

# **KONGUNADU ARTS AND SCIENCE COLLEGE**

(Autonomous)

Re-accredited by NAAC with 'A+' Grade (4<sup>th</sup> 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)**

(2021 – 2022 ONWARDS)

# **KONGUNADU ARTS AND SCIENCE COLLEGE**

**(AUTONOMOUS)**

**COIMBATORE – 641 029**

## **VISION OF THE COLLEGE**

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

## **MISSION OF THE COLLEGE**

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

## **DEPARTMENT OF CHEMISTRY (PG & RESEARCH)**

### **VISION AND MISSION OF THE DEPARTMENT**

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

## **PROGRAMME OUTCOMES (PO)**

**PO 1** : 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 2021 – 2022)

Semester	Course Code	Title of the Course	Instruction hours/cycle	Exam Marks			Duration of Exam (Hrs)	Credits
				CIA	ESE	Total		
I	21PCH101	C.P.-1- Organic Chemistry - I	5	50	50	100	3	5
	21PCH102	C.P. 2 - Inorganic Chemistry - I	5	50	50	100	3	5
	21PCH103	C.P. 3 - Physical Chemistry - I	5	50	50	100	3	5
	21PCH1E1	ME-1 Major Elective - I	5	50	50	100	3	5
		C.Pr.1 - Organic Chemistry Practical - I	3	-	-	-	-	-
		C.Pr.2 - Inorganic Chemistry Practical-I	3	-	-	-	-	-
		C.Pr.3 - Physical Chemistry Practical-I	4	-	-	-	-	-
<b>Total</b>			<b>30</b>			<b>400</b>		<b>20</b>
II	21PCH204	C.P. 4 - Organic Chemistry - II	5	50	50	100	3	5
	21PCH205	C.P. 5 - Inorganic Chemistry - II	5	50	50	100	3	5
	21PCH2E2	ME-2 - Major Elective - II	5	50	50	100	3	5
	21PCH2CL	C.Pr.1 - Organic Chemistry Practical - I	5	50	50	100	6	3
	21PCH2CM	C.Pr.2 - Inorganic Chemistry Practical-I	5	50	50	100	6	3
	21PCH2CN	C.Pr.3 - Physical Chemistry Practical-I	5	50	50	100	6	2
<b>Total</b>			<b>30</b>			<b>600</b>		<b>23</b>
III	21PCH306	C.P. 6 - Physical Chemistry - II	5	50	50	100	3	5
	21PCH307	C.P.7 - Organic Chemistry - III	5	50	50	100	3	5
	21PCH308	C.P.8- Inorganic Chemistry-III	4	50	50	100	3	5
	21PCH3N1	NME- 2 - Non-Major Elective - I	4	50	50	100	3	4
		Extra Departmental Course	2	50	50	100	3	2
	21PCH3CO	C.Pr.4 - Physical Chemistry Practical - II	4	50	50	100	6	2
		C.Pr.5 - Organic Chemistry Practical - II	3	-	-	-	-	-
		C.Pr.6- Inorganic Chemistry Practical- II	3	-	-	-	-	-
<b>Total</b>			<b>30</b>			<b>600</b>		<b>23</b>
IV	21PCH409	C.P.9 - Physical Chemistry - III	5	50	50	100	3	5
	21PCH410	C.P. 10 - Spectroscopy	5	50	50	100	3	5
	21PCH4N2	NME- 2 - Non-Major Elective - II	4	50	50	100	3	4
	21PCH4CP	C.Pr.5 - Organic Chemistry Practical - II	5	50	50	100	6	2
	21PCH4CQ	C.Pr.6 - Inorganic Chemistry Practical-II	5	50	50	100	6	2
	21PCH4Z1	Project Work & Viva -Voce	6 <sup>¥</sup>	50	50	100	-	4
		SWAYAM – MOOC	-	-	-	-	-	2
<b>Total</b>			<b>30</b>			<b>600</b>		<b>24</b>
<b>Total</b>						<b>2200</b>		<b>90</b>

<sup>¥</sup>6 hours are allotted for project work, which will not be accounted for the 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. Advanced Topics in Chemistry

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

21PCH3X1 – 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
<b>Grand Total</b>	<b>22</b>	<b>2200</b>	<b>90</b>

- 50 % CIA is applicable to all subjects except JOC, COP and SWAYAM courses which are considered as extra credit courses.
- The students should complete a **SWAYAM-MOOC** before the completion of the 3<sup>rd</sup> 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.

## Extra credit courses

<b>JOB ORIENTED COURSE</b>								
Semester	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
<b>ADVANCED LEARNER COURSES (UNDER SELF STUDY SCHEME)</b>								
	21PCH0D1	ALC- 1 Chemistry of Corrosion and its Prevention	-	-	100	100	3	2
	21PCH0D2	ALC- 2 Chemistry of Drugs	-	-	100	100	3	2
	21PCH0D3	ALC- 3 Food Chemistry	-	-	100	100	3	2

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

### Components of Continuous Internal Assessment (50 Marks)

Components		Marks	Total
<b>Theory</b>			
CIA I	75	(75+75) converted to 30	50
CIA II	75		
Problem based Assignment**		10	
Attendance		5	
Others*		5	
<b>Practical</b>			
CIA Practical		(50) converted to 30	50
Observation Notebook		15	
Attendance		5	
<b>Project</b>			
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-Appling;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	45	50	
K4		Record Work		05
K5				

**ESE Project Viva Voce:**

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

## QUESTION PAPER PATTERN FOR ESE

**JOC and ALC**

**Maximum marks: 100**

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





<b>Programme Code:</b> 04		<b>M.Sc., Chemistry</b>		
<b>Course Code:</b> 21PCH101		<b>C.P.1 – Organic Chemistry I</b>		
Batch	Semester	Hours / Week	Total Hours	Credits
2021-2022	I	5	75	5

### Course Objectives

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

### Course Outcomes (CO)

<b>K1 to K4</b>	<b>CO1</b>	Remember the concepts of aromaticity and the chemistry of intermediates
	<b>CO2</b>	Understand the mechanism of electrophilic and nucleophilic substitution reactions
	<b>CO3</b>	Relate the guidelines of retro synthetic approach in solving problems in the planning of organic synthesis
	<b>CO4</b>	Elucidate and analyze the synthesis of some terpenoid compounds

### Syllabus

#### UNIT – I: AROMATICITY

(15 hrs)

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

#### INTERMEDIATES

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

#### UNIT – II: ELECTROPHILIC SUBSTITUTION REACTIONS

(15 hrs)

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

Aromatic electrophilic substitution – Arenium ion mechanism – Orientation and reactivity of mono and di substituted benzene - nitration - halogenation and sulphonation - Friedel Crafts alkylation - Friedel Crafts arylation (Scholl reaction) and Friedel Crafts acylation - Jacobsen reaction - formylation with (i) disubstituted formamides (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 reaction - Cine substitution.

### **UNIT– IV: SYNTHETIC METHODOLOGY (15 hrs)**

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

### **UNIT – V: TERPENOIDS (15 hrs)**

Isoprene rule, isolation, classification and biogenesis of terpenoids\*, structural elucidation and synthesis of Caryophyllene, Zingiberene,  $\beta$ -Eudesmol, Abeitic acid.

\*Denotes self study portion

#### **Teaching methodology**

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

#### **Text Books**

1. Jerry March (2107) Advanced Organic Chemistry, Wiley eastern limited, Sixth Edition, New Delhi.
2. Jagdamba Singh, L. D. S. Yadav (2114) Advanced Organic Chemistry, Second Revised edition, Pragati Prakashan Educational publications, Meerut, India.
3. Jagdamba Singh, L. D. S. Yadav (2106) Organic Synthesis, Pragati Prakashan Educational Publications, Meerut, India.
4. I.L. Finar (2114) Organic Chemistry, Vol.I, 6<sup>th</sup>, Vol. II, 5<sup>th</sup> Edition, Addison Wesley Longman Ltd.

5. O. P. Agarwal (2107) Natural product Chemistry, 21<sup>th</sup> Edition, Goel Publishing house.
6. Janice Gorzynski Smith (2107) Organic chemistry, 2<sup>nd</sup> edition, McGrawHill Publishing.

### Reference Books

1. Clayden, Greeves, Warren (2101) Organic Chemistry, Oxford University Press.
2. P.S. Kalsi (2100) Organic Reaction Mechanism, New Age international publishers, India.
3. V.K.Ahluwalia and Rakesh kumar Parashar (2116) 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	L

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

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>		
<b>Course Code : 21PCH102</b>		<b>C.P.2 – Inorganic Chemistry I</b>		
Batch	Semester	Hours/Week	Total Hours	Credits
2021-2022	I	6	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)

<b>K1 to K4</b>	<b>CO1</b>	Remember the basics of periodic properties and acid-base concepts
	<b>CO2</b>	Understand the structures of some ionic solids and various defects; Investigate several diffraction techniques
	<b>CO3</b>	Explore Nuclear Chemistry and study the applications of radioisotopes
	<b>CO4</b>	Analyze the properties and uses of <i>f</i> -block elements

### Syllabus

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

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

#### UNIT – II: STRUCTURE AND BONDING (15 hrs)

Introduction, close packing of atoms and ions – bcc, fcc and hcc voids –radius ratio rule – derivation – its influence on structures – structures of NaCl, CsCl, rutile, fluorite, 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 – III: 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.

Fundamentals of X-ray diffraction – powder and rotating crystal methods – systematic absences and determination of lattice type – analysis of X-ray data for cubic system – electron and neutron diffraction.

**UNIT – IV: NUCLEAR CHEMISTRY**

**(15 hrs)**

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

**UNIT – V: CHEMISTRY OF LANTHANIDES AND ACTINIDES**

**(15 hrs)**

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

\* Denotes self study

**Teaching methods**

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

**Text Books**

1. Lee J. D (2109) Concise Inorganic Chemistry, Fifth edition, S.P. Printers, Delhi.
2. J.E. Huheey, E.A. Keiter (2113) Inorganic chemistry principles of structure and reactivity, 16<sup>th</sup> Edn, Pearson Noida.
3. Gary L. Miessler, Donald A. Tarr (2113) Inorganic Chemistry, 3<sup>rd</sup> edition, Prentice Hall.
4. H. J. Arnikaar (2107) Essential of Nuclear chemistry 4<sup>th</sup> Edition, New Age International Publishers.

### Reference Books

1. U. N. Dash (2112) Nuclear Chemistry 1<sup>st</sup> Edition.
2. Cotton F. A. and G. Wilkinson (2107) Advanced Inorganic Chemistry, Sixth edition, John Wiley & Sons, Inc.
3. Keith F. Purcell and John C. Kotz (2112) Inorganic Chemistry, W.B.Saunders Company.

### Mapping

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

S-Strong

H-High

M-Medium

L-Low

<b>Programme Code:</b> 04		<b>M.Sc., Chemistry</b>		
<b>Course Code :</b> 21PCH103		<b>C.P.3 – Physical Chemistry I</b>		
Batch	Semester	Hours/Week	Total Hours	Credits
2021-2022	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)

<b>K1 to K4</b>	<b>CO1</b>	Keep in mind the fundamentals of group theory
	<b>CO2</b>	Realize the relationship between symmetry and point groups and know the applications of group theory
	<b>CO3</b>	Explore different theories of reaction rates and the kinetics of fast reactions; Investigate various catalysis mechanisms and adsorption isotherms
	<b>CO4</b>	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 coordination, Ziegler-Natta polymerization-degree of polymerization-molecular weights and their determination-average molecular weight –number average and weight average molecular weight-sedimentation and viscosity average molecular weights – kinetics of free radical chain polymerization

(derivation of rate equation, kinetic chain length and degree of polymerization), process of polymerization – bulk, solution, suspension and emulsion.

\* Denotes self study

### Teaching methods

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

### Text Books

1. K. V. Raman (2104) Group Theory and its applications to chemistry, Tata McGraw Hill publishing company Ltd.
2. F. A. Cotton (2109) Chemical applications of group theory, 3<sup>rd</sup> Edition, A Wiley Interscience Publication.
3. S. Swarnalakshmi, T. Saroja, R. M. Ezhilarasi (2109) A Simple approach to group theory in chemistry, University press.
4. V. R. Gowariker & N. V. Viswanathan (2110) Polymer Science, New Age International Pvt Ltd publishers.
5. K. J. Laidler ( 2111) Chemical kinetics, 3<sup>rd</sup> Edition, Tata McGraw Hill Ltd.
6. Steinfeld, Francisco and Hase, Chemical Kinetics and Dynamics, 2<sup>nd</sup> edition, Prentice Hall International . Inc
7. Santhosh K. Upadhyay, Chemical Kinetics and Reaction Dynamics, Springer, 2106.
8. Richard I. Masel, Chemical Kinetics and Catalysis , Wiley Interscience, 2111.

### Reference Books

1. Veera Reddy (2114) Symmetry and Spectroscopy of molecules, New Age International.
2. Gurdeep Raj (2114) Chemical kinetics, 6<sup>th</sup> Edition, Goel Publishing House.
3. P. W. Atkins (2109) Physical Chemistry, 8<sup>th</sup> Edition, Oxford University Press.

### Mapping

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	M	S	S	M	M
<b>CO2</b>	H	M	S	M	S
<b>CO3</b>	M	S	H	S	S
<b>CO4</b>	H	S	H	S	M

S-Strong

H-High

M-Medium

L-Low

<b>Programme Code:</b> 04		<b>M.Sc., Chemistry</b>		
<b>Course Code:</b> 21PCH204		<b>C.P.4 – Organic Chemistry II</b>		
Batch	Semester	Hours/Week	Total Hours	Credits
2021-2022	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)

<b>K1 to K4</b>	<b>CO1</b>	Recollect the essentials of addition and elimination reactions
	<b>CO2</b>	Comprehend different types of notations in stereochemistry
	<b>CO3</b>	Relate correlation and FMO approach for electrocyclic, cycloaddition and Sigmatropic reactions and explore Organic Photochemistry
	<b>CO4</b>	Elucidate the structural features of some important alkaloids

### Syllabus

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

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

Elimination reactions - E1 and E2 mechanisms - orientations – E1CB mechanism - Hofmann and Saytzeff rules - Chugaev 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\*, quantum yield, physical and chemical actinometry, Jablonski diagram, photophysical processes – Fluorescence, phosphorescence, internal conversion and intersystem crossing, photosensitization and quenching, Typical photochemical reactions – Norrish type I and type II reactions, Paterno-Buchi reaction, photoreduction, photo oxidation, Cis-trans isomerization, photochemistry of arenes, di- $\pi$  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 (2106) Organic Synthesis, Pragati Prakashan Educational Publications, Meerut, India.
2. P. S. Kalsi (2105) Stereochemistry, Conformation and Mechanism (6<sup>th</sup> edn.), New age international publishers.

3. Jagdamba Singh and Jaya Singh (2114) Photo Chemistry and Pericyclic reactions, 3<sup>rd</sup> Revised Edition, New Age International Publisher.
4. Rastogi.K.K, Mukherjee (2114) Fundamentals of photochemistry, Revised edition, New age international publications.
5. O. P. Agarwal (2112) Natural product Chemistry, 21<sup>th</sup> Edition, Goel Publishing house.

### Reference Books

1. Jerry March (2114) Advanced organic chemistry, 6<sup>th</sup> Edition, A Wiley eastern limited, New Delhi.
2. D. Nasipuri (2112) Stereochemistry of organic compounds, Publisher, New Age International.
3. Ernest. L. Eliel (2114) Stereochemistry of carbon compounds, McGraw-Hill, New York.
4. I.L. Finar (2114) Organic Chemistry, Vol.I, 6<sup>th</sup>, Vol.II, 5<sup>th</sup> Edition, Addison Wesley Longman Ltd.

### Mapping

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

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

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>		
<b>Course Code : 21PCH215</b>		<b>C.P.5 – Inorganic Chemistry II</b>		
Batch	Semester	Hours/Week	Total Hours	Credits
2021-2022	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)

<b>K1 to K4</b>	CO1	Bear in mind the elemental ideas of coordination chemistry
	CO2	Realize the postulates of Crystal Field Theory and Molecular Orbital Theory
	CO3	Evaluate Term symbols, study and analyse Orgel and Tanabe-Sugano diagrams of coordination complexes
	CO4	Formulate the mechanism of reactions of transition metal complexes

### Syllabus

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

Recall the nomenclature of coordination compounds - types of ligands - coordination number - Structure of coordination compounds with reference to the existence of various coordination numbers - complexes with coordination number two - complexes with coordination number three - complexes with coordination number four - tetrahedral and square planar complexes - complexes with coordination number five - regular trigonal bipyramidal and square pyramidal - coordination number six - distortion from perfect octahedral symmetry - trigonal prism – geometrical 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  $\Delta_0$  –

applications of CFSE, applications of CFT – Jahn-Teller distortions - limitations - LFT and MOT- applications to octahedral complexes – ( $\sigma$  - 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  $\Delta_0$  and  $\beta$  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 (2113) Inorganic chemistry principles of structure and reactivity, 16<sup>th</sup> Edn, Pearson Noida.
2. Lee J. D (2109) Concise Inorganic Chemistry, Fifth edition, ELBS.



3. Keith F. Purcell and John C.Kotz (2112) Inorganic Chemistry, W.B.Saunders Company.
4. Malik, Wahid U, Tuli G.D and Madan R.D, Selected Topics in Inorganic Chemistry, (2113) S. Chand Limited.

### Reference Books

1. Basolo and Pearson, Ralph. G (2107) Mechanism of Inorganic Reactions- A study of metal complexes in solution. Wiley Eastern, New Delhi.
2. Cotton F.A. and G.Wilkinson (2107) Advanced Inorganic Chemistry, Sixth edition, John Wiley & Sons, Inc.

### Mapping

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

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

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>		
<b>Course Code : 21PCH2CL</b>		<b>C.Pr.1 – Organic Chemistry Practical I</b>		
Batch	Semester	Hours/Week	Total Hours	Credits
2021-2022	I & II	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)

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

### Syllabus

#### A. Analysis of two component organic mixtures

(Separation and characterization of individual compounds)

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

#### B. Single stage Preparations (minimum 6)

##### 1. Hydrolysis:

Preparation of Salicylic acid from Methyl Salicylate.

##### 2. Acetylation:

Preparation of Acetanilide from Aniline.

##### 3. Bromination:

Preparation of p-Bromoacetanilide from Acetanilide.

##### 4. Nitration:

Preparation of m-dinitrobenzene from nitrobenzene.

##### 5. Benzoylation:

Preparation of Benzanilide from Aniline.

### 6. Oxidation:

Preparation of Benzoic acid from Benzaldehyde.

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

### Reference books

1. Gnanprakasam and Ramamurthy (2100) Organic Chemistry Laboratory Manual, Ananda Book Depot, Chennai.
2. NK Vishnoi (2114) Advanced Practical Organic Chemistry, Vikas Publishing House.
3. R. Jagmohan (2102) Advanced Practical Organic Chemistry, Vol. I & II.

### Distribution of Marks

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

### Mapping

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

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

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>		
<b>Course Code : 21PCH2CM</b>		<b>C.Pr.2 – Inorganic Chemistry Practical I</b>		
Batch	Semester	Hours / Cycle	Total Hours	Credits
2021-2022	I and II	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)

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

### Syllabus

#### A. Semi micro Qualitative Analysis:

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

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

#### B. Preparation of complexes

**Any Five preparations selected from the following list:**

Tris(thiourea)Copper(I)chloride

Potassiumtrioxalatoaluminate(III)

Potassiumtrioxalatochromate (III)

Tetramminecopper (II) sulphate

Tris(thiourea) copper(II) sulphate

Nickelammoniumsulphatehexahydrate

Hexaminecobalt (III) chloride

Potassiumtrioxalatoferrate (III).

### C. Colorimetric Estimations (using photoelectric colorimeter)

Estimation of Copper, Iron, Nickel and Manganese

#### Text Books

- 1.V.V.Ramanajum (1971) Semimicro Qualitative Inorganic Analysis, National Publishing Co.
2. V.Venkateswaran, R.Veerawamy and A.R. Kulandaivelu (2104) Principles of Practical Chemistry, Sultan Chand & Sons. 2 nd Edition.
3. S.Giri. D.N. Bajpai.and O.P. Panday (2105) Practical Chemistry Vol.I & II, S.Chand & Co.

#### Distribution of Marks

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

#### Mapping

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

S-Strong

H-High

M-Medium

L-Low

Programme Code: 04		M.Sc., Chemistry		
Course Code : 21PCH2CN		C.Pr.3 – Physical Chemistry Practical I		
Batch	Semester	Hours / Cycle	Total Hours	Credits
2021 - 2022	I & II	5	120	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)

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

### Syllabus

#### Non Electrical Experiments

##### 1. Properties of Matter

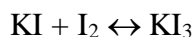
Simple Eutectic System- determination of unknown compositions

##### 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 (2103) 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 (2105) Practical Physical Chemistry, S.Chand & Co.
4. J.B.Yadav (2110) Advanced Practical Physical Chemistry, Goel Publishing House, 29<sup>th</sup> edition.

**Distribution of Marks**

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

**Mapping**

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

S – Strong

H – High

M – Medium

L – Low

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>		
<b>Course Code : 21PCH306</b>		<b>C.P.6 – Physical Chemistry II</b>		
Batch	Semester	Hours/Week	Total Hours	Credits
2021-2022	III	6	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)

<b>K1 to K4</b>	CO1	Recall the elementary aspects of quantum chemistry, learn the postulates of quantum mechanics and compare classical and quantum mechanical principles
	CO2	Solve Schrodinger wave equation for harmonic oscillators
	CO3	Employ various approximation methods to Helium atom
	CO4	Probe different electrochemical theories and examine the methods of coulometry, voltametry and polarography

### Syllabus

#### UNIT – I: QUANTUM CHEMISTRY I

(15 hrs)

Success of quantum theory and the failure of classical mechanics in explaining black-body radiation, photo-electric effect and the H-atom spectrum, de Broglie's matter waves, Heisenberg's uncertainty principle. Schrodinger wave equation for particle waves, postulates of quantum mechanics, Time-dependent and Time - independent Schrodinger equations. Wave function ( $\psi$ ) 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. Born – Oppenheimer approximation, treatment of  $H_2^+$  ground state by LCAO–MO method.

### **UNIT – IV: ELECTROCHEMISTRY-I**

**(15 hrs)** Interionic

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

Electrokinetic phenomena: theories of double layer - 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 (2106) Quantum Chemistry, New Age International Publishers.
2. A.K. Chandra (2102) Quantum chemistry, 4<sup>th</sup> edition, Tata McGraw-Hill.

3. B.R. Puri & L R. Sharma (2113) Advanced Physical Chemistry, Milestone Publishers & Distributors.
4. F.L. Pilar, (2106) Elementary Quantum Chemistry ,McGraw-Hill.
5. S. Glasstone (2105) Introduction to electrochemistry, 10<sup>th</sup> Edition, East West Press Private Ltd.

#### Reference Books

1. Ira. N. Levine (1999) Quantum Chemistry, Prentice Hall; 5<sup>th</sup> edition.
2. P. W. Atkins (2109) Physical Chemistry, 6<sup>th</sup> Edition, Oxford University Press.
3. L. I. Andropov (2109) Theoretical Electrochemistry, Mir Publishers, Moscow.
4. Horia Metiu (2106) Physical Chemistry –Quantum Mechanics, Taylor& Francis.

#### Mapping

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

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

<b>Programme Code:</b> 04		<b>M.Sc., Chemistry</b>		
<b>Course Code:</b> 21PCH307		<b>C.P.7 – Organic Chemistry III</b>		
Batch	Semester	Hours/Week	Total Hours	Credits
2021-2022	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)

<b>K1 to K4</b>	<b>CO1</b>	Retain information on molecular rearrangements and study the mechanisms of various molecular rearrangements
	<b>CO2</b>	Understand the synthetic utility of different reagents in oxidation and reduction reactions
	<b>CO3</b>	Elucidate the structure of selected steroids, proteins and vitamins
	<b>CO4</b>	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 Wolff rearrangement - Base catalysed rearrangement – Favorskii, Carbon to Carbon migration of other groups - Neber rearrangement - Carbon to Nitrogen migration - Hofmann rearrangement, Curtius rearrangement, Lossen rearrangement, Schmidt rearrangement, Beckmann rearrangement -nitrogen to carbon (Stevens rearrangement), oxygen to carbon (Wittig rearrangement).

#### Unit – II: REAGENTS FOR OXIDATION AND REDUCTION

(15 hrs)

Oxidation: Selenium dioxide, periodic acid, aluminium-t-butoxide, peroxides and peroxyacids, PCC (Corey's reagent), MnO<sub>2</sub>, OsO<sub>4</sub>, Jones reagent, copper chromite, Ozonolysis, Oppenauer oxidation, Lead tetraacetate, Mercuric acetate, Thallium acetate, DMSO.

Reduction: Complex metal hydrides such as  $\text{LiAlH}_4$ ,  $\text{NaBH}_4$ , and trialkyl tin hydride-  $\text{BH}_3$  / THF, 9-BBN- Dissolving metal reduction – Clemenson and Wolff-Kishner reduction.

**UNIT – III: STEROIDS (15 hrs)**

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

**UNIT – IV: PROTEINS AND VITAMINS (15 hrs)**

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

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

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

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

**REAGENTS FOR ORGANIC SYNTHESIS**

Reagents: Gilman`s reagent, lithium diisoprylamide (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 Rakesh kumar Parashar (2116) Organic reaction mechanisms, 3<sup>rd</sup> edition, Narosa publishing house.
2. Jagdamba Singh, L. D. S. Yadav (2114) Organic Synthesis, 10<sup>th</sup> edition, Pragati Prakashan Educational Publications, Meerut, India.
3. I. L Finar (2114) Organic Chemistry Vol. I 6<sup>th</sup>, Vol. II 5<sup>th</sup> edition, Pearson education, Ltd.
4. O. P. Agarwal (2110) Organic Chemistry- Natural products Vol II, 38<sup>th</sup> Edition, Goel Publishing house.
5. R K Bansal (2116) Heterocyclic Chemistry, 3<sup>rd</sup> edition New age international (P.) Ltd.

### Reference Books

1. O.P.Agarwal (2114) Organic Chemistry Reaction and Reagents, 51<sup>st</sup> edition, Goel Pub. House.
2. Jerry March (2114) Advanced Organic Chemistry, Wiley eastern limited, 6<sup>th</sup> edition, New Delhi.
3. F.A.Carey (2114) Organic Chemistry-Part-B-Reactions and synthesis, Springer, 5<sup>th</sup> edition.

### Mapping

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	H	S	M	H	M
<b>CO2</b>	M	S	M	S	M
<b>CO3</b>	H	M	H	M	M
<b>CO4</b>	S	S	M	H	S

S-Strong

H-High

M-Medium

L-Low

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>		
<b>Course Code : 21PCH308</b>		<b>C.P.8 – Inorganic Chemistry III</b>		
Batch	Semester	Hours/Week	Total Hours	Credits
2021-2022	III	6	75	5

### Course Objectives

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

### Course Outcomes (CO)

<b>K1 to K4</b>	<b>CO1</b>	Reminisce the essentials of organometallic chemistry and the chemistry of metal carbonyls
	<b>CO2</b>	Understand the structure, reactions and bonding in several organometallic compounds
	<b>CO3</b>	Explore the chemistry of bioinorganic compounds
	<b>CO4</b>	Inquest the chemistry of inorganic polymers

### Syllabus

#### UNIT – I: ORGANOMETALLIC COMPOUNDS I

(15 hrs)

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

#### UNIT – II : ORGANOMETALLIC COMPOUNDS II

(15 hrs)

Synthesis, reactions, bonding and structure in metal alkyl, alkene, alkyne, allyl and dienyls complexes. Carbene, carbyne and carbide complexes. carbocyclic pi compounds-synthesis, reactions,

bonding and structure of cyclopentadienyl complexes-Ferrocene-structure and bonding, arene complexes, complexes formed by 7 and 8 member aromatic rings.

**UNIT – III: ORGANOMETALLIC COMPOUNDS III (15 hrs)**

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

**UNIT – IV: BIOINORGANIC CHEMISTRY (15 hrs)**

Bioinorganic chemistry – metal ions in biology\* – metalloporphyrins (heme and non-heme proteins) – cytochromes, hemoglobin, myoglobin, chlorophyll, ferridoxins, rubredoxins, blue copper proteins, enzymes- Vitamin B<sub>12</sub> and B<sub>12</sub> coenzymes (structure and functions) – nitrogen fixation (invitro and invivo) – chelate therapy, antitumour agents - cis-platin.

**UNIT – V: INORGANIC POLYMERS (15 hrs)**

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

\* Denotes self study

**Teaching methods**

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

**Text Books**

1. J. D. Lee (2109) Concise Inorganic Chemistry, Fifth edition, Chapman & Hall Ltd.
2. J.E. Huheey (2109) Inorganic chemistry, 4<sup>th</sup> Edition, Pearson Education.
3. Dr. Asim K. Dass (2107) Bioinorganic Chemistry, Books and Allied (P) Limited.

### Reference Books

1. D.F. Shriver, P.W. Atkins and C.H. Longford (2110) Inorganic chemistry, Oxford University Press, 5<sup>th</sup> edition.
2. I. Bertini, H.B.Gray, S.J. Lippard and J.S. Nalentine, (2110) Bioinorganic Chemistry; University Science Books.

### Mapping

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

S-Strong

H-High

M-Medium

L-Low



<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>		
<b>Course Code: 21PCH3CO</b>		<b>C. Pr.4 – Physical Chemistry Practical II</b>		
Batch	Semester	Hours/Week	Total Hours	Credits
2021-2022	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)

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

### Syllabus

#### Electrical Conductance measurements

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

#### Conductometric Titrations

3. BaCl<sub>2</sub> Vs MgSO<sub>4</sub>
4. Buffer Vs Strong acid

#### Chemical Kinetics

5. Acid hydrolysis of an ester – Relative strength of acids
6. Reaction kinetics of KI and K<sub>2</sub>S<sub>2</sub>O<sub>8</sub>
7. Iodination of acetone

#### Adsorption

8. Adsorption of oxalic acid on charcoal

### Reference Books

1. S.R. Palit and S.K. De (2103) 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 (2105) Practical Physical Chemistry, S.Chand & Co.,
4. J.B.Yadav (2110) Advanced Practical Physical Chemistry, Goel Publishing House, 29<sup>th</sup> edition.

### Distribution of Marks

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

### 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

S-Strong

H-High

M-Medium

L-Low

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>		
<b>Course Code : 21PCH409</b>		<b>C.P.9 – Physical Chemistry III</b>		
Batch	Semester	Hours/Week	Total Hours	Credits
2021-2022	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)

<b>K1</b> <b>to</b> <b>K4</b>	<b>CO1</b>	Bring to mind the vitals of chemical thermodynamics
	<b>CO2</b>	Appreciate third law of thermodynamics and the theories of probability and thermodynamic probability
	<b>CO3</b>	Explore statistical thermodynamics and derive distribution laws and partition functions
	<b>CO4</b>	Review the various photophysical processes taking place in excited molecules

### Syllabus

#### UNIT – 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, Gibbs-Helmholtz equation, Thermodynamics of open system- Partial molar properties, chemical potential, Gibbs-Duhem equation and its applications.

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

#### UNIT – II: THIRD LAW OF THERMODYNAMICS AND PROBABILITY (15 hrs)

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

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

**UNIT – III: STATISTICAL THERMODYNAMICS-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, create models.

### Text Books

1. Puri, Sharma, Pathania (2113) Principles of physical chemistry, 46<sup>th</sup> Edition, Vishal Publishing Co.
2. Rajaram, Kuriacose (2106) Thermodynamics, Shoban lal & Co, 4<sup>th</sup> edition.
3. K.K.Rohatgi, Mukherjee (2106) Fundamentals of Photochemistry, New Age International.
4. Nicholas J. Turro (2113) Modern Molecular Photochemistry, 2<sup>nd</sup> edition, University Science Books.

### Reference Books

1. Glasstone (2113) Thermodynamics for chemists, Van Nostrands.
2. M.C. Gupta (2113) Statistical thermodynamics, New Age International.
3. Gurdeep Raj (2109) Advanced Physical Chemistry, Goel Publishing House.

### Mapping

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

S-Strong

H-High

M-Medium

L-Low

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>		
<b>Course Code : 21PCH410</b>		<b>C.P.10 – Spectroscopy</b>		
Batch	Semester	Hours/Week	Total Hours	Credits
2021-2022	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)

<b>K1 to K4</b>	CO1	Remember the fundamentals of IR spectroscopy
	CO2	Know the theories and rules for solving UV spectra of a compound
	CO3	Investigate the fragmentation pattern in a mass spectrum and determine the structural features of some compounds
	CO4	Scrutinize the $^1\text{H}$ and $^{13}\text{C}$ NMR spectra of simple organic molecules

### Syllabus

#### UNIT - I: IR SPECTROSCOPY

(15 hrs)

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

#### UNIT – II: UV-VISIBLE SPECTROSCOPY

(15 hrs)

Theory- Beer-Lambert's law of photochemistry - principle- electronic spectra of diatomic molecules-Born-Oppenheimer approximation- intensity of vibrational electronic spectra– Franck-Condon principle-selection rules–dissociation energy- Fortrat diagram- predissociation-types of transition\*-auxochromes and chromophores, Woodward-Fieser rules for calculating absorption maxima of dienes, polyenes and  $\alpha$ ,  $\beta$ -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 -<sup>1</sup>H NMR (15 hrs)**

Magnetic properties of nuclei – theory of nuclear resonance, Instrumentation, Relaxation mechanisms (spin-spin & spin-lattice)- Chemical shifts- Electronegative effect, shielding and deshielding effects, Hydrogen bonding effect, Anisotropy, spin-spin coupling, geminal, vicinal, Long range, deuterium exchange – solvents used in NMR, First order and non-first order NMR spectra- AB, ABC, A<sub>2</sub>B<sub>2</sub>, 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: <sup>13</sup>C NMR (15 hrs)**

Sensitivity, differences between <sup>13</sup>C NMR and <sup>1</sup>H NMR, measurement of <sup>13</sup>C NMR spectra, solvents, Types of <sup>13</sup>C NMR spectra - fully coupled, proton noise decoupled (fully decoupled), off resonance decoupled spectrum, DEPT, intensity of signals, carbon chemical shift- inductive effect, resonance effect, hydrogen bonding, heavy atom effect, substituent effects  $\gamma$ -gauche effect,  $\gamma$ -Anti effect.

2D NMR spectroscopy: Theory, basic components of two-dimensional experiment, Homonuclear Correlation Spectroscopy (H, H-COSY), Heteronuclear correlation (C,H-COSY) spectrum. Solving problems using IR, UV, NMR and mass spectra for simple organic molecules not exceeding C<sub>12</sub> units.

\* Denotes self study

#### **Teaching methods**

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

### Text Books

1. Jagmohan (2113) Organic Spectroscopy Principles and Applications, second edition, Narosa publishing house.
2. Y.R.Sharma (2113) Elementary Organic Spectroscopy, 5<sup>th</sup> Edition, S. Chand & Co. Ltd.
3. W. Kemp (2111) Organic Spectroscopy, 3<sup>rd</sup> Edition, Mc Millan Press Ltd.
4. C.N. Banwell, E.M. McCash, Fundamentals of Molecular Spectroscopy, 4<sup>th</sup> Edition, (2108), Tata McGraw-Hill.

### Reference Books

1. D.L. Pavia, G.M. Lampman, George S. Kriz (2109) Introduction to spectroscopy, Brooks Cole; 4<sup>th</sup> Edition.
2. Silverstien, Bassler and Morrill (2114) Spectrometric identification of organic compounds, 8<sup>th</sup> Edition, John Wiley and Sons.
3. P.S. Kalsi (2114) Spectroscopy of organic compounds, 6<sup>th</sup> edition, Wiley Eastern Ltd.,

### Mapping

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

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



<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>		
<b>Course Code : 21PCH4CP</b>		<b>C.Pr.5 - Organic Chemistry Practical- II</b>		
Batch	Semester	Hours/Cycle	Total Hours	Credits
2021-2022	III and IV	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)

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

### Syllabus

#### A. Quantitative estimations:

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

#### B. Two stage Preparations:

1. Benzanilide from benzophenone
2. Acetyl salicylic acid from methyl salicylate
3. Preparation of m- 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 (2100) Organic Chemistry Laboratory Manual, Anand Book Depot, Chennai.
2. R. Jagmohan (2102) Advanced Practical Organic Chemis, Vol. I & II.

**Distribution of Marks**

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

**Mapping**

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

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

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>		
<b>Course Code : 21PCH4CQ</b>		<b>C.Pr.6 – Inorganic Chemistry Practical II</b>		
Batch	Semester	Hours/Week	Total Hours	Credits
2021-2022	III & IV	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 complexometric titration using EDTA method
3. To learn about the preparation and properties of inorganic complexes

### Course Outcomes (CO)

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

### Syllabus

**A. Titrimetry:** Complexometric titration involving EDTA.

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

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

**C. Preparation:**

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

(single stage preparations)

HexathioureaLead(II) Nitrate, Potassium trioxalato ferrate(III), Pentathiourea dicopper(I) nitrate, Potassium trioxalatochromate(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.Veerawamy and A.R. Kulandaivelu (2104) Principles of Practical Chemistry, Sultan Chand & Sons. 2 nd Edition.
2. Giri. S, Bajpai. D.N. and O.P Panday (1972) Practical Chemistry Vol. I & II, S.Chand & Co.
3. J. Bassart, R.C. Denny, G.H. Jeffery and Mendham (2100) Vogel's text book of qualitative Inorganic Analysis, 6<sup>th</sup> Edn. Pearson Education.

### Distribution of marks

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

### Mapping

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

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

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>
<b>Course Code : 21PCH4Z1</b>		<b>Project work &amp; viva-voce</b>
Batch	Semester	Credits
2021-2022	III & 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)

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

### COMPONENT FOR PROJECT

<b>CIA / ESE</b>	<b>Particulars</b>	<b>Project Out of 100 Marks</b>
<b>CIA</b>	Project Review	30
	Regularity	10
	<b>Total Internal Marks</b>	<b>40</b>
<b>*ESE</b>	Project Report Present	40
	Viva Voce	20
	<b>Total External Marks</b>	<b>60</b>
<b>Total Marks(CIA+ESE)</b>		<b>100</b>

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

### Mapping

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

S-Strong

H-High

M-Medium

L-Low

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>
<b>Batch : 2021-2022</b>		<b>ME – Analytical Chemistry</b>
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)

<b>K1 to K4</b>	<b>CO1</b>	Keep in mind the ideas of error analysis
	<b>CO2</b>	Comprehend the principles and instrumentation of several chromatographic methods
	<b>CO3</b>	Discover the principles, instrumentation and applications of various thermo analytical techniques
	<b>CO4</b>	Interpret ESR, Mossbauer and AAS spectra of several metal complexes; Probe the principle and applications of ORD and CD

### Syllabus

#### UNIT – I: ERROR ANALYSIS

(15 hrs)

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

#### UNIT– II: CHROMATOGRAPHIC METHODS

(15 hrs)

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

**UNIT – III: THERMAL ANALYSIS**

**(15 hrs)**

Introduction - different types of thermo analytical methods. Thermo gravimetric analysis (TGA) - principle – factors influencing thermograms. Derivative thermogravimetry (DTG) - principle – factors influencing thermograms. TGA instruments – precautions in the use of thermo balance. Differential thermal analysis (DTA) – principle – instrumentation – applications – thermometric titrations-principle-instrumentation and applications. Differential scanning calorimetry (DSC) - principle - instrumentation and applications.

**UNIT –IV: ESR & MOSSBAUER**

**(15 hrs)**

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

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

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

AAS-Principle- instrumentation – detection of metals & non-metals, interference, detection limit & sensitivity and applications. Flame Emission spectrometry- Principle, instrumentation, methodology and applications. Comparison between AAS and FES.

Polarimetry – Plane polarized light – optical activity of molecules – polarimeter and its uses. ORD and CD spectrometry, circular birefringence, circular dichroism, optical rotatory dispersion, Plain curves, anomalous curves - cotton effect – axial haloketone rule and octant rule – application.

\* Denotes self study portion

**Teaching methods**

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

**Text Books**

1. B. K. Sharma (2113) Instrumental methods of Chemical analysis, Goel Publishing house, 29<sup>th</sup> edition.
2. V K Srivastava and K K Srivastava (2113) Introduction to chromatography-Theory and Practice, S.Chand& Company LTD, 2<sup>nd</sup> edition.
3. R.S. DragO (1996) Physical methods in Inorganic chemistry, 1<sup>st</sup> Edition, W. B. Saunders Company.
4. H. Kaur (2113) Instrumental methods of chemical analysis, Pragathi Prakashan Publishers, 9<sup>th</sup> edition.



### Reference Books

1. Gurdeep R. Chatwal & S.K. Anand (2114) Instrumental Methods of Chemical Analysis, Himalaya Publishing House.
2. Gary D. Christian (2114) Analytical Chemistry, 6<sup>th</sup> edition, John Wiley & Sons, Inc.
3. D.A. Skoog, D.M. West, F.J. Holder and S.R. Grouch (2114) Analytical chemistry an Introduction 9<sup>th</sup> Edition, Saunders College publishing.

### Mapping

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	M	S	H	S	M
<b>CO2</b>	S	M	S	M	H
<b>CO3</b>	H	S	M	M	S
<b>CO4</b>	S	S	H	S	H

S-Strong

H-High

M-Medium

L-Low

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>
<b>Batch: 2021-2022</b>		<b>ME – Green and Nano Chemistry</b>
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)

<b>K1 to K4</b>	CO1	Remember the twelve basic principles of green chemistry and other green concepts
	CO2	Appreciate the concept of green solvents; Explore the synthesis involving the principles of green chemistry and different green reactions
	CO3	Appraise the chemistry of nanomaterials
	CO4	Examine the applications and environmental hazards of nanomaterials

### Syllabus

#### UNIT – I: GREEN CHEMISTRY I

(15 hrs)

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

#### UNIT – II: GREEN CHEMISTRY II

(15 hrs)

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

**UNIT – III: GREEN CHEMISTRY III**

**(15 hrs)**

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

**UNIT – IV: NANOCHEMISTRY I**

**(15 hrs)**

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

**UNIT –V: NANOCHEMISTRY II**

**(15 hrs)**

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

\*Denotes self study portion

**Teaching methods**

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

**Text Books**

1. V. Kumar (2110) An Introduction to Green Chemistry, Vishal Publishing Co.
2. V S. Muralidharan, A. Subramania (2110) Nanoscience and technology, Ane books pvt. Ltd.,

### Reference Books

1. V.K. Ahluwalia (2113) Green Chemistry, Ane Books Pvt. Ltd.
2. B.S. Murty, P. Shankar, Baldev Raj, B.B. Rath, James Murday (2113) Text book of nanoscience and nanotechnology, Universities Press.
3. S. Shanmugam (2110) Nanotechnology, MJP Publishers.

### Mapping

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	M	S	S	M	M
<b>CO2</b>	S	H	S	S	S
<b>CO3</b>	H	S	H	M	S
<b>CO4</b>	S	M	H	S	M

S-Strong

H-High

M-Medium

L-Low

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>
<b>Batch: 2021-2022</b>		<b>ME – Bioinorganic Chemistry</b>
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)

<b>K1 to K4</b>	<b>CO1</b>	Revive the role of metal ions in biological systems
	<b>CO2</b>	Understand the physiology and functions of haemoglobin and myoglobin
	<b>CO3</b>	Analyze the electron transfer reactions in biological systems; Integrate the structure and functions of metalloenzymes
	<b>CO4</b>	Study the functions and applications of metals in medicine; Examine the toxicity of metals in biological systems

### Syllabus

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

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

#### UNIT– II: DIOXYGEN MANAGEMENT

(15 hrs)

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

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

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

#### **UNIT –IV: METALLOENZYMES**

**(15 hrs)**

Enzymes – structure and function – zinc enzyme – 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 B<sub>12</sub> 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 (2109) Bioinorganic Chemistry, Books and Allied (P) Limited.
2. J.E.Huheey, E.A.Keiter, R.L.Keiter (2109) Inorganic Chemistry 4<sup>th</sup> Edition, Addison Wesley Publishing Company.

#### **Reference Books**

1. Bertini, H.B.Gray, S.J. Lippard and J.S. Nalentine (2111) Bioinorganic Chemistry; University Science Books.
2. P.S. Kalsi and J.P. Kalsi (2111) Bioorganic, Bioinorganic and Supramolecular chemistry, New Age International Publishers.
3. K. Hussain Reddy (2107) Bioinorganic Chemistry, New Age International.

### Mapping

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

S-Strong

H-High

M-Medium

L-Low

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>
<b>Batch: 2021-2022</b>		<b>ME – Advanced Topics in Chemistry</b>
Hours/Cycle	Total Hours	Credits
5	75	5

### Course Objectives

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

### Course Outcomes (CO)

<b>K1 to K4</b>	<b>CO1</b>	Refresh the rudiments of non-aqueous solvents
	<b>CO2</b>	Realize the concept of Supramolecular chemistry
	<b>CO3</b>	Apply photoelectron, rotational and Raman spectroscopic techniques for solving the structures of inorganic compounds
	<b>CO4</b>	Relate the technique of NQR for structure solving

### Syllabus

#### UNIT I: NON-AQUEOUS SOLVENTS

(15 hrs)

Classification of solvents, General properties of ionizing solvents, Chemical reactions – Liquid NH<sub>3</sub>, Liquid H<sub>2</sub>SO<sub>4</sub>, Liquid HF, Liquid N<sub>2</sub>O<sub>4</sub>, Liquid SO<sub>2</sub>, Liquid H<sub>2</sub>S, Liquid HCN, Acetic acid, Liquid BrF<sub>3</sub>, superacids.

#### UNIT II: SUPRAMOLECULAR CHEMISTRY

(15 hrs)

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



### **UNIT III: PHOTOELECTRON SPECTROSCOPY**

**(15 hrs)**

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

### **UNIT IV: ROTATIONAL AND RAMAN SPECTROSCOPY**

**(15 hrs)**

Rotational microwave spectroscopy- Rigid diatomic molecule-selection rule-effect of isotopic substitution-non rigid rotator-force constant-centrifugal distortion constant D –application of rotational spectra.

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

### **UNIT V: NQR**

**(15 hrs)**

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

#### **Text Books**

1. E. A. V. Ebsworth, David W. H. Rankin, Stephan Craddock (2109) Structural methods in inorganic chemistry, 2<sup>nd</sup> edition, Taylor and Francis.
2. R.S. Drago (1996) Physical methods in Inorganic chemistry, 2<sup>nd</sup> Edition, W. B. Saunders Company.
3. Jonathan W. Steed, Jerry L. Atwood (2109) Supramolecular Chemistry, Wiley and Sons.

#### **Reference Books**

1. J. Michael Hollas (2106) Modern Spectroscopy, 4<sup>th</sup> Edition, Wiley and Sons.
2. Malik, Wahid U, Tuli G.D and Madan R.D, (2106) Selected Topics in Inorganic Chemistry, S. Chand Limited.

**Mapping**

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

S-Strong

H-High

M-Medium

L-Low

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>
<b>Batch: 2021 - 2022</b>		<b>NME – Chemistry of Environment</b>
Hours / Week	Total Hours	Credits
4	75	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)

<b>K1 to K4</b>	<b>CO1</b>	Bear in mind the composition of air, Know the different sources of air pollutants and their effects
	<b>CO2</b>	Understand the different sources of water pollution, their effects and control measures
	<b>CO3</b>	Recognize the types and consequences of soil and radioactive pollutants
	<b>CO4</b>	Scrutinize 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 – Chloro fluoro carbons (CFC), Smog-photochemical smog, Acid rain-theory of acid rain-effects of acid rain-prevention and control.

#### UNIT – II: WATER POLLUTION

(15 hrs)

Sources of water pollution sewage & domestic wastes, industrial effluents, agricultural discharges, fertilizers, detergents, toxic metals, siltation, thermal and radioactive materials. Types of water pollution - ground water, surface water, lake water, river water and sea water pollution and their harmful effects. Effects of oil pollution in marine water. Eutrophication –types, effects and its control measures. Control measures of water pollution.

#### UNIT – III : SOIL POLLUTION

(15 hrs)

Types of soil and their characteristics. Sources of soil pollutants and their 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, non-ionizing (unit of measurement REM), micro wave, radio frequency, x-ray etc. radiation. Disposal methods of radioactive wastes from nuclear power plants, low level and high level nuclear waste - biomedical waste.

**UNIT – V: THERMAL AND NOISE POLLUTION**

**(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

**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 (2110) Environmental Chemistry, GOEL Publishing Company.
2. A.K De (2110) Environmental Chemistry, Wiley Eastern Ltd, 5<sup>th</sup> edition.

**Reference Books**

1. G.S.Sodhi (2109) Fundamentals of Environmental Chemistry, Alpha science.
2. E. Lichtfouse, J. S. Bauer, D. Robert (2109) Environmental Chemistry, Springer.
3. Balram Pani (2107) Text book of environmental chemistry, I.K. International Pvt., Ltd.

**Mapping**

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	M	H	S	H	S
<b>CO2</b>	H	S	S	M	H
<b>CO3</b>	S	H	H	M	H
<b>CO4</b>	H	H	H	S	S

**S** – Strong

**H** – High

**M** – Medium

**L** – Low

<b>Programme Code:</b> 04	<b>M.Sc., Chemistry</b>	
<b>Batch:</b> 2021 – 2022	<b>NME – Scientific Thesis Writing</b>	
Hours / Week	Total Hours	Credits
4	75	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)

<b>K1 to K4</b>	<b>CO1</b>	Know how to write the ‘Introduction’ and ‘Review of Literature’ chapter of a thesis or dissertation
	<b>CO2</b>	Understand the guidelines for writing ‘Materials and Methods’ chapters of a thesis; Learn about the preparation of tables
	<b>CO3</b>	Apply the strategies specified for writing ‘Discussion’, ‘Abstract’, ‘Results’ and ‘References’ sections of a thesis
	<b>CO4</b>	Adopt the format for preparing manuscript for oral/poster presentation and journal publications

### 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 (14 hrs)**

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

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

**UNIT – V: MANUSCRIPT PREPARATION (14 hrs)**

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

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

Working knowledge in MS Word and MS power point.

**Teaching methodology**

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

**Text Books**

1. N. Gurumani (2110) Scientific thesis writing and paper presentation, MJP publishers.

**Reference Books**

1. Hans Fridrich Ebel, Claus Bliefert, Willaim E. Russey (2112) The art of scientific writing,

Wiley, VCH.

2. Martha Davis, Kaaron Davis (2112) Scientific papers and presentation, 3<sup>rd</sup> edition, Elsevier.

**Mapping**

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	M	H	S	S	H
<b>CO2</b>	H	M	H	H	H
<b>CO3</b>	H	S	H	H	M
<b>CO4</b>	M	H	S	S	S

**S** – Strong

**H** – High

**M** – Medium

**L** – Low



<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>
<b>Batch : 2021-2022</b>		<b>NME – Textile and Dye Chemistry</b>
Hours/Cycle	Total Hours	Credits
4	75	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.

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

**Course Outcomes (CO)**

<b>K1 to K4</b>	<b>CO1</b>	Keep in mind the chemistry of fibres
	<b>CO2</b>	Comprehend the manufacture and processing of fibres
	<b>CO3</b>	Study the different theories of colour and examine the principle of dyeing
	<b>CO4</b>	Probe the different treatment process of 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 dyes, Dye-Fibre interactions: Ionic, Covalent, Vander Waals, H-bonding interactions, Dyeing assisting agents: NaOH, Na<sub>2</sub>CO<sub>3</sub>, aluminium sulphate, chromic sulphate.

**UNIT-IV PRINCIPLES OF DYEING PROCESSES**

**(14 hrs)**

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

#### UNIT-V TREATMENT PROCESSES

(14 hrs)

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

#### Teaching methodology

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

#### TEXT BOOKS

1. B.K. Sharma, Industrial Chemistry, (2111) Goel Publishing Co.,
2. Jain and Jain, Engineering Chemistry, (2115) Dhanpat Rai & Sons.

#### REFERENCE BOOKS

1. K.Venkataraman, The Chemistry of Synthetic Dyes, (2109) Vol.I, II, III & IV, Academic Press, N.Y.
2. I.L Finar, Organic Chemistry, (2109) Vol II, ELBS.

#### Mapping

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

S – Strong

H – High

M – Medium

L – Low

<b>Programme Code: 04</b>		<b>M.Sc., Chemistry</b>
<b>Batch: 2021 – 2022</b>		<b>NME – Industrial Chemistry</b>
Hours / Week	Total Hours	Credits
4	75	4

### Course Objectives

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

### Course Outcomes (CO)

<b>K1 to K4</b>	<b>CO1</b>	Recall the properties, manufacture and properties of glass
	<b>CO2</b>	Understand the types and manufacturing process of cement
	<b>CO3</b>	Recognize the importance and need of fertilizers
	<b>CO4</b>	Assess the chemistry of paints and pigments, rubber and allied products

### Syllabus

#### UNIT –I: GLASS

(15 hrs)

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

#### UNIT –II: CEMENT

(15 hrs)

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

#### UNIT –III: FERTILIZERS

(15 hrs)

Plant nutrients-primary, secondary and micro nutrients. Need for fertilizers-classification of fertilizers. Source of fertilizers-natural and artificial. Nitrogenous fertilizers-ammonium nitrate, ammonium

sulphate and urea. Phosphate fertilizers-phosphate rocks-normal super phosphate-triple super phosphate. Potassium fertilizers-NPK fertilizers.

#### UNIT –IV: PAINTS AND PIGMENTS

(14hrs)

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

(14 hrs)

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

#### Teaching methodology

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

#### Text Books

1. B.K.Sharma (1991) Industrial Chemistry, GOEL Publishing Company, 4<sup>th</sup> Edn.
2. B.N. Chakarabarthi (1991) Industrial Chemistry, Oxford and IBH publishing house.

#### Reference Books

1. M.G. Arora, M. Singh (1994) Industrial Chemistry, Vol II, Anmol Publications Ltd.
2. H.L. White (2108) Introduction to Industrial Chemistry, John Wiley & sons.
3. Vermani O.P. (2108) Industrial chemistry, Galgotia Publications Pvt. Ltd.

#### Mapping

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

S – Strong

H – High

M – Medium

L – Low

<b>Programme Code: 04</b>	<b>All PG Programmes</b>
<b>Course Code : 21PCH3X1</b>	<b>EDC – Food Science</b>
Batch 2021 – 2022	Credits 2

**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, functions of some important nutrients – carbohydrates, proteins, fats, vitamins, minerals.

**UNIT – III: FOOD ADDITIVES (6 hrs)**

Some important food additives – antioxidants, colouring agents, flavouring agents, anticaking agents, non-nutritive sweeteners, 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 LAWS AND STANDARDS (6 hrs)**

Food safety – general principles, FSSAI, BIS, AGMARK, ISO, Codex Alimentarius, HACCP.

**TEXT BOOK**

1. B. Srilakshmi (2115) Food science, New Age International, VI edition.

**REFERENCE BOOKS**

1. Lillian H. Meyer (2104) Food chemistry, CBS publishers and distributors.
2. Seema Yadav (2106) Food chemistry, Anmol publishers.

**JOB ORIENTED COURSE**

**21PCH0J1**

<b>Programme Code: 04</b>	<b>M.Sc., Chemistry</b>	
<b>Course Code : 21PCH0J1</b>	<b>JOC – Pharmaceutical chemistry</b>	
Batch 2021 – 2022	Total Hours 30 (Out of Class hours)	Credits 2

**Course Outcomes**

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

**UNIT –I: THE NATURE AND SOURCES OF DRUGS**

**(6 hrs)**

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

**UNIT –II: FIRST AID FOR ACCIDENTS**

**(6 hrs)**

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

**UNIT –III: COMMON DISEASES**

**(6 hrs)**

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

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

**UNIT – IV: BLOOD AND DIABETES**

**(6 hrs)**

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

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

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

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

**Unit – V: THERAPEUTIC AGENTS**

**(6 hrs)**

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

**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 (2108) A Text Book of Pharmaceutical Chemistry 3<sup>rd</sup> Edn, S.Chand & Co Ltd.
2. L.M.Atherden (1995) Text Book of Pharmaceutical Chemistry, 8<sup>th</sup> Edn, Oxford University Press.
3. C.R.Chatwal (2107) Pharmaceutical Chemistry Vol. I & II, III Edn, Himalaya Publishing House.

<b>Programme Code: 04</b>	<b>M.Sc., Chemistry</b>
<b>Course Code : 21PCH0D1</b>	<b>ALC- 1 Chemistry of Corrosion</b>
Batch 2021 – 2022	Credits 2

### **UNIT – I: INTRODUCTION TO CORROSION**

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

### **UNIT – II: KINETICS**

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

### **UNIT-III: PASSIVITY**

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

### **UNIT – IV: FORMS OF CORROSION**

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



## UNIT – V: MONITORING TECHNIQUES

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

### Text Book

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

<b>Programme Code: 04</b>	<b>M.Sc., Chemistry</b>
<b>Course Code : 21PCH0D2</b>	<b>ALC- 2 Chemistry of Drugs</b>
Batch 2021 – 2022	Credits 2

### **UNIT– I: INTRODUCTION TO DRUGS**

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

### **UNIT– II: DRUG ACTION**

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

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

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

### **UNIT – IV: DRUG DESIGN AND DRUG-TARGET INTERACTION**

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

### **UNIT – V: THERAPEUTIC AGENTS**

Structure Activity Relation (SAR) of antibiotics cephalosporins, streptomycin, tetracycline, erythromysin and chloremphenicol-SAR of antimalarial drug cinchonine-SAR of anticancer drug cisplatin-

cardiovascular drugs-definition and categories-synthesis and use of diuretic drug chloemerodrin Hg<sup>197</sup>-  
antiparkinsonism drug biperiden hydrochloride-antipsychotics and the structure of reserpine-antithyroid  
drugs-drugs to combat aids.

### REFERENCE BOOKS

1. Rama Rao Nadendla (2107) Medicinal chemistry, Pharmamid press.
2. K.Illango, P.Valentina (2107) Text book of medicinal chemistry-Volume I &II- First edition, Keerthi publishers.
3. Ashutosh kar (2106) Medicinal chemistry-4<sup>th</sup> edition-New age international publishers.

<b>Programme Code:</b> 04	<b>M.Sc., Chemistry</b>
<b>Course Code :</b> 21PCH0D3	<b>ALC- 3 Food Chemistry</b>
Batch 2021 – 2022	Credits 2

### **UNIT – I: FUNCTIONS OF FOOD**

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

### **UNIT – II: IMPORTANT NUTRIENTS IN FOOD**

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

### **UNIT – III: FOOD ADDITIVES**

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

### **UNIT – IV: FOOD PRESERVATION**

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

### **UNIT – V: FOOD ADULTERATION AND FUTURE FOODS**

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

### **REFERENCE BOOKS**

1. B. Srilakshmi (2115) Food science, New Age International, VI edition.
2. Lillian H. Meyer (2104) Food chemistry, CBS publishers and distributors.
3. Seema Yadav (2106) Food chemistry, Anmol publishers.