CO4**	Adopt the format for preparing manuscript for oral and poster presentation

UNIT – I: INTRODUCTION (15 hrs)

Writing introduction of thesis- General introduction and chapter introduction - example of organization of the thesis in general introduction – example of statement if aims and objectives in a general introduction – introduction of a chapter in a thesis

Writing review of literature – need for review of literature* – review process and bibliography – locating literature – publications – reading the literature – placement of review of literature in a thesis – organizing and writing literature review – time period covered in the review – contents of a review — use of tabular format in review – focus of the organization – revision of the draft.

UNIT – II: MATERIALS AND METHODS (15 hrs)

Writing materials and methods – General guidelines – details required about the chemical material. Writing results – voice, tense and style – topical sentence – sequence – structure – content.

Preparation of table – tabular form – introduction and placement of a table – table format – numbering of table – title of the table – the stub – box heading – unit of measurements – footnotes. Preparation of figures – introduction – introduction and placement of figures – numbering of figures – caption of figures – preparation of statistical diagrams – preparation of photographs and microphotographs.

UNIT – III: DISCUSSION (15 hrs)

Writing discussion – style of writing discussion – sequence of discussion – structure and content of discussion – key findings and interpretation – discussion of methodology – comparison of results – discussion of the significance of the result – discussion of unexpected result – discussion of unexpected result – discussion in the absence of pertinent literature – conclusion of discussion – structured format of discussion – an example of discussion.

Writing abstract, keywords, summary and synopsis of thesis.

UNIT – IV: FORMATTING (15 hrs)

References citing and listing – introduction – different systems of reference citation – name year system – citation in the text – listing references- citation sequence system – alphabet number system.

Formatting and typing thesis – introduction – paper – margins – paragraph indentations – widow and orphan lines – spacing – alignment – hyphenation – fonts – pagination – format of a thesis .

UNIT – V: MANUSCRIPT PREPARATION (15 hrs)

Preparing manuscript for presentation – poster presentation – poster size – poster Vs. oral presentation – preparation of poster – poster printing – displaying the poster – presenting the poster. Preparing for oral presentation – preparation of the script – timings – using visual aids – presentation style.

Journal article – types – original research paper, Short communications, Review articles, case studies - peer review - impact factor of journals - h-index - ISSN.

Working knowledge in MS Word and MS power point.

Teaching methodology

Lecture by chalk & talk, power point presentation, e-content, numerical exercises, group discussion, assignment, quiz, seminar.

Text Books

1. N. Gurumani (2010) Scientific thesis writing and paper presentation, MJP publishers.

Reference Books

1. Hans Fridrich Ebel, Claus Bliefert, Willaim E. Russey (2004) The art of scientific writing, Wiley, VCH.
2. Martha Davis, Kaaron Davis (2012) Scientific papers and presentation, 3rd edition, Elsevier.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	S	S	H
CO2	H	M	H	H	H
CO3	H	S	H	H	M
CO4	M	H	S	S	S

S – Strong **H –** High **M –** Medium **L –** Low

Programme Code: 04		**M.Sc., Chemistry**
Batch : 2019-2021		**NME – Textile and Dye Chemistry**
Hours/Cycle 5	Total Hours 75	Credits 5

Course Objectives

1. To understand the classification , structure, properties of various textile fibres.
2. To enable the students to attain knowledge to understand the interaction between dye and textile fibres.

   To learn about types of fibres and dyeing processes and after treatment techniques.

Course Outcomes (CO)

K1	CO1	Keep in mind the classification and properties of fibres
K2	CO2	Comprehend the manufacture and processing of fibres
K3	CO3	Relate different theories of colour for the dyeing of textile fibres
K4	CO4	Probe the principle of dyeing process

Syllabus

UNIT–I STRUCTURE OF FIBRES (15 hrs)

Introduction -General properties of textile fibres, Classification of fibres: (natural, synthetic and Semi synthetic fibres), Differences between cellulose and synthetic fibres, Structure of textile fibres: Cotton, wool , silk, nylon, polyester, polyacrylamide, and Hydrophilic and hydrophobic fibres, Physical, chemical and biological properties and uses of cellulose fibre(cotton), protein fibre(silk and wool) and synthetic fibres (nylon and polyester).

UNIT–II MANUFACTURE AND PROCESSING OF FIBRES (15 hrs)

Semi synthetic fibres: Rayon -manufacture of viscose rayon, cuprammonium rayon and Acetate rayon, Synthetic fibres: Preparation, properties and Uses of Nylon 6, Nylon 66, Polyester, and poly acryl amide, Mercerization-Manufacture of mercerized cotton and their applications.

UNIT–III DYES (15 hrs)

Dyes –Requisites of a dye* –Theories of colour -Witt Theory and Modern theory, Classification of dyes with examples –according to application and structure - methyl orange, bismark brown, congo red, Malachite green, crystal violet, Phenolphthalein, Fluorescein, sulphur dyes, Phthalocyanines, Cyanine dyes, Dye-Fibre interactions: Ionic, Covalent, Vander

Waals, H-bonding interactions, Dyeing assisting agents: NaOH, Na_2CO_3, aluminium sulphate, chromic sulphate.

UNIT–IV PRINCIPLES OF DYEING PROCESSES (15 hrs)

General concept of dyeing process: affinity of a dye, conditions for dyeing, selection of dye stuff, Dyeing methods –Direct dyeing, Top dyeing, Stock dyeing, Yarn dyeing, piece dyeing and garment dyeing, Silk dyeing.

UNIT–V TREATMENT PROCESSES (15 hrs)

After treatment processes: Stripping of dyes, low temperature dyeing, Sizing: sizing agents and applications, Bleaching: Types of bleaching, Reductive bleaching, oxidative bleaching agents, Brightening: -Optical brightening agents-Types and uses

Teaching methodology

Lecture by chalk & talk, power point presentation, e-content, numerical exercises, group discussion, assignment, quiz, seminar.

TEXT BOOKS

1. B.K. Sharma, Industrial Chemistry, (1997) Goel Publishing Co.,
2. Jain and Jain, Engineering Chemistry, (1995) Dhanpat Rai & Sons.

REFERENCE BOOKS

1. E.N. Abraham, Dyes and Their Intermediates, (1969) Bergamon Press.
2. H. A. Lubs, The Chemistry of synthetic dyes and pigments, (1970) ACS publication, Halner.
3. K.Venkataraman, The Chemistry of Synthetic Dyes, (1949) Vol.I, II, III & IV, Academic Press, N.Y.
4. F. P. Schafer, Physical and Chemical Applications of Dyestuffs, (1976) Springer – Veriag N.Y.
5. I.L Finar, Organic Chemistry, (2009) Vol II, ELBS.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	H	S	S
CO2	H	H	H	M	S
CO3	S	M	M	H	S
CO4	S	H	H	M	H

S – Strong **H –** High **M –** Medium **L –** Low

Programme Code: 04		**M.Sc., Chemistry**
Batch: 2019 – 2021		**NME – Industrial Chemistry**
Hours / Week 5	Total Hours 75	Credits 5

Course Objectives

1. To introduce students to the chemistry of Industrial products.
2. To focus on the preparation and applications of glass, cement, fertilizer, paints and pigments.
3. On successful completion of the syllabus, the student will be able to gain knowledge about the manufacture of glass, cement and paint.

Course Outcomes (CO)

K1	**CO1**	Recall the raw materials used for the manufacture of several types of glass
K2	**CO2**	Understand the manufacturing process of cement
K3	**CO3**	Recognize the importance of nitrogenous fertilizers
K4	**CO4**	Assess the chemistry of paints and pigments

Syllabus

UNIT –I: GLASS (15 hrs)

Physical and chemical properties of glass. Raw materials used in the manufacture. Steps used for the manufacture-formation of batch materials, melting, shaping, annealing and finishing. Chemical reactions in the furnace. Pot furnace and tank furnace. Regenerative and recuperation types. Verity of glasses-silica, optical, borosilicate, lead, safety, pyrex, alkali silicate, photochromic and glass wool.

UNIT –II: CEMENT (15 hrs)

Types of cement. Types of Portland cement. Raw materials-manufacturing process – wet and dry process-types of kiln and reactions in kiln- composition of clinker-additives added during grinding-setting, curing and hardening of cement-physiochemical transformations. Properties of cement Mortars and concrete-RCC.

UNIT –III: FERTILIZERS (15 hrs)

Plant nutrients-primary, secondary and micro nutrients. Need for fertilizers-classification of fertilizers. Source of fertilizers-natural and artificial. Nitrogenous fertilizers-ammonium nitrate, ammonium sulphate and urea. Phosphate fertilizers-phosphate rocks-normal super phosphate-triple super phosphate. Potassium fertilizers-NPK fertilizers.

UNIT –IV: PAINTS AND PIGMENTS (15 hrs)

Paints:- Definition-classification-constituents-manufacture-requirements of a good paint*. Paint failure. Types of paints-emulsion paints-latex-luminescent-fire retardant-heat resistant. Methods of applying paint. Paint removers. Varnishes - types and classes. Lacquers, solvents, thinners and oils. Pigments:-white pigments- manufacture-white lead(electrolytic method)-zinc oxide(French process) - titaniumdioxide (chlorine method). Blue pigment-ultramarine. Red pigment-red lead. Green pigment-chrome green. Yellow pigment-chrome yellow.

UNIT –V: RUBBER AND ALLIED PRODUCTS (15 hrs)

Natural rubber-types and classification-latex-coagulation-refining of crude rubber-vulcanization (sulphur and non-sulphur)-properties of vulcanized rubber. Synthetic rubber-manufacture and uses of-Buna-S (from petroleum), Neoprene, Butyl rubber, silicone rubber and poly urethane.

Teaching methodology

Lecture by chalk & talk, power point presentation, e-content, numerical exercises, group discussion, assignment, quiz, seminar.

Text Books

1. B.K.Sharma (1991) Industrial Chemistry, GOEL Publishing Company, 4th Edn.
2. B.N. Chakarabarthy (1981) Industrial Chemistry, Oxford and IBH publishing house.

Reference Books

1. M.G. Arora, M. Singh (1994) Industrial Chemistry, Vol II, Anmol Publications Ltd.
2. H.L. White (1986) Introduction to Industrial Chemistry, John Wiley & sons.
3. Vermani O.P. (2008) Industrial chemistry, Galgotia Publications Pvt. Ltd.

Mapping

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CO1	H	M	M	H	H
CO2	H	M	H	S	S
CO3	S	H	M	H	H
CO4	S	H	H	M	H

S – Strong **H –** High **M –** Medium **L –** Low

JOB ORIENTED COURSE 19PCH0J1

Programme Code: 04	**M.Sc., Chemistry**	
Course Code : 19PCH0J1	**JOC – Pharmaceutical chemistry**	
Batch 2019 – 2021	Total Hours 30 (Out of Class hours)	Credits 2

Course Outcomes

1. To give the students a thorough introduction to the study of drugs.
2. To educate the students and to create an awareness about first aid.
3. On successful completion of the syllabus, the students should have been aware of the causes, treatment and prevention of some common diseases, biological role of some elements, the structure, uses and adverse effects of analgesics, antiseptics and disinfectants.

UNIT –I: THE NATURE AND SOURCES OF DRUGS (6 hrs)

Terminologies used in pharmaceutical chemistry-pharmacy, pharmacology, bacteria, virus, fungi, chemotherapy, pharmacopeia and toxicology, biological and chemical classification of drugs, metabolism of drugs-biotransformation-oxidative reaction-hydroxylation, oxidative dealkylation, oxidative deamination and hydrolytic (hydrolysis) reactions, conjugation reactions-glucuronide conjugation, aminoacid conjugation, sulphate conjugation, methylation and N-acetylation, routes of administration and the process of adsorption of drugs.

UNIT –II: FIRST AID FOR ACCIDENTS (6 hrs)

Aims and rules of first aid, first aid treatment for cuts/abrasions/ bruises, bleeding, fracture, burns, fainting and poisonous bites, clinical symptoms of poisoning and basic therapeutic treatment, common poisons and their antidotes-acid, alkali, disinfectants, hallucinogens, alcohol, mercury and salicylate poisoning, articles to be kept in a standard first aid box.

UNIT –III: COMMON DISEASES (6 hrs)

Some common diseases: Causes, treatment and prevention of malaria, filarasis, plague, diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis(T.B), cholera, typhoid, dysentery, jaundice, asthma, epilepsy, piles and leprosy.

Biological role of following elements and their compounds: potassium, calcium, iodine, copper and zinc.

UNIT – IV: BLOOD AND DIABETES (6 hrs)

Composition of Blood: Plasma, RBC, WBC, platelets (thrombocytes)-their functions.

Blood pressure: Primary and secondary hypertension-hypotension-measurement of blood pressure.

Anaemia: Causes and control-sign, symptoms & types-antinaemic drugs.

Diabetes: Types-diabetes insipdus and diabetes mellitus-juvenile & adult, control of diabetes-insulin structure and sources, oral hypoglycemic drugs - tolbutamide, chlorpropamide, glibenclamide, bigunides (penformin and metformin)

Unit – V: THERAPEUTIC AGENTS (6 hrs)

Structure, uses and adverse effects of Analgesics agents: morphine, pethidine and methadone. Antipyretic-anti-inflammatory agents: aspirin, methyl salicylate, para acetamolphenacetin, analgin, indomethacin & ibuprofen. Antiseptic and disinfectants: distinction between disinfectants and antiseptics, standardization of disinfectants and antiseptics, source, structure and uses of the following compounds-cresols, thymol, chloroxylenol, chloramines-T, crystal violet, methylene blue, nitromersol, dequalinium chloride and formalin.

Reference Books

1. Jayashree Ghosh (2008) A Text Book of Pharmaceutical Chemistry 3rd Edn, S.Chand & Co Ltd.
2. L.M.Atherden (1995) Text Book of Pharmaceutical Chemistry, 8th Edn, Oxford University Press.
3. C.R.Chatwal (2007) Pharmaceutical Chemistry Vol. I & II, III Edn, Himalaya Publishing House.

19PCH0D1

Programme Code: 04	**M.Sc., Chemistry**
Course Code : 19PCH0D1	**ALC- 1 Chemistry of Corrosion**
Batch 2019 – 2021	Credits 2

UNIT – I: INTRODUCTION TO CORROSION

Definition of corrosion cost of corrosion, importance of corrosion studies – classification of corrosion* – expressions for corrosion rate – corrosion principles – electrochemical principles of corrosion – Faradays Laws, types of electrochemical cells, concentration cells. Thermodynamic principles of corrosion – Standard electrode potentials and thermodynamic corrosion theory – Galvanic series of metals and alloys.

UNIT – II: KINETICS

Kinetics of electrochemical corrosion – importance of kinetics, graphical presentation of kinetic data, exchange current density, polarization of electrodes, concentration polarization, activation polarization and resistance polarization. Mixed potential theory. Applications of electrodes kinetics to experimental observation

UNIT-III: PASSIVITY

Kinetics of passivity – introduction – electrochemical behavior of active / passive metals, flade reactivation potential, criteria for selecting a metal exhibiting passivity, factors influencing electrochemical behavior and corrosion rate of metals exhibiting passivity, theories of passivity.

UNIT – IV: FORMS OF CORROSION

Different form of corrosion and the factors influencing atmospheric, intergranular, pitting, galvanic, crevice, stress, soil) *. Protection against corrosion - design improvement, changes of metal, change of environment, change of metal potential, use of coatings.

UNIT – V: MONITORING TECHNIQUES

Interpretation and measurement of corrosion – potential measurements, corrosion current measurements using rotating disc electrode, polarization measurements (polarization break, Tafel and linear)- two electrode system, three electrode system, advantages, disadvantages and precautions in usage, Corrosion behavior diagram.

Text Book

1. Raj Narayan (1983) An introduction to metallic corrosion and its prevention, Oxford and IBH Publishing Co.

19PCH0D2

Programme Code: 04	**M.Sc., Chemistry**
Course Code : 19PCH0D2	**ALC- 2 Chemistry of Drugs**
Batch 2019 – 2021	Credits 2

UNIT– I: INTRODUCTION TO DRUGS

Introduction to drugs, development of various classes of drugs - cell structure - types of molecules in the cell affected by drugs - protein binding.

UNIT– II: DRUG ACTION

Definition of drugs-classification of drugs - characteristics of different routes to drug administration-absorption of drug-distribution of drug-mode of drug action-mechanism of drug action-drug receptors-drug-receptor bonds-excretion.

UNIT– III: PHYSIO CHEMICAL PARAMETERS IN RELATION TO BIOLOGICAL ACTIVITY

Introduction-physical properties-solubility, partition coefficient, ionization and pka values-hydrogen bonding-surface activity-applications-complexation-redox potential-steric features of drug-conformational isomers-optical isomers-bioisosterism-classical bioisosterers-nonclassical bioisosterers.

UNIT – IV: DRUG DESIGN AND DRUG-TARGET INTERACTION

Drug design-Fundamentals and objectives of QSAR-variation of substituents-alkyl and aromatic substituents-extension of the structure-chain extensions/contractios-ring expansions/contractions-ring variations-ring fusions-isosterers-simplification and rigidification of the structure-conformation blockers-X-ray crystallographic studies-molecular modeling studies-drug design by nuclear magnetic resonance- a case study-oxaminquine.

UNIT – V: THERAPEUTIC AGENTS

Structure Activity Relation (SAR) of antibiotics cephalosporins, streptomycin, tetracycline, erithromysin and chloremphenicol-SAR of antimalarial drug cinchonine-SAR of anticancer drug cisplatin-cardiovascular drugs-definition and categories-synthesis and use of diuretic drug chloemerodrin Hg^{197}-antiparkinsonism drug biperiden hydrochloride-antipsychotics and the structure of reserpine-antithyroid drugs-drugs to combat aids.

REFERENCE BOOKS

1. Rama Rao Nadendla (2007) Medicinal chemistry, Pharmamid press.
2. K.Illango, P.Valentina (2007) Text book of medicinal chemistry-Volume I &II- First edition, Keerthi publishers.
3. Ashutosh kar (2006) Medicinal chemistry-4th edition-New age international publishers.

19PCH0D3

Programme Code: 04	**M.Sc., Chemistry**
Course Code : 19PCH0D3	**ALC- 3 Food Chemistry**
Batch 2019 – 2021	Credits 2

UNIT – I: FUNCTIONS OF FOOD

Food – definition, functions, basic food groups, chemical composition and nutritive value of some common food stuffs – cereals, pulses, vegetables and fruits, eggs, milk and meat.

UNIT – II: IMPORTANT NUTRIENTS IN FOOD

Nutrients – definition, properties and nutritive value of some important nutrients – carbohydrates, proteins, fats, vitamins, minerals and water.

UNIT – III: FOOD ADDITIVES

Some important food additives – antioxidants, chelating agents, colouring agents, flavouring agents, curating agents, emulsifiers, leavening agents, anticaking agents, humectants, non-nutritive sweeteners, thickeners, stabilizers, preservatives.

UNIT – IV: FOOD PRESERVATION

Food spoilage, methods of food preservation, preservation of food by – low temperature, high temperature, preservatives, osmotic pressure, dehydration, food irradiation.

UNIT – V: FOOD ADULTERATION AND FUTURE FOODS

Adulteration – definition, types of adulterants – intentional and incidental adulterants, metallic contaminants, food laws, organic foods, low cost nutrient supplement, packaging of foods, nutrition labeling, nutraceuticals.

REFERENCE BOOKS

1. B. Srilakshmi (2015) Food science, New Age International, VI edition.
2. Lillian H. Meyer (2004) Food chemistry, CBS publishers and distributors.
3. Seema Yadav (2006) Food chemistry, Anmol publishers.