

KONGUNADU ARTS AND SCIENCE COLLEGE

(Autonomous)

Re-accredited by NAAC with 'A+' Grade (4th Cycle)

Affiliated to Bharathiar University

College of Excellence (UGC)

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



PG & RESEARCH DEPARTMENT OF CHEMISTRY

CURRICULUM AND SCHEME OF EXAMINATIONS (CBCS)

(2022 – 2023 ONWARDS)

KONGUNADU ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

COIMBATORE – 641 029

PG & RESEARCH DEPARTMENT OF CHEMISTRY

VISION AND MISSION OF THE DEPARTMENT

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

PROGRAMME OUTCOMES (PO)

PO 1 : The programme is designed in such a manner that the students are offered a more significant and advanced knowledge in the major areas of chemistry – Organic chemistry, Inorganic Chemistry and Physical Chemistry.

PO 2 : The students are exposed to applied laboratory techniques, critical thinking, independent and team learning, and are provided with research opportunities.

PO 3 : The students should be capable of broadening their professional foundation through activities such as teaching (seminars), internships and projects.

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 2022 – 2023)

Semester	Course Code	Title of the Course	Instruction hours/cycle	Exam Marks			Duration of Exam (Hrs)	Credits
				CIA	ESE	Total		
I	22PCH101	Core Paper 1- Organic Chemistry - I	5	50	50	100	3	5
	22PCH102	Core Paper 2 - Inorganic Chemistry - I	5	50	50	100	3	5
	22PCH103	Core Paper 3 - Physical Chemistry - I	5	50	50	100	3	5
	22PCH1E1	Major Elective - 1	5	50	50	100	3	5
		Core Practical 1 - Organic Chemistry Practical - I	3	-	-	-	-	-
		Core Practical 2 - Inorganic Chemistry Practical-I	3	-	-	-	-	-
		Core Practical 3 - Physical Chemistry Practical-I	4	-	-	-	-	-
Total			30			400		20
II	22PCH204	Core Paper 4 - Organic Chemistry - II	5	50	50	100	3	5
	22PCH205	Core Paper 5 - Inorganic Chemistry - II	5	50	50	100	3	5
	22PCH2E2	Major Elective - 2	5	50	50	100	3	5
	22PCH2CL	Core Practical 1 - Organic Chemistry Practical - I	5	50	50	100	6	3
	22PCH2CM	Core Practical 2 - Inorganic Chemistry Practical-I	5	50	50	100	6	3
	22PCH2CN	Core Practical 3 - Physical Chemistry Practical-I	5	50	50	100	6	2
Total			30			600		23
III	22PCH306	Core Paper 6 - Physical Chemistry - II	5	50	50	100	3	5
	22PCH307	Core Paper 7 - Organic Chemistry - III	5	50	50	100	3	5
	22PCH308	Core Paper 8 - Inorganic Chemistry-III	4	50	50	100	3	5
	22PCH3N1	Non-Major Elective - 1	4	50	50	100	3	4
		Extra Departmental Course	2	100	-	100	3	2
	22PCH3CO	Core Practical 4 - Physical Chemistry Practical - II	4	50	50	100	6	2
		Core Practical 5 - Organic Chemistry Practical - II	3	-	-	-	-	-
	Core Practical 6- Inorganic Chemistry Practical- II	3	-	-	-	-	-	
Total			30			600		23
IV	22PCH409	Core Paper 9 - Physical Chemistry - III	5	50	50	100	3	5
	22PCH410	Core Paper 10 - Spectroscopy	5	50	50	100	3	5
	22PGI4N2	Non-Major Elective 2 - Information Security	4	100	-	100	3	4
	22PCH4CP	Core Practical 5 - Organic Chemistry Practical - II	5	50	50	100	6	2
	22PCH4CQ	Core Practical 6 - Inorganic Chemistry Practical-II	5	50	50	100	6	2
	22PCH4Z1	Project & Viva -Voce	6**	50	50	100	-	4
		SWAYAM - MOOC	-	-	-	-	-	2
Total			30			600		24
Total						2200		90

** 6 hours are allotted for project work, which will not be accounted for staff workload.

Major Electives papers

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

1. Analytical Chemistry
2. Green and Nano Chemistry
3. Bioinorganic chemistry
4. Drug design and development

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. Information Security*
- (*To be offered by the department)

Sub. Code & Title of the Extra Departmental Course (EDC) :

22PCH3X1 – EDC Paper 1 – Food Science

Tally Table

Subject	No. of Subjects	Total Marks	Credits
Core – Theory / Practical / Project	17	1700	68
SWAYAM – MOOC	-	-	2
Major Elective Papers	2	200	10
EDC Paper	1	100	2
Non Major Elective Paper	2	200	8
Grand Total	22	2200	90

- 50 % CIA is applicable to all subjects except JOC, COP, NME 2 and SWAYAM courses.
- The students should complete a **SWAYAM-MOOC** before the completion of the 3rd semester and the course completed certificate should be submitted through the HOD to the Controller of Examinations. Two credits will be given to the candidates who have successfully completed. In case the students have completed more than one online course, the appropriate 2 extra credits shall be awarded to such candidates upon the submission of certificate through the HOD to the Controller of Examinations.
- 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							
Course code/ Q.P.Code	Title of the Course	Instruction hours/cycle	Exam Marks			Duration of Exam (Hrs)	Credits
			CIA	ESE	Total		
21PCH0J1	JOC - Pharmaceutical Chemistry	6	-	100	100	3	2
ADVANCED LEARNER COURSES (UNDER SELF STUDY SCHEME)							
21PCH0D1	ALC- 1 Chemistry of Corrosion	-	-	100	100	3	2
21PCH0D2	ALC- 2 Industrial Chemistry	-	-	100	100	3	2
21PCH0D3	ALC- 3 Advanced Functional Materials	-	-	100	100	3	2

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

Components of Continuous Internal Assessment (50 Marks)

Components		Marks	Total
Theory			
CIA I	75	(75+75) converted to 30	50
CIA II	75		
Problem based Assignment**		10	
Attendance		5	
Others*		5	
Practical			
CIA Practical		(50) converted to 30	50
Observation Notebook		15	
Attendance		5	
Project			
Review		45	50
Regularity		5	

* Class Participation, Case Studies Presentation, Field Work, Field Survey, Group Discussion, Term Paper, Workshop/Conference Participation. Presentation of Papers in Conferences, Quiz, Report/Content writing, etc.,

** Two Assignments to be given (Each 5 marks).

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

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

Theory Examination:

CIA I & II and ESE: 75 Marks

Knowledge Level	Section	Marks	Description	Total
K1 – K2 Q1 to 20	A (Answer all)	20 x 1 = 20	MCQ-10/ Fill ups-5/ One word-5	75**
K2 – K5 Q21 to 28	B (5 out of 8)	5 x 5 = 25	Short Answers	
K2 – K5 Q29 to 33	C (3 out of 5)	3 x 10 = 30	Descriptive / Detailed	

****For ESE 75 marks converted to 50 marks.**

ESE Practical Examination:

Knowledge Level	Section	Marks	Total
K3	Experiments Record Work	45	50
K4		05	
K5			

ESE Project Viva Voce:

Knowledge Level	Section	Marks	Total
K3	Project Report	35	50
K4		15	
K5	Viva voce		

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	

Programme Code: 04		M.Sc., Chemistry		
Course Code:22PCH101		Core Paper 1 – Organic Chemistry I		
Batch	Semester	Hours / Cycle	Total Hours	Credits
2022-2024	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 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 to K5	CO1	Recall the concepts of aromaticity, chemistry of intermediates, substitution reactions, retrosynthesis and terpenoids
	CO2	Review the mechanism of electrophilic substitution reactions
	CO3	Illustrate the mechanisms of aliphatic and aromatic nucleophilic substitution reactions
	CO4	Connect the guidelines of retro synthetic approach to solve problems in the planning of organic synthesis
	CO5	Appraise the structural elucidation and synthesis of some important 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 (Vilsmeier-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 – Schiemann reactions.

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 Caryophyllene, Zingiberene, β -Eudesmol, Abeitic acid.

*Denote self study portion

Teaching methodology

Chalk & talk, Google classroom, 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 (2014) 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, 21th 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 Rakeshkumar Parashar (2016) Organic reaction mechanisms, Fourth edition, Narosa publishing house.

Mapping

CO \ PSO	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	M
CO5	S	H	M	S	L
	S-Strong	H-High	M-Medium	L-Low	

Programme Code: 04		M.Sc., Chemistry		
Course Code : 22PCH102		Core Paper 2 – Inorganic Chemistry I		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2022-2024	I	5	75	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 to K5	CO1	Enumerate the fundamentals of acid-base concepts, solid state chemistry, nuclear chemistry and <i>f</i> -block chemistry
	CO2	Describe the structures of some ionic solids, spinels and related structures
	CO3	Discover several diffraction techniques for structure determination
	CO4	Examine the concepts of Nuclear Chemistry and the applications of radioisotopes
	CO5	Assess the chemistry of <i>f</i> -block elements

Syllabus

UNIT – I: 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, antiferite, 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 – II: SOLID STATE AND CRYSTALLOGRAPHY

(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, – relationship between molecular symmetry and crystallographic symmetry, 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-Basic principle, Crystal Growth methods: From melt and solution (hydrothermal, Gel methods).

UNIT – III: CHEMISTRY OF f-BLOCK ELEMENTS (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*.

UNIT – IV: INORGANIC POLYMERS (15 hrs)

Types of inorganic polymers, comparison with organic polymers, Chains – catenation, heterocatenation, 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 – Clusters - dinuclear, trinuclear, tetranuclear, hexanuclear and organometallic clusters (structures only), Wade's theory – closo, nido and arachno structures of boranes, carboranes and carbonyl compounds.

UNIT – V: 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.

* Denotes self study

Teaching methods

Lecture by chalk & talk, Google classroom, power point presentations, Group discussions, Seminar, Quiz, Assignment, create models.

Text Books

1. J. D.Lee (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. H. J. Arnikar (2007) Essential of Nuclear chemistry 4th Edition, New Age International Publishers.

Reference Books

1. U. N. Dash (2012) Nuclear Chemistry, 1st Edition.
2. F. A. Cotton 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.
4. Gary L. Miessler, Donald A. Tarr (2013) Inorganic Chemistry, 3rd edition, Prentice Hall.
5. U.K. Malik, G.D. Tuli, and R.D. Madan, (2010) Selected Topics in Inorganic Chemistry, S. Chand Publication.
6. A.R. West (2013) Solid State Chemistry and its applications, Wiley & Sons.

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
CO5	S	H	M	H	M

S-Strong

H-High

M-Medium

L-Low

Programme Code: 04		M.Sc., Chemistry		
Course Code : 22PCH103		Core Paper 3 – Physical Chemistry I		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2022-2024	I	5	75	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 to K5	CO1	Narrate the fundamentals of group theory and chemical kinetics
	CO2	Relate the relationship between symmetry and point groups and discuss the applications of group theory
	CO3	Experiment different theories of reaction rates and the kinetics of fast reactions
	CO4	Correlate various catalysis mechanisms with the kinetics
	CO5	Appraise the 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- concept of molecular mass-Number average, weight average, Viscosity average - determination of Molecular mass – Osmometry - Light

Scattering method – Ultracentrifugation -Viscometer – kinetics of free radical chain polymerization (derivation of rate equation, kinetic chain length and degree of polymerization), Glass Transition Temperature - process of polymerization – bulk, solution, suspension and emulsion.

* Denotes self study

Teaching methods

Lecture by chalk & talk, Google classroom, 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 WileyInterscience 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, 2nd edition, Prentice HallInternational .Inc
7. Richard I. Masel, (2011) Chemical Kinetics and Catalysis, Wiley Interscience.

Reference Books

1. Veera Reddy (2014) 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

CO \ PSO	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
CO5	S	H	H	H	M

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

Programme Code: 04		M.Sc., Chemistry		
Course Code:22PCH204		Core Paper 4 – Organic Chemistry II		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2022-2024	II	5	75	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 to K5	CO1	Outline the essentials of addition and elimination reactions, stereochemistry, pericyclic reactions, photochemistry and alkaloids
	CO2	Identify the different types of notations in stereochemistry
	CO3	Relate correlation and FMO approach with electrocyclic, cycloaddition and Sigmatropic reactions
	CO4	Illustrate the mechanisms of various organic photochemical reactions
	CO5	Describe the structural features of some important compounds of 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 - carbene addition to double bonds - Birch and Meerwein-Ponndorf reduction - Hydroboration – Mannich - Wittig - Grignard reactions - Aldol - Knoevenagel- Stobbe-Michael - Darzen's glycidic ester and Benzoin condensations – Peterson alkene synthesis- hydration of olefins.

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: ($\pi 2s + \pi 2s$) Correlation and FMO approach, ($\pi 2s + \pi 4s$) - 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* - Grothus-Draper law, Einstein's Law of photochemical equivalence, Quantum yield - physical and chemical actinometry, Jablonski diagram, photophysical processes – Fluorescence, phosphorescence, internal conversion and intersystem crossing, photosensitization, quenching, Typical photochemical reactions – Norrish type I and type II reactions, Paterno-Buchi reaction, photoreduction, photo oxidation, Cis-trans isomerization, photochemistry of arenes, Photo Fries rearrangement, di- π methane rearrangement, oxa & aza - 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, Google classroom, power point presentation, e-content, numerical exercises, assignment, quiz, seminar.

Text Books

1. Jagdamba Singh, L. D. S. Yadav (2006) Organic Synthesis, PragatiPrakashan Educational Publications, Meerut, India.

2. P. S. Kalsi(2005)Stereochemistry, Conformation and Mechanism (6thedn.), 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 (2014) Fundamentals of photochemistry, Revised edition, New age international publications.
5. O. P. Agarwal (2012) Natural product Chemistry, 21th 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 (2014) 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

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	H	M
CO2	H	S	S	M	S
CO3	H	S	M	H	H
CO4	S	H	H	H	M
CO5	H	H	M	H	M

S-Strong

H-High

M-Medium

L-Low

Programme Code: 04		M.Sc., Chemistry		
Course Code : 22PCH205		Core Paper 5 – Inorganic Chemistry II		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2022-2024	II	5	75	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 to K5	CO1	Read the elemental ideas of coordination chemistry and reaction mechanisms
	CO2	Cite the postulates of Crystal Field Theory and Molecular Orbital Theory
	CO3	Compute Term symbols and construct Orgel and Tanabe-Sugano diagrams of coordination complexes
	CO4	Elucidate the mechanisms of reactions of transition metal complexes and calculate their stability constants
	CO5	Compare and contrast the different types of electron transfer reactions

Syllabus

UNIT – I: CO-ORDINATION CHEMISTRY I

(15 hrs)

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 and optical 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 and π 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 - 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^2 , d^6 complexes and its applications)- calculation of Δ_0 and β and Racah parameters – examples from d^3 , d^7 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, Google classroom, 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, 16thEdn, 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, (2013) Selected Topics in Inorganic Chemistry, S.Chand Limited.

Reference Books

1. Basolo and Pearson, Ralph. G (2007) Mechanism of Inorganic Reactions- A study of metal complexes in solution. Wiley Eastern, New Delhi.
2. F.A. Cotton 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
CO5	S	M	H	M	H

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

Programme Code: 04		M.Sc., Chemistry		
Course Code : 22PCH2CL		Core Practical 1 – Organic Chemistry Practical I		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2022-2024	I & II	3 or 5	120	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)

K1 to K5	CO1	Describe systematic procedures for carrying out experiments
	CO2	Identify organic compounds by their characteristic reactions towards standard reagents
	CO3	Relate the principle of separation for separating two organic compounds in a given mixture
	CO4	Categorize the components present in the organic mixture and report the same
	CO5	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 Diphenylhydantoin from Benzil and urea.

9. Microwave synthesis (Group Experiment, Not for ESE)

Reference books

1. Gnanaprakasam 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 50)	ESE (Maximum 50)
1. CIA Practical exam – 30 (Exam marks 50 converted to 30)	1. Qualitative analysis – 30
2. Observation note book – 15	2. Preparation of an organic compound – 10
3. Attendance – 5	3. Viva-Voce – 5
	4. Record – 5

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
CO4	S	H	M	M	H
CO5	S	M	H	S	M
	S-Strong	H-High	M-Medium		L-Low

Programme Code: 04		M.Sc., Chemistry		
Course Code : 22PCH2CM		Core Practical 2– Inorganic Chemistry Practical I		
Batch	Semester	Hours / Cycle	Total Hours	Credits
2022-2024	I and II	3or 5	120	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)

K1 to K5	CO1	Read the procedure for the group separation and systematic analysis of cations
	CO2	Identify the appropriate preparation method of complexes
	CO3	Experiment the preparation of some inorganic complexes
	CO4	Analyze and report two familiar metal cations and two less familiar metal cations
	CO5	Estimate 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

Nickelammoniumsulfatehexahydrate

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.Veerarwamy 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 50)	ESE (Maximum 50)
1. CIA Practical exam – 30 (Exam marks 50 converted to 30)	1. Qualitative analysis – 20
2. Observation note book – 15	2. Preparation of an inorganic compound – 10
3. Attendance – 5	3. Colorimetric estimation – 10
	4. Viva-Voce - 5
	5. Record – 5

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
CO4	S	H	H	M	H
CO5	S	M	S	M	H
	S-Strong	H-High	M-Medium		L-Low

Programme Code: 04		M.Sc., Chemistry		
Course Code : 22PCH2CN		Core Practical 3 – Physical Chemistry Practical I		
Batch	Semester	Hours / Cycle	Total Hours	Credits
2022 - 2024	I & II	4 or 5	135	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)

K1 to K5	CO1	Recall the disciplinary regulations to be followed inside a physical chemistry lab
	CO2	Describe the determination of equilibrium constant of a reaction
	CO3	Use the principle of potentiometric titrations for estimating the strength of solutions
	CO4	Calculate the molecular weight of a compound by Rast's method
	CO5	Evaluate the properties of matter by Simple Eutectic System

Syllabus

Non Electrical Experiments

1. Properties of Matter

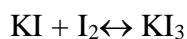
Simple Eutectic System- determination of unknown compositions

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



Electrical Experiments – 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 50 marks)	ESE (Maximum 50 marks)
1. CIA Practical exam – 30 (Exam marks 50 converted to 30)	1. Experiment – 40
2. Observation note book – 15	2. Viva-Voce – 5
3. Attendance – 5	3. Record – 5

Mapping

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	H	S	M
CO2	H	H	M	S	H
CO3	H	S	H	H	M
CO4	S	H	H	S	M
CO5	S	M	M	H	H

S – Strong

H – High

M – Medium

L – Low

Programme Code: 04		M.Sc., Chemistry		
Course Code : 22PCH306		Core Paper 6– Physical Chemistry II		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2022-2024	III	5	75	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 to K5	CO1	Recall the elementary aspects of quantum chemistry and electrochemistry
	CO2	Illustrate the quantum mechanical operations in solving Schrodinger wave equations
	CO3	Apply various approximation methods to Helium atom
	CO4	Outline different electrochemical theories and point out their importance
	CO5	Describe 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 degeneracy. 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, Approximate wave function of many electron atoms- Born – Oppenheimer approximation, Hartree self-consistent field theory.

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 - Helmholtz-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, Google classroom, 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 (2006) Elementary Quantum Chemistry, McGraw-Hill.
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 (2009) Theoretical Electrochemistry, Mir Publishers, Moscow.
4. Horia Metiu (2006) Physical Chemistry –Quantum Mechanics, Taylor& Francis.

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
CO5	H	S	M	H	M

S-Strong

H-High

M-Medium

L-Low

Programme Code: 04		M.Sc., Chemistry		
Course Code:22PCH307		Core Paper 7– Organic Chemistry III		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2022-2024	III	5	75	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 to K5	CO1	Enumerate the mechanisms of various molecular rearrangements, reagents and biologically important compounds
	CO2	Discuss the synthetic utility of different reagents in oxidation and reduction reactions
	CO3	Sketch and elucidate the structure of selected steroids
	CO4	Classify proteins and vitamins; examine their structures and biological importance
	CO5	Appraise the chemistry of some plant pigments and 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, Benzidine rearrangement, Wolff rearrangement - Base catalysed rearrangement – Favorskii, Carbon to Carbon migration of other groups - Neber rearrangement Sommelet-Hauser 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), MnO₂, OsO₄, Jones reagent, copper chromite, Ozonolysis, Oppenauer oxidation, Sharpless asymmetric epoxidation, Lead tetraacetate, Mercuric acetate, Thallium acetate, DMSO.

Reduction: Complex metal hydrides such as LiAlH₄, NaBH₄, NaCNBH₃, DIBAL-H and trialkyl tin hydride, Dissolving metal reduction – Sodium-alcohol, Zinc-Hydrochloric acid (Clemenson), Reduction by hydrazine (Wolff-Kishner reduction), stannous chloride (Stephen reaction).

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 two), 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 and B12.

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 diisopropylamide (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, Google classroom, power point presentation, e-content, numerical exercises, assignment, quiz, seminar.

Text Books

1. V.K.Ahluwalia and RakeshkumarParashar (2016) Organic reaction mechanisms, 3rd edition, Narosa publishing house.

2. Jagdamba Singh, L. D. S. Yadav (2014) Organic Synthesis, 10th edition, PragatiPrakashanEducational 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 (2016) 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 (2014) Organic Chemistry-Part-B-Reactions and synthesis, Springer, 5th edition.

Mapping

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	M	H	M
CO2	M	S	M	S	M
CO3	H	M	H	M	H
CO4	S	S	M	H	S
CO5	S	H	M	H	M

S-Strong

H-High

M-Medium

L-Low

Programme Code: 04		M.Sc., Chemistry		
Course Code : 22PCH308		Core Paper 8– Inorganic Chemistry III		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2022-2024	III	5	75	4

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 to K5	CO1	Record the essentials of organometallic chemistry, bioinorganic chemistry and inorganic polymers
	CO2	Explain the structure, reactions and bonding in several organometallic compounds
	CO3	Illustrate the role of organometallic compounds in catalysis
	CO4	Discover the chemistry and significance of bioinorganic compounds
	CO5	Appraise the chemistry of inorganic polymers; justify the structures of cages and clusters using Wade's rules

Syllabus

UNIT – I: ORGANOMETALLIC COMPOUNDS I

(15 hrs)

Hapticity, 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 membered 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 hydrosylation of alkenes – Wacker process- carbonylation of methanol and methyl acetate (Monsanto acetic acid process), Zeigler-Natta catalyst, Synthesis gas.

UNIT – IV: BIOINORGANIC CHEMISTRY I (15 hrs)

Iron containing proteins: Metalloporphyrins-Haemoglobin and myoglobin – Structures and work functions – synthetic oxygen carriers – Cytochrome – structure and work function, Non-heme oxygen carriers – Electron carrier proteins – Iron sulphur proteins, Magnesium containing proteins: Chlorophyll – structure, Copper containing proteins: Classification – blue copper proteins – structure of blue copper electron transferases – copper protein as oxidases – cytochrome c oxidase – mechanistic studies of cytochrome c oxidase.

UNIT – V: BIOINORGANIC CHEMISTRY II (15 hrs)

Metallo enzymes: Carboxy peptidase A – structure and functions; Carbonic anhydrase – inhibition and poisoning – Corrin ring system – Vitamin B12 (cyanocobalamin) and B12 coenzymes – In vivo and In vitro nitrogen fixation, Essentials of trace elements and chemical toxicology: Trace elements in biological system, Metal ion toxicity - classes of toxic metal compounds – detoxification, Metals in medicine: Anti arthritis drugs – Au and Cu in rheumatoid arthritis – Li in psychiatry – Pt, Au and metallocenes in anti cancer drugs, metals in radiodiagnosis and magnetic resonance imaging. Transport and storage of metals: Mechanism – Fe, Cu, Zn and V storage and transport – metallothioeins. Molecular mechanism of iron transport across the membrane – sodium and potassium ion pumps.

* Denotes self study

Teaching methods

Lecture by chalk & talk, Google classroom, power point presentations, Group discussions, Seminar, Assignment and activity.

Text Books

1. J. D. Lee (2009) 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, (2010) 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
CO5	S	H	M	S	M

S-Strong

H-High

M-Medium

L-Low

Programme Code: 04		M.Sc., Chemistry		
Course Code: 22PCH3CO		C. Pr.4 –Physical Chemistry Practical II		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2022-2024	III	4	60	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)

K1 to K5	CO1	Read the various laws used for measuring electrical conductance
	CO2	Relate the principle of conductometric titrations to the estimation of the strengths of solutions
	CO3	Apply Freundlich adsorption isotherm for the adsorption of oxalic acid on charcoal
	CO4	Examine the reaction kinetics of two different solutions
	CO5	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. BaCl₂ Vs MgSO₄
4. Buffer Vs Strong acid

Chemical Kinetics

5. Acid hydrolysis of an ester – Relative strength of acids
6. Reaction kinetics of KI and K₂S₂O₈
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 50 marks)	ESE (Maximum 50 marks)
1. CIA Practical exam – 30 (Exam marks 50 converted to 30)	1. Experiment – 40
2. Observation note book – 15	2. Viva-Voce – 5
3. Attendance – 5	3. Record – 5

Mapping

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	S	S	H
CO2	M	H	S	H	M
CO3	H	M	H	S	M
CO4	S	H	S	H	M
CO5	S	M	H	S	H

S-Strong

H-High

M-Medium

L-Low

Programme Code: 04		M.Sc., Chemistry		
Course Code : 22PCH409		Core Paper 9–Physical Chemistry III		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2022-2024	IV	5	75	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 to K5	CO1	Define the vitals of chemical thermodynamics, statistical thermodynamics and photochemistry
	CO2	Discuss the third law of thermodynamics, theories of probability and thermodynamic probability
	CO3	Apply the principles of statistical thermodynamics to derive distribution laws
	CO4	Derive the expressions for the partition functions of molecules
	CO5	Summarize various photophysical processes taking place in excited molecules

Syllabus

UNIT – I: CHEMICAL THERMODYNAMICS I

SECOND LAW OF 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. 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.

IRREVERSIBLE THERMODYNAMICS

Phenomenological Laws and Onsager's Reciprocal Relations- Verification of the Onsager relations, The principle of Microscopic Reversibility, Electrokinetic Effects, Non-linear Thermodynamics of Irreversible Processes, Application of Irreversible Thermodynamics to Biological systems.

UNIT – II: CHEMICAL THERMODYNAMICS II

(15 hrs)

THIRD LAW OF THERMODYNAMICS

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.

PROBABILITY

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-I

(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-II

(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, Google classroom, power point presentations, Group discussions, Seminar, Quiz, Assignment, models.

Text Books

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

Reference Books

1. Glasstone (2013) Thermodynamics for chemists, Van Nostrands.
2. M.C. Gupta (2013) 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
CO5	S	M	H	M	H

S-Strong

H-High

M-Medium

L-Low

Programme Code: 04		M.Sc., Chemistry		
Course Code : 22PCH410		Core Paper 10 – Spectroscopy		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2022-2024	IV	5	75	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 to K5	CO1	List the fundamental concepts of IR, UV, Mass and NMR spectroscopic techniques
	CO2	Discuss the theories and rules for solving UV spectrum of a compound
	CO3	Interpret the fragmentation pattern in a mass spectrum and determine the structural features of some compounds
	CO4	Elucidate the ^1H spectra of simple organic molecules
	CO5	Solve the ^{13}C NMR spectra of organic compounds

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-¹H 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, A₂B₂, 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: ¹³C NMR (15 hrs)

Sensitivity, differences between ¹³C NMR and ¹H NMR, measurement of ¹³C NMR spectra, solvents, Types of ¹³C 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 C₁₂ units.

* Denotes self study

Teaching methods

Lecture by chalk & talk, Google classroom, power point presentations, Group discussions, Seminar, Assignments and solving problems.

Text Books

1. Jagmohan (2013) 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, McMillan 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 Morrill (2014) Spectrometric identification of organic compounds, 8th Edition, John Wiley and Sons.
3. P.S. Kalsi (2014) 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
CO5	S	H	M	H	M

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

Programme Code: 04		M.Sc., Chemistry		
Course Code : 22PCH4CP		Core Practical 5 - Organic Chemistry Practical- II		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2022-2024	III and IV	3 or 5	120	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)

K1 to K5	CO1	Define clearly, the procedures of quantitative estimations
	CO2	Report the significance of the preparation of Aspirin and Paracetamol drugs
	CO3	Apply the principle involved in double stage preparation of some organic compounds and prepare the compounds
	CO4	Analyze Reichert-Meisel value, saponification value and iodine value in the given oil or fat
	CO5	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), Ascorbic acid.

B. Two stage Preparations:

1. Preparation of Drugs: Aspirin, Paracetamol
2. Preparation of Benzanilide from benzophenone
2. Preparation of m- nitrobenzoic 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)

Reichert – Meisel value, saponification 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 Chemistry, Vol. I & II.

Distribution of Marks

Internal (Maximum 50 marks)	ESE (Maximum 50 marks)
1. CIA Practical exam – 30 (Exam marks 50 converted to 30) 2. Observation note book – 15 3. Attendance – 5	1. Experiment – 40 2. Viva-Voce – 5 3. Record – 5

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
CO4	S	H	H	S	M
CO5	S	H	S	M	H
	S-Strong	H-High	M-Medium	L-Low	

Programme Code: 04		M.Sc., Chemistry		
Course Code : 22PCH4CQ		Core Practical 6 – Inorganic Chemistry Practical II		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2022-2024	III & IV	3 or 5	120	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 UV-Visible Spectral studies
3. To learn about the preparation and analyse the properties of inorganic complexes

Course Outcomes (CO)

K1 to K5	CO1	Recall the principles of Gravimetry
	CO2	Demonstrate the chromatographic separation techniques for the prepared compounds
	CO3	Apply the principle of UV-Visible Spectroscopy to solve the structures of complexes
	CO4	Comment on the physical properties such as melting point, etc., of the prepared inorganic complexes
	CO5	Estimate the amount of cations present in a solution mixture

Syllabus

A. UV-Visible spectral studies: Recording UV-Visible spectrum of five coordination complexes and interpretation of the spectra. (Group Experiment, Not for ESE practicals)

B. Chromatography: Column, Paper and Thin layer chromatographic techniques (Group Experiments, Not for ESE practicals)

C. Preparation:

Single stage preparation, analysis and study of the properties of at least five coordination complexes.

HexathioureaLead(II)nitrate, Potassiumtrioxalatoferate(III), Pentathioureadicopper(I)nitrate, Potassiumtrioxalatochromate(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.Veerarwamy and A.R. Kulandaivelu (2004) Principles of Practical Chemistry, Sultan Chand & Sons, 2nd 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. Denny, G.H. Jeffery and Mendham (2000) Vogel's text book of qualitative Inorganic Analysis, 6th Edn. Pearson Education.

Distribution of marks

Internal (Maximum 50 marks)	ESE (Maximum 50 marks)
1. CIA Practical exam – 30 (Exam marks 50 converted to 30)	1. Quantitative analysis (volumetric and gravimetric estimations: 15+15) – 30
2. Observation note book – 15	2. Preparation – 10
3. Attendance – 5	3. Viva-Voce – 5
	4. Record – 5

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
CO4	S	H	M	H	S
CO5	S	M	S	H	M

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

Programme Code: 04		M.Sc., Chemistry
Course Code : 22PCH4Z1		Project & viva-voce
Batch	Semester	Credits
2022-2024	IV	4

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)

K1 to K5	CO1	Choose scrupulously, an appropriate research topic
	CO2	Summarize the findings of a thorough literature review
	CO3	State exactly, the problem of the experimental study/ research undertaken
	CO4	Interpret the results of the research using some basic tools
	CO5	Evaluate the research outcomes and present them in written and oral

COMPONENT FOR PROJECT

CIA / ESE	Particulars	Project Out of 100 Marks
CIA	Project Review	45
	Regularity	5
	Total Internal Marks	50
*ESE	Project Report Present	35
	Viva Voce	15
	Total External Marks	50
Total Marks(CIA+ESE)		100

Note: The Project 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
CO4	S	H	M	H	H
CO5	S	H	H	S	M

S-Strong

H-High

M-Medium

L-Low

Programme Code: 04		M.Sc., Chemistry
Batch : 2022-2024		Major Elective –Analytical Chemistry
Hours/Cycle	Total Hours	Credits
5	75	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 to K5	CO1	Define the ideas of error analysis, chromatography, thermogravimetry, ESR, AAS, ORD and CD
	CO2	Discuss the principles and instrumentation of several chromatographic methods
	CO3	Discover the principles, instrumentation and applications of various thermo analytical techniques
	CO4	Interpret ESR and Mossbauer spectra of several metal complexes
	CO5	Assess the principle and applications of AAS , 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, Google classroom, 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 KSrivastava and K KSrivastava (2013) 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, PragathiPrakashan Publishers, 9th edition.

Reference Books

1. Gurdeep R. Chatwal & S.K. Anand (2014) 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

CO \ PSO	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
CO5	H	H	S	H	M

S-Strong

H-High

M-Medium

L-Low

Programme Code: 04		M.Sc., Chemistry
Batch: 2022-2024		Major Elective – Green and Nanochemistry
Hours/Cycle	Total Hours	Credits
5	75	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 to K5	CO1	List the basic principles of green chemistry and the essentials of nanochemistry
	CO2	Relate the twelve principles of green chemistry with several green syntheses
	CO3	Discover the microwave and ultra sound assisted syntheses
	CO4	Elucidate the chemistry of nanomaterials and their synthetic methods
	CO5	Describe various characterization techniques for nanomaterials; summarize the applications 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 – Cannizzaro 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 arcing, chemical vapour deposition, electrodeposition, sol-gel synthesis, ball-milling.

UNIT –V: NANOCHEMISTRY II

(15 hrs)

Chemical methods of preparation of nanomaterials – Chemical reduction – borohydride, citrate and polyol reduction, co-precipitation, high temperature thermal decomposition, liquid-liquid interface reaction, Characterization Techniques – principle, instrumentation and applications of - Scanning Electron Microscopy (SEM), Scanning Tunnelling Microscope (STM), 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, Google classroom, power point presentations, Group discussions, Seminar, Quiz.

Text Books

1. V. Kumar (2010) 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 (2013) 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

CO \ PSO	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
CO5	H	S	H	S	M

S-Strong

H-High

M-Medium

L-Low

Programme Code: 04		M.Sc., Chemistry
Batch: 2022-2024		Major Elective – Bioinorganic Chemistry
Hours/Cycle	Total Hours	Credits
5	75	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 to K5	CO1	State the role of metal ions in biological systems
	CO2	Identify the physiology and functions of haemoglobin and myoglobin
	CO3	Examine several electron transfer reactions in biological systems
	CO4	Discover the structure and functions of metalloenzymes
	CO5	Appraise the functions and applications of metals in medicine

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- hemosiderin - 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 – carboxypeptidase and carbonic anhydrase – iron enzymes – catalase, peroxidase and cytochrome P-450 – copper enzymes – Enzymes – structure and function – zinc enzyme – carboxypeptidase and carbonic anhydrase – iron enzymes – catalase, peroxidase and cytochrome P-450 – copper enzymes – superoxide dismutase – molybdenum oxotransferase enzymes – xanthine oxidase – vitamin B₁₂ 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, Google classroom, power point presentation, e-content, assignment, discussions and seminar.

Text Books

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

Reference Books

1. Bertini, H.B.Gray, S.J. Lippard and J.S. Nalentine (2011) Bioinorganic Chemistry; University Science Books.
2. P.S. Kalsi and J.P. Kalsi (2011) Bioorganic, Bioinorganic and Supramolecular chemistry, NewAge 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
CO5	H	S	M	M	H

S-Strong

H-High

M-Medium

L-Low

Programme Code: 04		M.Sc., Chemistry
Batch: 2022-2024		Major Elective – Drug design and development
Hours/Cycle	Total Hours	Credits
5	75	5

Course Objectives

1. To create awareness among the students about various drugs used for therapeutic purposes.
2. To enable the students to know the principle of drug designing and drug targeting.
3. On successful completion of the syllabus, the students should have learnt about various drugs, their design and development.

Course Outcomes (CO)

K1 to K5	CO1	Describe the chemistry of drugs and their action as therapeutics
	CO2	Discuss the action mechanism of drugs
	CO3	Examine the physicochemical properties of drugs
	CO4	Outline the Structure Activity Relation of several therapeutic agents
	CO5	Assess drug design and drug target interaction

Syllabus

UNIT– I: INTRODUCTORY DRUG CHEMISTRY (15 hrs)

Introduction to drugs, definition of drugs, requisites of a good drug, classification of drugs, development of various classes of drugs –revolutions in drug discovery, some common drugs – anaesthetics, antiseptics, analgesics, antipyretics, cell structure - types of molecules in the cell affected by drugs - protein binding.

UNIT– II: DRUG ACTION (15 hrs)

Characteristics of different routes to drug administration, sites of drug action, mode of drug action, mechanism of drug action, drug receptors – drug-receptor complex nomenclature, chemical nature, types, drug receptor interactions – covalent, ionic, hydrogen bonding, Vander Waals and hydrophobic interactions, receptor site theories – occupation, rate and induced-fit theories.

UNIT– III: PHYSICOCHEMICAL PROPERTIES OF DRUGS (15 hrs)

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-non classical bioisosterers.

UNIT – IV: THERAPEUTIC AGENTS

(15 hrs)

Structure Activity Relation (SAR) of antibiotics – cephalosporins, streptomycin, tetracycline, erythromycin and chloramphenicol, SAR of antimalarial drug cinchonine, SAR of anticancer drug cisplatin, cardiovascular drugs – definition and categories, synthesis and use of diuretic drug – chloemerodrin Hg¹⁹⁷, antiparkinsonism drug – biperiden hydrochloride, antipsychotics, antithyroid drugs, drugs to combat aids, antiviral drugs, vaccines and their action mechanism.

UNIT – V: DRUG DESIGN AND DRUG-TARGET INTERACTION

(15 hrs)

Drug design – Fundamentals and objectives of QSAR, variation of substituents – alkyl and aromatic substituents, extension of the structure, chain extensions/contractions, 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.

TEXTBOOKS

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

REFERENCE BOOKS

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

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
CO5	H	S	H	M	H

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

Programme Code: 04		M.Sc., Chemistry
Batch: 2022 -2024		Non Major Elective – Chemistry of Environment
Hours / Cycle	Total Hours	Credits
4	60	4

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 to K5	CO1	Enumerate the different sources of pollutants and their effects
	CO2	Classify water pollutants; Report their sources and harmful effects
	CO3	Identify different sources of soil pollution, their effects and control measures
	CO4	Discover the types and consequences of radioactive pollutants
	CO5	Assess the causes and harmful effects of thermal and noise 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 – Chlorofluoro 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 detrimental 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

(14hrs)

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

UNIT – V: THERMAL AND NOISE POLLUTION

(14 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.

* Denotes self study portion

Teaching methodology

Lecture by chalk & talk, Google classroom, 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 (2010)Environmental Chemistry, Wiley Eastern Ltd, 5th edition.

Reference Books

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

Mapping

CO \ PSO	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
CO5	S	H	S	H	M

S – Strong

H – High

M – Medium

L – Low

Programme Code: 04	M.Sc., Chemistry	
Batch: 2022 – 2024	Non Major Elective – Scientific Thesis Writing	
Hours / Cycle 4	Total Hours 60	Credits 4

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 to K5	CO1	Discover the ways to write the ‘Introduction’, ‘Review of Literature’ and other chapters of a thesis or dissertation
	CO2	Discuss the guidelines for writing ‘Materials and Methods’ chapter of a thesis
	CO3	Explain the strategies adopted for writing ‘Discussion’, ‘Abstract’, and ‘Synopsis’ sections of a thesis
	CO4	Elucidate the different types of reference citation in a thesis
	CO5	Distinguish between oral and poster presentation; Compare various article types in journal publication

Syllabus

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 of 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

(14hrs)

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

(14hrs)

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.

Working knowledge in software-Origin, Chemdraw.

* Denotes self study portion

Teaching methodology

Lecture by chalk & talk, Google classroom, 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 FridrichEbel, Claus Bliefert, Willaim E. Russey (2012) The art of scientific writing, Wiley, VCH.

2. Martha Davis, Kaaron Davis (2012) Scientific papers and presentation, 3rd edition, Elsevier.

Mapping

CO \ PSO	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
CO5	S	H	S	S	M

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

Programme Code: 04		M.Sc., Chemistry
Batch : 2022-2024		Non Major Elective – Textile and Dye Chemistry
Hours/Cycle	Total Hours	Credits
4	60	4

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

Course Outcomes (CO)

K1 to K5	CO1	Examine the chemistry of fibres and dyes
	CO2	Explain the manufacture and processing of fibres
	CO3	Illustrate various theories of colour and dye-fibre interactions
	CO4	Analyze the principle of dyeing
	CO5	Evaluate several treatment processes involved in dyeing

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

Programme Code: 04		M.Sc., Chemistry		
Course Code: 22PGI4N2		Non Major Elective – Information Security		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2022-2024	IV	4	60	4

Course Objectives

1. Students will identify the core concepts of Information security.
2. To examine the concepts of Information Security.
3. To design and implement the security features for IT and Industrial sectors.

Course Outcomes (CO)

K1 to K5	CO1	To Learn the principles and fundamentals of information security.
	CO2	To Demonstrate the knowledge of Information security concepts
	CO3	To Understand about Information Security Architecture.
	CO4	To Analyze the various streams of security in IT and Industrial sector.
	CO5	To know about Cyber Laws and Regulations.

Syllabus

UNIT I

(12 Hours)

Information Security basics: Definition of Information Security - History of Information Security - Characteristics of Information Security - Components of Information Security - Security System Development Life Cycle (SDLC).

Information Security for technical administrators: Server Security – Network security- Social Media Security.

UNIT II

(12 Hours)

Cryptography: Basic concepts - plain text - Cipher text - Encryption Principles - CRYPT Analysis - Cryptographic Algorithms - Cryptographic Tools – Authentication -Biometrics* - passwords - Access Control Devices - Physical Security - Security and Personnel.

Language-based Security: Analysis of code for security errors, Safe language and sandboxing techniques.

UNIT III

(12 Hours)

Firewalls, Viruses & Worms & Digital Rights Management : Viruses and Worms-Worms - Digital Rights Management – Firewalls - Application and Circuit Proxies - Stateful Inspection - Design Principles of Firewalls.

Logical Design: Access Control Devices- Physical Security-Security and Personnel - NIST Models-VISA International Security Model- Design of Security Architecture-Planning for Continuity.

UNIT IV

(12 Hours)

Hacking : Introduction – Hacker Hierarchy – Password cracking – Phishing - Network Hacking - Wireless Hacking - Windows Hacking - Web Hacking*- Ethical Hacking.

Security Investigation: Need for Security- Business Needs-Threats- Attacks- IP Addressing and Routing - Social Media

UNIT V

(12 Hours)

Cyber Laws : What is Cyber Law? - Need for Cyber laws - Common Cyber Crimes and Applicable Legal Provisions: A Snapshot - Cyber Law (IT Law) in India – The Information Technology Act of India 2000 - Cyber Law and Punishments in India - Cyber Crime Prevention guide to users – Regulatory Authorities.

***Self study** (Questions for examination may be taken from the self-study portions also)

Teaching Methods:

Chalk and Talk, Power point presentation, Seminar, Brainstorming, Assignment, Google Classroom.

TEXT BOOK:

Information Security – Textbook is prepared by KONGUNADU ARTS AND SCIENCE COLLEGE, Coimbatore -29, 2022.

REFERENCE BOOKS:

1. Charles P Pfleeger and Shai Lawrence Pfleeger, “Security in Computing”, Fourth & Third Edition, Prentice Hall, 2007 & 2011.
2. Ross J. Anderson and Ross Anderson, “Security Engineering: A guide to building Dependable Distributed System”, Wiley, 2009.
3. Thomas R. Peltier, Justin Peltier and John Bleckley, “Information Security Fundamentals”, 2nd Edition, Prentice Hall 1996.

4. Gettier, Urs E. "Information Security: Strategies for Understanding and Reducing Risks", John Wiley & Sons, 2011.
5. "Principles of information security". Michael Whiteman and Herbert J. Mattord, 2012.
6. Information security -Marie wright and John kakalik, 2007.
7. Information security Fundamentals- Thomas R. Peltier, Justin Peltier and John Blackley-2005.
8. Information Security theory and practical PHI publication, Dhiren R. Patel-2008.
9. Debby Russell and Sr. G.T. Gangemi, "Computer Security Basics", 2nd edition, O'Reilly Media, 2006.

MAPPING

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	S	S
CO2	M	H	H	S	H
CO3	H	S	S	M	S
CO4	H	M	H	S	H
CO5	H	S	H	S	H

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

Programme Code: 04		All PG Programmes
Course Code : 22PCH3X1		Extra Departmental Course EDC Paper 1 – Food Science
Batch	Hours/Cycle	Credits
2022 – 2024	2	2

Syllabus

UNIT – I: FOOD AND ITS GROUPS (6 hrs)

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

UNIT – II: NUTRIENTS IN FOOD (6 hrs)

Nutrients – definition, sources and functions of some important nutrients – carbohydrates, proteins, fats, vitamins, minerals and water.

UNIT – III: FOOD ADDITIVES (6 hrs)

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 ADULTERATION (6 hrs)

Adulteration – definition, types of adulterants – intentional and incidental adulterants, metallic contaminants, adulterants in common food stuffs – coffee, sugar, milk, turmeric powder, chilli powder, ghee, honey, edible oils.

UNIT – V: FOOD STANDARDS AND FUTURE FOODS (6 hrs)

Food safety – general principles, FSSAI, BIS, AGMARK, ISO, Codex Alimentarius, HACCP, Organic foods, low cost nutrient supplement, packaging of foods, nutrition labeling, nutraceuticals.

TEXT BOOK

1. B. Srilakshmi (2015) Food science, New Age International, VI edition.

REFERENCE BOOKS

1. Lillian H. Meyer (2004) Food chemistry, CBS publishers and distributors.

2. SeemaYadav (2006) Food chemistry, Anmol publishers.

JOB ORIENTED COURSE

Programme Code: 04	M.Sc., Chemistry	
Course Code : 22PCH0J1	Job Oriented Course – Pharmaceutical chemistry	
Batch 2022 – 2024	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- antianemic drugs.

Diabetes: Types - diabetes insipidus and diabetes mellitus-juvenile & adult, control of diabetes-insulin structure and sources, oral hypoglycemic drugs - tolbutamide, chlorpropamide, glibenclamide, biguanides (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, paracetamolphenacetin, 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.

Teaching methodology

Lecture by chalk & talk, Google classroom, power point presentation, e-content, guest lectures by experts in the field.

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.

Programme Code: 04	M.Sc., Chemistry
Course Code : 22PCH0D1	Advanced Learners Course – 1 Chemistry of Corrosion
Batch 2022 – 2024	Credits 2

Syllabus

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.

REFERENCE BOOK

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

Programme Code: 04	M.Sc., Chemistry
Course Code : 22PCH0D2	Advanced Learners Course – 2 Industrial Chemistry
Batch 2022 – 2024	Credits 2

Syllabus

UNIT –I: GLASS

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, Varieties of glasses-silica, optical, borosilicate, lead, safety, pyrex, alkali silicate, photochromic and glass wool.

UNIT –II: CEMENT

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

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

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

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, Google classroom, power point presentation, e-content, numerical exercises, group discussion, assignment, quiz, seminar.

REFERENCE BOOKS

1. B.K.Sharma (1991) Industrial Chemistry, GOEL Publishing Company, 4thEdn.
2. B.N. Chakarabarthi (1991) Industrial Chemistry, Oxford and IBH publishing house.
3. H.L. White (2008) Introduction to Industrial Chemistry, John Wiley & sons.
4. Vermani O.P. (2008) Industrial chemistry, Galgotia Publications Pvt. Ltd.

Programme Code: 04	M.Sc., Chemistry
Course Code : 22PCH0D3	Advanced Learners Course – 3 Advanced Functional Materials
Batch 2022 – 2024	Credits 2

Syllabus

UNIT – I: MOLECULAR-LEVEL DEVICES AND MACHINES

Molecular machines: Pseudorotaxanes, rotaxanes and catenanes – Systems featuring charge-transfer interactions –systems featuring hydrogen bonding interactions. Devices based on Electronic and Nuclear motion: Plug/socket and related systems – electrochemically controlled systems.

UNIT – II: PAMAM DENDRIMER-BASED MULTIFUNCTIONALNANOPARTICLES

Poly(Amidoamine)Dendrimers: Structure and biological properties – Synthesis and characterization, PAMAM dendrimers as a vehicle for molecular delivery into cells – PAMAM dendrimers as MRI contrast agents.

UNIT III - ADVANCED FUNCTIONAL OXIDE MATERIALS AND THEIR APPLICATIONS

High temperature superconductors: Cuprate Materials, Electrical and Magnetic properties - Magnetic oxide materials: Ferromagnetic oxide materials, Ferrites materials - MultiferroicMaterials : Origin of magnetic ordering in the oxide materials.

UNIT IV - BIODEGRADABLE POLYMERS BIODEGRADABLE POLYMERS

Polyε-caprolactone- modified poly ε-caprolactone copolymer with ester, amide and urethane linkages, polyglycolate, polymandelic acid - biodegradable polyamides – polyester urea – polyamide urethane.

UNIT V - SMART POLYMERS SUPRAMOLECULAR POLYMERS

Main chain supramolecular polymers, side-chain supramolecular polymers, examples of stimuli responsive supramolecular polymers, self-healing polymers.

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