SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

[An Autonomous College Affiliated to Periyar University, Salem, Tamil Nadu]

[Accredited by NAAC with 'A' Grade with CGPA of 3.27]

[Recognized 2(f) & 12(B) Status under UGC Act of 1956]

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DEGREE OF BACHELOR OF SCIENCE IN CHEMISTRY

CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS AND SYLLABUS FOR

B.SC. CHEMISTRY PROGRAMME

(SEMESTER PATTERN)

(For Students Admitted in the College from the Academic Year 2023-2024 Onwards)

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1. INTRODUCTION

B.Sc. Chemistry: Programme Outcome, Programme Specific Outcome and Course Outcome

Chemistry is the study of composition and transformation of matter. Science is central to energy production, healthcare, new material development for electronics and other applied fields and environmental protection. Bachelor's degree in chemistry is the culmination of in-depth knowledge of Inorganic, Organic and Physical chemistry and specialized courses such as Pharmaceutical Chemistry, Spectroscopy, Nanoscience, Forensic Science, Cosmetics & Personal Grooming, Food Chemistry, Dairy Chemistry and so on. Thus, this programme inculcates learners in building a solid foundation for higher studies in Chemistry. The hands-on experience the students gain in practical's enables the students to apply theory to solve problems in everyday life, think critically and innovatively. An aptitude for research is instilled through project work and industrial internship.

Students completing this program will be able to present the concepts of Chemistry clearly and precisely. They can find solutions to solve problems that mankind is facing today. They can interpret data and present their findings to both scientific community as well as laymen can work as a team and evolve to become an entrepreneur.

The completion of this programme will also enable the learners to join teaching profession, conducting research in Industry and Government run research labs. A B.Sc., chemistry student has the option to diversify to other branches such as Biochemistry, Biotechnology and Forensic Science etc. They have employability opportunities in public and private sector jobs in Energy, Pharmaceutical, Food, Cosmetic industries etc…

REGULATIONS

1. Condition for Admission

A candidate who has passed the Higher Secondary Examination of Tamil Nadu Higher Secondary Board or an examination of some other board accepted by the syndicate as equivalent there with Chemistry and Physics and any one of the following subjects namely Maths, Botany, Zoology or Biology shall be eligible for admission into B.Sc., course in Chemistry.

2. Duration of the Course

The course for the degree of Bachelor of Science shall consist of three academic years divided into six semesters.

3. Course of study

The course of study for the B.Sc., degree in the Branch IV-Chemistry shall comprise of the following subjects according to the syllabus and books prescribed from time to time. The Syllabus for various subjects shall be demarcated into five units in each subject.

Part – I – Tamil / Other languages

Part – II – English

Part – III – Core Courses

Elective Courses

Project with viva voce

Part – IV – Foundation course

Skill Enhancement courses (Non-Major Elective)

Skill Enhancement courses (Discipline Specific)

Skill Enhancement courses

Environmental Studies

Value Education

Internship / Industrial Visit / Field Visit

Professional Competency Skill

Part – V – Extension Activity

NSS / NCC / Sports / YRC and other co and extra curricular

activities offered under part – V of the programmes

The two Elective (Allied) subjects may be chosen by the respective colleges and the same must be communicated to the University.

Skill Enhancement Courses (Non-Major Elective) may be chosen by the respective colleges and the same must be communicated to the University.

The College may also choose the Elective (Allied) of their choice in the first and second year.

4. Examinations

There shall be six examinations - two in the first year, two in the second year and two in the third year. Candidates failing in any subject / subjects will be permitted to appear for such failed subject / subjects at subsequent examinations.

The syllabus has been divided into six semesters. Examinations (theory and practical) for I, III and V semesters will be held in November / December and Examinations (theory and practical) for II, IV and VI semesters will be held in April / May.

Requirement to appear for the examination

A candidate shall be permitted to appear for the University examinations for any semester (theory or practical) if He / She secures not less than 75% of attendance in the number of working days during the semester.

5. Passing Minimum

A candidate who secures not less than 40% in the University (external) Examination and 40% marks in the external examination and continuous internal assessment put together in any course of Part I, II, III & IV shall be declared to have passed the examination in the subject (theory or practical). For practical, the minimum for a pass includes the record notebook marks also. There is no passing minimum for the record note book. However, submission of a record note book is a must.

6. Classification of Successful Candidates

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in First Class. All other successful candidates shall be declared to have passed in the Second Class. Candidates who obtain 75% of the marks in the aggregate shall be declared to have passed the examination in First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance.

Grading:

Conversion of marks to Grade points and letter grade (Performance in a course / paper)

Classification of successful candidates:

A candidate who passes all the examinations in Part I to Part V securing following CGPA and Grades shall be declared as follows for Part I or Part II or Part III:

CGPA	GRADE	Classification of Final Result
9.5-10.0	O+	First Class – Exemplary
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	First Class with Distinction
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
4.5 and above but below 5.0	C+	

4.0 and above but below 4.5	C	Third Class

7. Ranking

Candidates who pass all the examinations prescribed for the course in the first instance and within a period of three academic years from the year of admission to the course only are eligible for University Ranking.

8. Maximum Duration for the completion of the UG Programme

The maximum duration for completion of the UG Programme shall not exceed twelve semesters.

9. Commencement of this Regulation

These regulations shall take effect from the academic year 2023-2024, i.e., for students who are to be admitted to the first year of the course during the academic year 2023-2024 and thereafter.

1.PO AND PSO DESCRIPTIONS

Programme Outcomes (POs)

PO1	Graduates are prepared to be creators of new knowledge leading to innovation and **entrepreneurship employable** in various sectors such as private, government, and research organizations
PO2	Graduates are trained to evolve new technologies in their own discipline.
PO3	Graduates are groomed to engage in lifelong learning process by exploring their knowledge independently
PO4	Graduates are framed to design and conduct experiments /demos/create models to analyze and interpret data.
PO5	Graduates ought to have the ability of effectively communicating the findings of Physical sciences; incorporating with existing knowledge
PO6	Entrepreneurial Skills shall empower the students to start their own industries / business in core-chemistry fields

Programme Specific Outcomes (PSOs)

PSO1	Human and Social Values and Responsibilities in the context of learning Chemistry
PSO2	Communicative Skills and the Creative scientific mind towards learning chemistry
PSO3	Positive approach towards Environment and Ecology from the Chemistry perspective
PSO4	Critical thinking and the Analytical mind, students develop for the in depth

	knowledge in advanced-level Chemistry
PSO5	The relevance of extension of Chemistry in the social context for solving social issues
PSO6	Employability Skills shall enable the students to find jobs in core- chemistry and other related fields

PO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1	✓					
PO2		✓				
PO3			✓			
PO4				✓		
PO5					✓	
PO6						✓

2. Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising statistical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced statistical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Statistics based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Statistical Quality Control course is included to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.

- The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest DBMS and Computer software for Analytics.

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	**Foundation Course** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Statistics and simulating mathematical concepts to real world.	• Instil confidence among students • Create interest for the subject
I, II, III, IV	**Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial)	• Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable
		• Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects
		• Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.
		• Entrepreneurial skill training will provide an opportunity for independent livelihood

		• Generates self – employment • Create small scale entrepreneurs • Training to girls leads to women empowerment
		• Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools
III, IV, V & VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	• Strengthening the domain knowledge • Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Students are exposed to Latest topics on Computer Science / IT, that require strong statistical background • Emerging topics in higher education / industry / communication network / health sector etc. are introduced with hands-on-training, facilitates designing of statistical models in the respective sectors
IV	DBMS and Programming skill, Biostatistics, Statistical Quality Control, Official Statistics, Operations Research	• Exposure to industry moulds students into solution providers • Generates Industry ready graduates • Employment opportunities enhanced
II year Vacation activity	Internship / Industrial Training	• Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.
V Semester	Project with Viva – voce	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI Semester	Introduction of Professional Competency component	• Curriculum design accommodates all category of learners; 'Statistics for Advanced Explain' component will comprise of advanced topics in Statistics and allied fields, for those in the peer group / aspiring researchers; • 'Training for Competitive Examinations' –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, ISS, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.
Extra Credits:		• To cater to the needs of peer learners / research

For Advanced Learners / Honors degree	aspirants
Skills acquired from the Courses	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

PATTERN OF QUESTION PAPER

Time: 3 Hours **Maximum: 75 Marks**

Part A: 15x 1=15 (Answer all questions)

Choose the correct answer

(Three questions from each unit)

Part B: 2 x 5 = 10 (Answer any two questions)

(One question from each unit with internal choice)

Part C: 5 x 10= 50 (Answer All questions)

(One question from each unit with internal choice)

INTERNSHIP 2 WEEKS

The students have the option to select any organization – Government / private like industry, R & D organizations, scientific companies, etc., in consultation with the staff coordinator & Head of the Department. The students have to undergo training for a period of two weeks at the end of semester- IV during vacation. The students must maintain a work diary and prepare a report of the training undergone and submit the same.

SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE(Autonomous)

Bachelor of Science (B.Sc.) in Chemistry

Programme Pattern and Syllabus (CBCS)

(For Students Admitted in the College from the Academic Year 2023-2024 Onwards)

Sl. No	Nature of the Course	Course Code	Name of the Course	Hours / Week	Credits	Marks		
						CIA	ESE	Total
SEMESTER I								
1	Language	23UTA1F01	Tamil - I	6	3	25	75	100
2	Language	23UEN1E01	English – I	6	3	25	75	100
3	Core-I	23UCHCC01	General Chemistry I	5	5	25	75	100
4	Core practical-I	23UCHCC02	Quantitative Inorganic Estimations (Titrimetry) and Inorganic Preparations CC2	3	3	40	60	100
5	Allied I	23UMA1A01	Allied Mathematics-I	4	4	25	75	100
		23UZO1A01	Allied Zoology-I					
6	Allied-I Practical	23UMA2AP01	Allied Mathematics Practical -I	3	-	-		
		23UZO2AP01	Allied Zoology Practical -I					
7	NMEC	21UVE101	Skill Enhancement Course SEC-1 (Non-Major Elective)	2	2	25	75	100
8	Foundation Course	23UCHFC01	Foundation Course in Chemistry - FC	2	2	25	75	100
Total				**30**	**22**	**190**	**510**	**700**
SEMESTER II								
9	Language-II	23UTA2F02	Tamil - II	6	3	25	75	100
10	Language-II	23UEN2E02	English – II	6	3	25	75	100
11	Core-II	23UCHCC03	General Chemistry II	5	5	25	75	100
12	Core practical-II	23UCHCC04	Qualitative Organic Analysis and Preparation of Organic Compounds	3	3	40	60	100
13	NMEC-II		Skill Enhancement Course SEC-2 (Non-Major Elective)	2	2	25	75	100
14	SEC-3	23UCHSE03	Skill Enhancement Course SEC-3 Cosmetics and Personal Care Products	2	2	25	75	100
15	Allied II	23UMA2A02	Allied Mathematics-II	4	4	25	75	100
		23UZO2A02	Allied Zoology-II					
16	Allied-I Practical	23UMA2AP02	Allied Mathematics Practical -II	3	2	40	60	100
		23UZO2AP02	Allied Zoology practical - II					

Total	**30**	**24**	**230**	**570**	**800**

Sl. No	Nature of the Course	Course Code	Name of the Course	Hours / Week	Credits	Marks		
						CIA	ESE	Total
SEMESTER III								
17	Language -III	23UTA3F03	Tamil - III	6	3	25	75	100
18	Language-III	23UEN3F03	English – III	6	3	25	75	100
19	Core-III	23UCHCC05	General Chemistry III	5	5	25	75	100
20	Core practical-III	23UCHCC06	Qualitative Inorganic Analysis CC6	3	3	40	60	100
21	Allied	23UPH3A01	Physics EC 3(Theory)	4	3	25	75	100
22	Allied Practical	23UPH3AP01	Physics EC-3 (Practical)	2	2	40	60	100
23	SEC-4	23UCHSE04	Skill Enhancement Course SEC-4 :Entrepreneurial skills in Chemistry	1	1	100	-	100
24	SEC-5	23UCHSE05	Skill Enhancement Course SEC-5: Pesticide Chemistry	2	2	25	75	100
25	EVS		EVS	1	-	-	-	-
Total				**30**	**22**	**305**	**495**	**800**
SEMESTER IV								
26	Language-IV	23UTA4F04	Tamil - IV	6	3	25	75	100
27	Language-IV	23UEN4E04	English – IV	6	3	25	75	100
28	Core-IV	23UCHCC07	General Chemistry IV	4	5	25	75	100
29	Core practical-IV	23UCHCC08	Physical Chemistry Practical- I CC8	3	3	40	60	100
30	Allied	23UPH4A01	Physics EC 4(Theory)	4	3	25	75	100
31	Allied Practical	23UPH4AP01	Physics EC-4 (Practical)	2	2	40	60	100
32	SEC-6	23UCHSE06	Skill Enhancement Course: Instrumental methods of Chemical Analysis	2	2	25	75	100
33	SEC-7	23UCHSE07	Skill Enhancement Course: Forensic Science	2	2	25	75	100
34	EVS			1	2	25	75	100
Total				**30**	**25**	**255**	**645**	**900**

THIRD YEAR

Sl. No	Nature of the Course	Course Code	Name of the Course	Hours / Week	Credits	Marks		
						CIA	ESE	Total
SEMESTER V								
35	Core-IX	23UCHCC09	Organic Chemistry -I CC9	5	4	25	75	100
36	Core-X	23UCHCC10	Inorganic Chemistry - I CC10	4	4	25	75	100
37	Core-XI	23UCHCC11	Physical Chemistry -I CC11	5	4	25	75	100
38	Elective-V	23UCHEC05	Biochemistry EC5	4	3	25	75	100
39	Elective-VI	23UCHEC06	Industrial Chemistry EC 6	4	3	25	75	100
40	Practical	23UCHCC12	Physical Chemistry Practical-II CC12	3	2	40	60	100
41	Project	23UCHCC13	Project with viva-voce CC13	3	2	40	60	100
42	Value Education		Value Education	2	2	25	75	100
43	Internship		Internship / Industrial Visit / Field Visit(Carried out in II Year Summer vacation) (30 hours)	-	2	-	-	-
Total				**30**	**26**	**230**	**570**	**800**
SEMESTER VI								
44	Core-14	23UCHCC14	Organic Chemistry -II CC14	5	3	25	75	100
45	Core-15	23UCHCC15	Inorganic Chemistry - II CC15	4	3	25	75	100
46	Core-16	23UCHCC16	Physical Chemistry –II CC16	5	3	25	75	100
47	Elective-VII	23UCHEC07	EC7 Fundamentals of Spectroscopy	5	3	25	75	100
48	Elective-VIII	23UCHEC08	Nano science (or) Polymer science (or) Pharmaceutical Chemistry (Elective based) EC-8	4	3	25	75	100
49	Extension Activity	23UEX01	Extension Activity	-	1	-	-	-
50	Core practical-V	23UCHCC17	Gravimetric Estimation Practical CC17	5	3	40	60	100
51	Competency	23UCHPC01	Professional Competency Skill	2	2	25	75	100
Total				**30**	**21**	**190**	**510**	**700**

Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or overview	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate	
	between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	12	14	13	13	22	18	92
Part IV	4	4	3	6	4	2	23
Part V	-	-	-	-	-	1	1
Total	22	24	22	25	26	21	**140**

*Part I, II and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components IV, V have to be completed during the duration of the programme as per the norms, to be eligible to obtain the UG degree.

Program: B.Sc. Chemistry				
Core – I	**Course Code:** 23UCHCC01		**Course Title:** General Chemistry – I	
Semester I	**Hours/Week** 5	**Total Hours** 75	**Credits** 5	**Total Marks** 100

Course Objectives

The course aims at giving an overall view of the

- various atomic models and atomic structure
- wave particle duality of matter
- periodic table, periodicity in properties and its application in explaining thechemical behaviour
- nature of chemical bonding, and fundamental concepts of organic chemistry

UNIT I -Atomic structure and Periodic trends

History of atom (J.J.Thomson, Rutherford); Moseley's Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom;The Franck-Hertz Experiment; Interpretation of H- spectrum; Photoelectric effect, Compton effect; Dual nature of Matter- De- Broglie wavelength-Davisson and Germer experiment Heisenberg's Uncertainty Principle; Electronic Configuration of Atoms and ions- Hund's rule, Pauli'exclusion principle and Aufbau principle; Numerical problems involving the core concepts.

Unit II Introduction to Quantum mechanics

Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wave functions, Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals -Probability density and significance of Ψ and Ψ^2.

Modern Periodic Table-Cause of periodicity; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity-electronegativity scales, applications of electronegativity.

Problems involving the core concepts

UNIT-III: Structure and bonding - I

Ionic bond-Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle – lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion polarisation

– polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds; problems involving the core concepts.

Covalent bond-Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency - hybridization; VSEPR theory - shapes of molecules of the type AB2, AB3, AB4, AB5, AB6 and AB7. Partial ionic character of covalent bond-dipole moment, application to molecules of the type A2, AB, AB2, AB3, AB4; percentage ionic character- numerical problems based on calculation of percentage ionic character..

UNIT-IV: Structure and bonding - II

VB theory – application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species – CO_2, NO_2, CO_3^{2-}, NO_3^- ; limitations of VBT; MO theory - bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of H_2, C_2, O_2, O_2^+, O^{2-}, O $^{2-}N_2$, NO, HF, CO;magnetic characteristics, comparison of VB and MO theories.

Coordinate bond: Definition, Formation of BF_3, NH_3, NH_4^+, H_3O^+ properties

Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types, applicationsof semiconductors

Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding – Types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boilingpoints

UNIT-V:

Basic concepts in Organic Chemistry and Electronic effects

Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrynes.

Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects.

Resonance – resonance energy, conditions for resonance - acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free radicals, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene, bond lengths; steric inhibition to resonance. Hyperconjugation - stability of alkenes, bond length, orienting effect of methylgroup, dipole moment of aldehydes and nitromethane

Types of organicreactions- addition, substitution, elimination and rearrangements

Text Books

1. Madan, R. D. and Sathya Prakash, *Modern Inorganic Chemistry*, 2nded.; S.Chand and Company: New Delhi, 2003.
2. Rao, C.N. R. University General Chemistry, Macmillan Publication: NewDelhi, 2000.
3. Puri, B. R. and Sharma, L. R. *Principles of Physical Chemistry*, 38thed.;Vishal Publishing Company: Jalandhar, 2002.
4. Bruce, P. Y. and PrasadK. J. R. *Essential Organic Chemistry*, PearsonEducation: New Delhi, 2008.
5. Dash UN, Dharmarha OP, Soni P.L. Textbook of Physical Chemistry, Sultan Chand & Sons: New Delhi,2016

Reference Books

1. Maron, S. H. and Prutton C. P. *Principles of Physical Chemistry*,4thed.; The Macmillan Company: Newyork,1972.
2. Lee, J. D. *Concise Inorganic Chemistry*, 4th ed.; ELBS WilliamHeinemann: London,1991.
3. Gurudeep Raj, *Advanced Inorganic Chemistry*, 26thed.; Goel PublishingHouse: Meerut, 2001.
4. Atkins, P.W. & Paula, J. *Physical Chemistry*, 10th ed.; Oxford University Press:New York, 2014.
5. Huheey, J. E. *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th ed .; Addison, Wesley Publishing Company: India,1993.

Website ande-learning source

1) https://onlinecourses.nptel.ac.in
2) http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm
3) http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html
4) https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding
5)https://www.chemtube3d.com/

Course Outcomes (COs)

Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to

CO1: explain the atomic structure, wave particle duality of matter, periodic properties bonding,and properties of compounds.

CO2: classify the elements in the periodic table, types of bonds, reaction intermediates electroniceffects in organic compounds, types of reagents.

CO3: apply the theories of atomic structure, bonding, to calculate energy of a spectral transition,Δx, Δp electronegativity, percentage ionic character and bond order.

CO4: evaluate the relationship existing between electronic configuration, bonding, geometry ofmolecules and reactions; structure reactivity and electronic effects

CO5: construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms.

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	M	S	S	S	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO'

Program: B.Sc. Chemistry				
Core Practical – I	**Course Code:** 23UCHCC02		**Course Title: Quantitative Inorganic Estimation (titrimetry) and Inorganic Preparations**	
Semester I	**Hours/Week 3**	**Total Hours 45**	**Credits 3**	**Total Marks 100**

Course Objectives

This course aims at providing knowledge on

- laboratory safety
- handling glasswares

Quantitative estimation and preparation of inorganic compounds

Unit I

Chemical Laboratory Safety in Academic Institutions

Introduction - importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers-types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal.

Common Apparatus Used in Quantitative Estimation (Volumetric)

Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand.

Principle of Quantitative Estimation (Volumetric)

Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox, complexometric, iodimetric and iodometric titrations; indicators – types, theory of acid–base, redox, metal ion and adsorption indicators, choice of indicators.

Unit II - Quantitative Estimation(Volumetric)

Preparation of standard solution, dilution from stock solution

Permanganometry

Estimation of sodium oxalate using standard ferrous ammonium sulphate

Dichrometry

Estimation of ferric alum using standard dichromate (external indicator)Estimation of ferric alum using standard dichromate (internal indicator)

Iodometry

Estimation of copper in copper sulphate using standard dichromate

Argentimetry

Estimation of chloride in barium chloride using standard sodium chloride/ Estimation of chloride in sodium chloride (Volhard's method)

Unit III Complexometry

Estimation of hardness of water using EDTA

Estimations

Estimation of iron in iron tabletsEstimation of

ascorbic acid.
Preparation of Inorganic compounds-Potash alum
Tetraammine copper (II) sulphateHexamminecobalt (III) chloride Mohr's Salt
Skills acquiredfrom this course
Knowledge, Problem solving, Analytical ability, Professional Competency,Professional Communication and Transferable skills.

Reference:

1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. *Basic Principles ofPractical Chemistry*,2nd ed.; Sultan Chand &Sons: New Delhi, 1997.
2. Nad, A. K.; Mahapatra, B.; Ghoshal, A.; *An advanced course in Practical Chemistry*, 3rd ed.; New Central Book Agency: Kolkata, 2007.

Website ande-learning source

1) http://www.federica.unina.it/agraria/analytical-chemistry/volumetric- analysis
2) https://chemdictionary.org/titration-indicator/

Course Outcomes

Course Learning Outcomes (for Mapping with POs and PSOs)

On successful completion of the course the students should be able to

CO1: explain the basic principles involved in titrimetric analysis and inorganic preparations.
CO2: compare the methodologies of different titrimetric analysis.
CO3: calculate the concentrations of unknown solutions in different ways and develop the skillto estimate the amount of a substance present in a given solution.
CO4: assess the yield of different inorganic preparations and identify the end point of various titrations.

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Core –II	Course Code: 23UCHCC03		Course Title: General Chemistry – II	
Semester II	Hours/Week 5	Total Hours 75	Credits 5	Total Marks 100

Course Objectives

This course aims at providing an overall view of the

- chemistry of acids, bases and ionic equilibrium
- properties of s and p-block elements
- chemistry of hydrocarbons
- applications of acids and bases compounds of main block elements and hydrocarbons

UNIT-I

Acids, bases and Ionic equilibria

Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept Lewis concept; Relative strengths of acids, bases and dissociation constant;dissociation of poly basic acids, ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degreeof dissociation; acid base indicators, theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves - use of acid base indicators;

Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation;

Salt hydrolysis - salts of weak acids and strong bases, weak bases and strong acids, weak acids and weak bases - hydrolysis constant, degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis;

Solubility product - determination and applications; numerical problems involving the core concepts

Unit-II

Chemistry of s - Block Elements

Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, Na2CO3, KBr, KClO3 alkaline earth metals. Anomalous behaviour of Be.

Chemistry of p- Block Elements (Group 13 & 14)

preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al. comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses. Percarbonates, per monocarbonates and per dicarbonates.

UNIT-III

Chemistry of p- Block Elements (Group 15-18)

General characteristics of elements of Group 15; chemistry of H2N-NH2, NH2OH, HN3 and HNO3. Chemistry of PH3, PCl3, PCl5, POCl3, P2O5 and oxy acids of phosphorous (H3PO3 and H3PO4).

General properties of elements of group16 - Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids).

Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine.

Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids ($HClO_4$). Inter-halogen compounds (ICl, ClF_3, BrF_5 and IF_7), pseudo halogens [$(CN)_2$ and $(SCN)_2$] and basic nature of Iodine. Noble gases: Position in the periodic table. Preparation, properties and structure of XeF2, XeF4, XeF6 and XeOF4; uses of noble gases - clathrate compounds.

UNIT-IV

Hydrocarbon Chemistry-I

Petroproducts: Fractional distillation of petroleum; cracking, isomerisation, alkylation, reforming and uses

Alkenes-Nomenclature, general methods of preparation – Mechanism of □- elimination reactions – E1 and E2 mechanism - factors influencing – stereochemistry – orientation – Hofmann and Saytzeff rules. Reactions of alkenes – addition reactions – mechanisms – Markownikoff's rule, Kharasch effect, oxidation reactions – hydroxylation, oxidative degradation, epoxidation, ozonolysis; polymerization.

Alkadienes

Nomenclature - classification – isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes– Diels–Alder reactions – polymerisation – polybutadiene, polyisoprene (natural rubber), vulcanisation, polychloroprene.

Alkynes

Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerisation and isomerisation.

Cycloalkanes: Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations. Conformational analysis of cyclohexane, mono and di substituted cyclohexanes. Geometrical isomerism in cyclohexanes.

UNIT-V

Hydrocarbon Chemistry - II

Benzene: Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's (4n+2) rule and its applications. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation, halogenation, Friedel-Craft's alkylation and acylation. Mono substituted and disubstituted benzene - Effect of substituent – orientation and reactivity.

Polynuclear Aromatic hydrocarbons: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at α - position – reduction, oxidation – uses.

Anthracene – synthesis by Elbs reaction, Diels – Alder reaction and Haworth synthesis; physical properties; reactions - Diels-Alder reaction, preferential substitution at C-9 and C-10; uses.

Text Books:

1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded, S.Chand and Company, New Delhi.
2. Sathya Prakash, Tuli G D,Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17th ed., S.Chand and Company, New Delhi.
3. Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3rd ed., S.Chand and Company, New Delhi.
4. Tewari K S, Mehrothra S N and Vishnoi N K, (1998), Text book of Organic Chemistry, 2nd ed., Vikas Publishing House, New Delhi.

5. Puri B R, Sharma L R, (2002), Principles of Physical Chemistry, 38th ed., Vishal Publishing Company, Jalandhar

Reference Books

1. Maron S H and Prutton C P, (1972), Principles of Physical Chemistry, 4th ed., The Macmillan Company, Newyork.
2. Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, NewDelhi.
3. Lee J D, (1991), Concise Inorganic Chemistry, 4thed., ELBS WilliamHeinemann, London.
4. Huheey J E, (1993), Inorganic Chemistry: Principles of Structure andReactivity, 4th ed., Addison Wesley Publishing Company, India.
5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol – I, 26th ed.,Goel Publishing House, Meerut.

6.Agarwal O P, (1995), Reactions and Reagents in Organic Chemistry,8thed., Goel Publishing House,Meerut.

Website ande-learning source

https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/smblack/chem1010/lecture_notes/4B.html
http://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding

MOOC components

http://nptel.ac.in/courses/104101090/
Lecture 1: Classification of elements and periodic properties
http://nptel.ac.in/courses/104101090/

Course Learning Outcomes (for Mapping with POs and SOs)On completion of the course the students should be able to

CO1: explain the concept of acids, bases and ionic equilibria; periodic properties of s and pblock elements, preparation and properties of aliphatic and aromatic hydrocarbons

CO2: discuss the periodic properties of sand p- block elements, reactions of aliphatic andaromatic hydrocarbons and strength of acids

CO3: classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons

CO4: explain theories of acids, bases and indicators, buffer action and important compoundsof s-block elements

CO5: assess the application of hard and soft acids indicators, buffers, compounds of s and p- block elements and hydrocarbons

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	M	S	S	S	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Program: B.Sc. Chemistry		
Category: SEC III	Course Code: 23UCHSE03	Course Title : COSMETICS AND PERSONAL CARE PRODUCTS

Semester	Hours/Week	Total Hours	Credits	Total Marks
IV	2	75	2	100

Course Objective

This course aims at familiarizing the students with

- formulations of various types of cosmetics and their significance
- hair, skin and dental care
- makeup preparations and personal grooming

UNIT-I Skin care

Nutrition of the skin, skin care and cleansing of the skin; face powder - ingredients; creams and lotions - cleansing, moisturizing all purpose, shaving and sunscreen (formulation only); Gels - formulation and advantages; astringent and skin tonics - key ingredients, skin lightness, depilatories.

UNIT-II Hair care

Shampoos - types - powder, cream, liquid, gel – ingredients; conditioner – types - ingredients

Dental care

Tooth pastes - ingredients - mouth wash

UNIT-III Make up

Base - foundation - types - ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouge

UNIT-IV Perfumes

Classification - Natural - plant origin - parts of the plant used, chief constituents; animal origin - amber gries from whale, civetone from civet cat, musk from musk deer; synthetic - classification emphasizing characteristics - esters - alcohols - aldehydes - ketones .

UNIT-V

Beauty treatments

Facials - types - advantages - disadvantages; face masks - types; bleach - types - advantages - disadvantages; shaping the brows; eyelash tinting; perming
- types; hair colouring and dyeing ; permanent waving - hair straightening; wax
-types - waxing; pedicure, manicure - advantages - disadvantages .

Reference Books

1. Wilkinson J B E and Moore R J, (1997) Harry's cosmeticology, 7th ed., Chemical Publishers, London.
2. George Howard, (1987) Principles and practiceof perfumes and cosmetics, Stanley Therones, Chettenham.

Website and e-learning source

1. http://www.khake.com/page75.html
2. Net.foxsm/list/284

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

- **CO1:** know about the composition of various cosmetic products
- **CO2** understand chemical aspects and applications of hair care and dental care and skin care products.
- **CO3** understand chemical aspects and applications of perfumes and skin care products.
- **CO4** to understand the methods of beauty treatments their advantages and disadvantage
- **CO5** understand the hazards of cosmetic products.

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	M	S	S	S	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Program: B.Sc. Chemistry		
Core Practical – II	**Course Code:** 23UCHCC04	**Course Title :** Qualitative Organic Analysis and Preparation Of Organic Compounds

Semester	Hours/Week	Total Hours	Credits	Total Marks
II	3	45	3	100

Course Objective

This course aims at providing knowledge on

- laboratory safety
- handling glass wares
- analysis of organic compounds preparation of organic compounds

UNIT I

Safety rules, symbols and first-aid in chemistry laboratory
Basic ideas about Bunsen burner, its operation and parts of the flame. Chemistry laboratory glassware –basis information and uses

Unit II

Qualitative Organic Analysis

Preliminary examination, detection of special elements - nitrogen, sulphur andhalogens
Aromatic and aliphatic nature, Test for saturation and unsaturation,identification of functional groups using solubility tests
Confirmation of functional groups

- monocarboxylic acid, dicarboxylic acid
- monohydric phenol, polyhydric phenol
- aldehyde, ketone, ester
- carbohydrate (reducing and non-reducing sugars)
- primary, secondary, tertiary amine
- monoamide, diamide, thioamide
- anilide, nitro compound

Preparation of derivatives for functional groups

UNIT III

Preparation of Organic Compounds

i. Nitration - picric acid from Phenol
ii. Halogenation - p-bromo acetanilide from acetanilide
iii. Oxidation - benzoic acid from Benzaldehyde
iv. Microwave assisted reactions in water:
v. Methyl benzoate to Benzoic acid
vi. Salicylic acid from Methyl Salicylate
vii. Rearrangement - Benzil to Benzilic Acid

Hydrolysis of benzamide to Benzoic Acid

Separation and Purification Techniques (Not for Examination)

1. Purificationof organic compounds by crystallization (from water / alcohol)and distillation

2. Determination of melting and boiling points of organic compounds.

3.**Steam distillation** - Extraction of essential oil from citrus fruits/eucalyptusleaves.

4. Chromatography (any one) (Group experiment)

(i) Separation of amino acids by Paper Chromatography

(ii)Thin Layer Chromatography - mixture of sugars / plant pigments /permanganatedichromate.

(iii) Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves / separation of anthracene - anthracene picrate.

5. **Electrophoresis –** Separation of amino acids and proteins.

(Demonstration)

Isolation of casein from milk/Determination of saponification value of oil or fat/Estimation of acetic acid from commercial vinegar. (Any one Group experiment) (4,5& 6–not for ESE)

REFERENCE BOOKS:

1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. *Basic Principlesof Practical Chemistry*, 2nd ed.; Sultan Chand: New Delhi, 2012.
2. Manna, A.K. *Practical Organic Chemistry*, Books and Allied: India,2018.
3. Gurtu, J. N; Kapoor, R. *Advanced Experimental Chemistry (Organic)*,Sultan Chand: New Delhi, 1987.
4.Furniss,B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. *Vogel'sTextbook of Practical Organic Chemistry*, 5th ed.; Pearson: India,

Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to

CO1: observe the physical state, odour, colour and solubility of the given organic compound.

CO2: identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.

CO3: compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non- reducing sugars and explain the reactions behind it.

CO4: exhibit a solid derivative with respect to the identified functional group.

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Program: B.Sc. Chemistry				
Category: Core V		Course Code: 23UCHCC05	Course Title : GENERAL CHEMISTRY -III	
Semester	Hours/Week	Total Hours	Credits	Total Marks

III	5	75	5	100

Objectives ofthe course

This course aims to provide a comprehensive knowledge on

- the physical properties of gases, liquids, solids and X-ray diffraction ofsolids.
- fundamentals of nuclear chemistry and nuclear waste management.
- applications of nuclear energy
- basic chemistry of halo-organic compounds, phenol and other aromaticalcohols.

preparation and properties of phenols and alcohols.

UNIT I

Gaseous state

Kinetic molecular model of a gas: postulates and derivation from the kinetic gas equation; The Maxwell –Boltzmann distribution of speed of molecules- average, root mean square and most probable velocity and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Collision frequency; collision diameter; mean free path and viscosity of gases.

Real gases: Deviations from ideal gas behaviour, (Andrew's and Amagat's plots); compressibility factor, Z, and its variation with pressure for different gases. equations of states for real gases-van der Waal's equation; Virial equation; Boyle temperature; Numerical problems based on equations of statesfor real gases, isotherms of real gases – critical phenomena – isotherms of CO_2- continuity of state–Van der waal's equation and the critical state; law of corresponding states-liquefaction of gases; numerical problems involving the core concepts**.**

Unit-II

Liquid and Solid State

Properties of Liquids- Surface tension, viscosity and their applications. Crystalline and amorphous – differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism.

Crystals –size and shape; laws of crystallography; symmetry elements – plane, centre and axis; cells and space lattices; classification of crystal systems; Bravais lattices; X – ray diffraction – Packing in atomic solids – simple cubic, body centered cubic, face centered and hexagonal clos packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO_2; comparison of structure and properties of diamond and graphite;.numerical problems involving core concepts Defects in solids - stoichiometric and nonstoichiometric defects.

Liquid crystals – classification and applications

UNIT-III

Nuclear Chemistry

Natural radioactivity – α, β and γ rays; half-life period; Fajan–Soddy group displacement law; Geiger–Nattal rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; nuclear isomerism radioactive decay series; magic numbers; units – Curie, Rutherford, Roentgen; nuclear stabili - neutron- proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and B.E., decay constant and t1/2 and radioactive series.

Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems to

be worked out)

Nuclear energy; nuclear fission and fusion – major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.

UNIT-IV

Halogen derivatives Aliphatic halogen derivatives

Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent.

Di, Tri & Tetra Halogen derivatives: Nomenclature, classification, preparation, properties and applications.

Aromatic halogen compounds

Nomenclature, preparation, properties and uses Mechanism of nucleophilic aromatic substitution – benzyne intermediate.

Aryl alkyl halides

Nomenclature, benzyl chloride – preparation – preparation properties and uses

Alcohols: Nomenclature, classification, preparation, properties, use; conversions – ascent and descent of series; test for hydroxyl groups. Oxidation of diols by periodic acid and lead tetraacetate.

UNIT-V

Phenols

Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process, Raching process; properties – acidic character and effect of substitution on acidity. Reactions – Fries, claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Gatermann synthesis, Libermann, nitro reaction, phthalein reaction.

Resorcinol, quinol, picric acid – preparation, properties and uses.

Aromatic alcohols

Nomenclature, benzyl alcohol – methods of preparation – hydrolysis, reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis, physical properties, reactions – reaction with sodium, phosphorus pentachloride, thionyl chloride, acetic anhydride, hydrogen iodide, oxidation – substitution on the benzene nucleus, uses.

Thiols: Nomenclature, structure, preparation and properties

Skills acquired from this course

Knowledge, Problem solving, Analytical ability, Professional Competency,
Professional Communication and Transferable skills.

Recommended Text

1. B.R. Puri, L.R. Sharma, M.S. Pathania; *Principles of Physical Chemistry*, 46th edition, Vishal Publishing, 2020.

2. B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009.

3. 4. P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & amp; Sons, twentieth edition, 2006.

4. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003.

5. S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.

Reference Books

1. T. W. Graham Solomons, *Organic Chemistry*, John Wiley & Sons, fifth edition, 1992.
2. A. Carey Francis, *Organic Chemistry*, Tata McGraw-Hill Education Pvt., Ltd.,New Delhi, seventh edition, 2009.
3. I. L. Finar, Organic Chemistry, Wesley Longman Ltd, England, sixth edition, 1996.
4. P. L. Soni, and H. M.Chawla - *Text Book of Organic Chemistry*, New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007.
5. J.D. Lee, *Concise Inorganic Chemistry*, Blackwell Science, fifth edition, 2005.

Website and e-learning source

MOOC components https://nptel.ac.in/courses/104104101
Solid state chemistry https://nptel.ac.in/courses/103106071
Nuclear industries and safety https://nptel.ac.in/courses/104106119s

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO1: explain the kinetic properties of gases by using mathematical concepts.
CO2: describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure determinations.
CO3: investigate the radioactivity, nuclear energy and it's production, also the nuclear waste management.
CO4: write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols.
CO5: investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol.

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	M	S	S	S	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15

Program: B.Sc. Chemistry

Category: Core VI practical		Course Code: 23UCHCC06	Course Title : QUALITATIVE INORGANIC ANALYSIS	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	3	45	3	100

Objectives ofthe course

To develop the skill on systematic analysis of simple inorganic salts and mixtureof salts.

Semi - Micro Qualitative Analysis

1. Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphite, chloride, bromide,
   iodide, nitrate
2. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate, arsenate, arsenite.
3. Elimination of interfering acid radicals and Identifying the group of basic radicals
4. Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, arsenic, zinc,manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium

Analysis of a mixture - I to VIII containing two cations and two anions (of which one is interfering type)

Skills acquired from this course

Knowledge, Problem solving, Analytical ability, Professional Competency,Professional Communication and Transferable skills.

Recommended Text

V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.

Website and e-learningsource

https://www.vlab.co.in/broad-area-chemical-sciences

On successful completion of the course the students should be able to

CO 1: acquire knowledge on the systematic analysis of Mixture of salts.
CO 2: identify the cations and anions in the unknown substance.
CO 3: identify the cations and anions in the soil and water and to test the quality of water.
CO4: assess the role of common ion effect and solubility product

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Program: B.Sc. Chemistry

Category: SEC IV		Course Code: 23UCHSE04	Course Title : ENTREPRENEURIAL SKILLS IN CHEMISTRY	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	1	15	1	100

Objectives of thecourse

The course aims at providing training to

- develop entrepreneur skills in students
- to provide hands on experience to prepare and develop products develop start ups

UNIT -I

Food Chemistry

Food adulteration-contamination of food items with clay stones, waterandtoxicchemicals -Common adulterants.

Food additives, Natural and synthetic anti-oxidants, glazing agents (hazardous effect),food colourants, Preservatives, leavening agents,Baking powder and baking soda, yeast,MSG,vinegar.

Dyes

Classification – Natural, synthetic dyes and their characteristics – basic methods and principles of dyeing

UNIT II

Hands on Experience (Students can choose any four)

Detection of adulterants in food items like coffee, tea, pepper, chilli powder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques. Preparation of Jam, squash and Jelly, Gulkand, cottage cheese. Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powde rand disinfectants in small scale.Extraction of oils from spices and flowers. Testing of water samples using testing kit.

Dyeing – cotton fabrics with natural and synthetic dyesPrinting – tie and dye, batik.

Skills acquired from this course

Entrepreneurial skills.

Reference Books

Shyam Jha, Rapid detection of food adulterants and contaminants (Theory and Practice), Elsevier, e Book ISBN 9087128004289, 1st Edition,2015

Website and e-learning source: https://www.vlab.co.in/broad-area-chemical-sciences

Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to

CO 1: identify adulterated food items by doing simple chemical tests.

CO 2: prepare cleaning products and become entrepreneurs

CO 3: educate others about adulteration and motivate them to become entrepreneurs

	PO1	PO2	PO3	PO4	PO5	PO6

CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S

CO /PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
Weightage	6	6	6	6	6
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry		
Category: SEC V	**Course Code:**	**Course Title :** PESTICIDE

		23UCHSE05	CHEMISTRY	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	2	30	2	100

Objectives of thecourse

This course aims to providing the students

- knowledge about the various types of pesticides and their toxicity.
- to understand the accumulation of pesticides in in the form ofresidues and its analysis.
- knowledge on choice of alternate and eco-friendly pesticides

Unit I

Introduction: History of pesticides. Chemistry of Pesticides: Brief introduction to classes of pesticides (Chemical class, targets), structures, chemical names, physical and chemical properties.

Toxicity of pesticides: Acute and chronic toxicity in mammals, birds, aquatic species etc. Methods of analysis of pesticides.

Insecticides: Classification and study of following insecticides with respect to structure, chemical name, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, Mode of action, uses, toxicity.

Organophosphates and Phosphothionates: Acephate, Chlorpyriphos, Monocrotophos, and parathion-methyl. Organochlorine – Endosulfan, heptachlor; Carbamate: Cartap hydrochloride, Methomyl, Propoxur

Unit II

Pesticides residues: Introduction- application of agrochemicals, dissemination pathways of pesticides, causes of pesticide residues, remedies. Pesticides residues in atmosphere- entry into atmosphere, action of pesticides, effects on environments. Pesticides residues in water - entry into water systems, action and effect in aquatic environment. Pesticides residues in soil. entry into soil, absorption, retention and transport in soil, effects on microorganism, soil condition and fertility, decomposition and degradation by climatic factors and microorganism.

Pesticide Residues effect and analysis: Effects of pesticides residue on human life, birds and animals- routes for exposure to pesticides, action of pesticides on living system. Analysis of pesticides residues- sample preparation, extraction of pesticides residues (soil, water and vegetables/fruits) simple methods and schemes of analysis, multi-residue analysis**.**

Unit III

Biopesticides: Pheromones, attractants, repellents – Introduction, types and application (8-Dodecen-1-ol, 10-cis-12-hexadecadienoic, Trimedlure, Cue-lure, methyl eugenol, N,N-Diethyl-m-toluamide, Dimethyl phthalate, Icaridin). Baits- Metaldehyde, Iron (II) phosphate,

Indoxacarb, Zinc Phosphide, Bromadiolone.

Skills acquired from this course

Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills..

Reference Books

1. Handa SK. Principles of pesticide chemistry. Agrobios (India); 2012.

2. Matolcsy G, Nádasy M, Andriska V. Pesticide chemistry. Elsevier; 1989.
3. J. Miyamoto and P. C. Kearney Pesticide Chemistry Human Welfare and the Environment vol. IV Pesticide Residue and Formulation Chemistry, Pergamon press,1985.
4.R. Cremlyn: Pesticides, John Wiley.

RecommendedText

1. Roy N. K., Chemistry of Pesticides. CBS Publisher & Distributors PLtd; 1st Ed. (2010).
2. Nollet L.M., Rathore H.S., Handbook of pesticides: methods ofpesticide residues analysis. CRC press; 2016.
Ellerbrock R.H., Pesticide

Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to

CO 1: teach about the pesticides and their toxicity with respect to structure and category.
CO 2: explain the preparation and property of pesticides
CO 3: investigate the pesticide residues, prevention and care
CO 4: demonstrate the extraction and analytical methods of pesticide residues
CO 5: make awareness to the public on bio-pesticides

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage ofCourse Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry

Category: Core VII		Course Code: 23UCHCC07	Course Title : GENERAL CHEMISTRY-IV	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	4	75	5	100

Objectives of thecourse

This course aims to provide a comprehensive knowledge on

- thermodynamic concepts on chemical processes and appliedaspects.
- thermo chemical calculations
- transition elements with reference to periodic properties and groupstudy of transition metals.
- the organic chemistry of ethers, aldehydes and ketones the organic chemistry of carboxylic acids

UNIT I

Thermodynamics I

Terminology – Intensive, extensive variables, state, path functions; isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; First law of thermodynamics – Concept and significance of heat (q), work (w), internal energy (E), enthalpy (H); calculations of q, w, E and H for reversible, irreversible expansion of ideal and real gases under isothermal and adiabatic conditions; relation between heat capacities (Cp & Cv); Joule Thomson effect- inversion temperature.

Thermochemistry - heats of reactions, standard states; types of heats of reactions and their applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions; Hess's law and its applications; determination of bond energy; Measurement of heat of reaction – determination of calorific value of food and fuels Zeroth law of thermodynamics-Absolute Temperature scale.

Unit II

Thermodynamics II

Second Law of thermodynamics - Limitations of first law, spontaneity and randomness; Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, entropy of mixing, calculation of entropy changes of an ideal gas and a van der Waals gas with changes in temperature, volume and pressure, entropy and disorder.

Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application.

Third law of thermodynamics - Nernst heat theorem; Applications of third law - evaluation of absolute entropies from heat capacity measurements, exceptions to third law.

UNIT III

General Characteristics of d-block elements

Transition Elements- Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes. Comparative study of transition elements and non transition elements – comparison of II and III transition series with I transition series. Group study of

Titanium, Vanadium, Chromium, Manganese, Iron, Cobalt, Nickel and Zinc groups

UNIT IV

Ethers, Thio ethers and Epoxides

Nomenclature, isomerism, general methods of preparations, reactions involving cleavage of C-O linkages, alkyl group and ethereal oxygen. Zeisel's method of estimation of methoxy group.Reactions of epoxides with alcohols, ammonia derivatives and LiAH4 Thioethers - nomenclature, structure, preparation, properties and uses.

Aldehydes and Ketones

Nomenclatue, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions, base catalysed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Baeyer - Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf - Kishner reduction, Meerwein – Pondorf Verley reduction, reduction with LiAlH4 and NaBH4.

Addition reactions of unsaturated carbonyl compounds: Michael addition.

UNIT V

Carboxylic Acids: Nomenclature, structure, preparation and reactions of aliphatic and aromatic monocarboxylic acids. Physical properties, acidic nature, effect of substituent on acidic strength. HVZ reaction, Claisen ester condensation, Bouveault Blanc reduction, decarboxylation, Hunsdieckerreaction.Formic acid-reducing property.

Reactions of dicarboxylic acids, hydroxy acids and unsaturated acids.

Carboxylic acid Derivatives: Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of acyl halide, anhydride, ester, amide. Schottan- Baumann reaction. Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation and Curtius rearrangement.

Active methylene compounds: Keto – enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate

Halogen substituted acids – nomenclature; preparation by direct halogenation, iodination from unsaturated acids, alkyl malonic acids

Hydroxy acids – nomenclature; preparation from halo, amino, aldehydic and ketonic acids, ethylene glycol, aldol acetaldehyde; reactions – action of heat on α, β, γ hydroxy acids.

Skills acquired from this course

Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

RecommendedText

1. B.R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, ShobanLal Nagin Chand and Co., thirty three edition, 1992.
2. K. L. Kapoor, *A Textbook of Physical chemistry*, (volume-2 and 3), Macmillan, India Ltd, thirdedition, 2009.
3. P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, SultanChand & Sons, twentieth edition, 2006.
4. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, VishalPublishing, fourth reprint, 2003.

S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in OrganicChemistry*, Macmillan India Ltd., third edition, 1994.

ReferenceBooks

1. Maron, S. H. and Prutton C. P. *Principles of Physical Chemistry*,4thed.; The Macmillan Company: Newyork,1972.
2. Lee, J. D. *Concise Inorganic Chemistry*, 4th ed.; ELBS WilliamHeinemann: London,1991.

3. Gurudeep Raj, *Advanced Inorganic Chemistry*, 26th ed.; GoelPublishing House: Meerut, 2001.
4. Atkins, P.W. & Paula, J. *Physical Chemistry*, 10th ed.; OxfordUniversity Press:New York, 2014.
Huheey, J. E. *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th ed; Addison Wesley Publishing Company: India,1993.

Website ande-learning source

MOOC components https://nptel.ac.in/courses/112102255 Thermodynamics
https://nptel.ac.in/courses/104101136 Advanced transition metal chemistry

Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to

CO1: explain the terms and processes in thermodynamics; discuss the various laws of thermodynamics and thermo chemical calculations.
CO2: discuss the second law of thermodynamics and its application to heat engine; discussthird law and its application on heat capacity measurement.
CO3: investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions.
CO4: discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compoundsincluding named organic reactions.
CO5: discuss the chemistry and named reactions related to carboxylic acids and their derive

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	M	S	S	S	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Category: Core VIII practical		Course Code: 23UCHCC08	Course Title : PHYSICAL CHEMISTRY PRACTICAL – I	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	3	3	3	100

Objectives of thecourse

The course aims at providing an understanding of

- the laboratory experiments in order to understand the conceptsof physical changes in chemistry
- the rates of chemical reactions
- colligative properties and adsorption isotherm

UNIT-I

Chemical kinetics

1. Determination of rate constant of acid catalysed hydrolysis of an ester
2. Determination of order of reaction between iodide and persulphate (initial rate method).
3. Polarimetry: Determination of rate constant of acid catalysed inversion of cane sugar

Thermochemistry

4. Determination of heat of neutralisation of a strong acid by a strong base.
5. Determination of heat of hydration of copper sulphate.

UNIT II

Electrochemistry – Conductance measurements

6. Determination of cell constant
7. Determination of molar conductance of strong electrolyte
8. Determination of dissociation constant of acetic acid

Colorimetry

9. Determination of concentration of copper sulphate solution

UNIT III

Colligative property

10. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent

Adsorption

11. Construction of Freundlich isotherm for the adsorption of acetic acid on activated charcoal

Skills acquired from this course

Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

Reference Books

1. Sindhu, P.S.*Practicals in Physical Chemistry*, Macmillan India :New Delhi, 2005.
2. Khosla, B. D.Garg,V. C.; Gulati, A.; *Senior Practical PhysicalChemistry*, R.Chand : New Delhi, 2011.

Gupta, Renu, *Practical Physical Chemistry*, 1st Ed.; New AgeInternational: New Delhi, 2017.

Website and e-learning source : https://www.vlab.co.in/broad-area-chemical-sciences

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the

course the students should be able to
CO1: describe the principles and methodology for the practical work

CO2: explain the procedure, data and methodology for the practical work.

CO3: apply the principles of electrochemistry, kinetics for carrying out the practical work.
CO4: demonstrate laboratory skills for safe handling of the equipment and chemicals

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Program: B.Sc. Chemistry		
Category: SEC VI	**Course Code:**	**Course Title :**

		23UCHSE06		INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	2	30	2	100

Objectives of thecourse

The course aims at providing an overall view of the

- operation and troubleshooting of chemical instruments
- fundamentals of analytical techniques and itsapplication in the characterization of compoundstheory of chromatographic separation and
- theory of thermo / electro analytical techniques
- stoichiometry and the related concentration terms

UNIT-I

Qualitative and Quantitative Aspects of Analysis

S.I Units, Distinction between Mass and Weight. Moles, Millimoles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. Density and Specific Gravity of Liquids. Stoichiometry Calculations

Sampling, evaluation of analytical data, Errors – Types of Errors, Accuracy, Precision, Minimization of Errors. Significant Figures. Methods of Expressing Precision: Mean, Median, Average Deviation, Standard Deviation, Coefficient of Variation, Confidence Limits, Q- test, F-test, T-test. The Least Square Method for Deriving Calibration plots.

UNIT II

Atomic Absorption Spectroscopy: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

UNIT III

UV-Visible and IR Spectroscopy

Origin of spectra, interaction of radiation with matter, fundamental laws of spetroscopy and selection rules, validity of Beer-Lambert's law.

UV-Visible Spectrometry: Basic principles, instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. **Infrared Spectroscopy:** Basic principles of instrumentation (choice of source, monochromator& detector) for single and double beaminstrument; sampling techniques.

UNIT IV

Thermal and Electro-analytical Methods of Analysis

TGA and DTA- Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate and calcium acetate

DSC- Principle, Instrumentation and applications.

Electroanalytical methods: polarography - principle, instrumentation and applications. Derivative polarography- Cyclic Voltammetry - principle.

UNIT V

Separation and purification techniques

Classification, principle, Factors affecting - Solvent Extraction – Liquid - Liquid Extraction,

Chromatography: Column, TLC, Paper, Gas, HPLC and Electrophoresis, Principle, Classification, Choice of Adsorbents,Solvents, Preparation of Column, Elution Mechanism of separation: adsorption, partition & ion exchange. Development of

chromatograms and Rf value.

Skills acquired from this course

Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills

RecommendedText

1. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed., The English Language Book Society of Longman.
2. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007
3. Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017).
4. R. Speyer, Thermal Analysis of Materials, CRC Press, 1993.

R.A. Day and A.L. Underwood, Quantitative Analysis, 6thedn., Prentice Hall of India Private Ltd., New Delhi, 1993

Reference Books

1. D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5thedn., Saunders college publishing, Philadelphia, 1998.
2. Dash U N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011.
3. Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley & Sons, New York, 2004.
4. Mikes, O. &Chalmes, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London
5. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, sixth edition PearsonEducation, 2000

Website ande-learning sources

1. http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-14- final.pdf
2. http://eric.ed.gov/?id=EJ386287
3. http://www.sjsu.edu/faculty/watkins/diamag.htm
4. http://www.britannica.com/EBchecked/topic/108875/separation- and-purification
5. http://www.chemistry.co.nz/stoichiometry.html

Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to

CO1: apply error analysis in the calibration and use of analytical instruments, explain theory,instrumentation and application of flame photometry and Atomic Absorption spectrometry

CO2: explain theory, instrumentation and application of UV visible and Infrared spectroscopy.

CO3: able to discuss instrumentation, theory and applications of thermal and electrochemicaltechniques

CO4: explain the use of chromatographic techniques in the separation and identification of mixtures

CO5: explain preparation of solutions, stoichiometric calculations

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S

CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	M	S	S	S	S

CO /PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Program: B.Sc. Chemistry		
Category: SEC VII	**Course Code:**	**Course Title : FORENSIC**

		23UCHSEC06	SCIENCE	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	2	30	2	100

Objectives of thecourse

This course aims at giving an overall view of

- crime detection through analytical instruments
- forgery and its detection
- medical aspects involved

UNIT I

Poisons

Poisons - types and classification - diagnosis of poisons in the living and the dead - clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of seafoods - use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning – use of antidotes for common poisons.

Unit-II

Crime Detection

Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs - possible explosives (gelatin sticks and RDX) - metal detector devices andother security measures for VVIP-composition of bullets and detecting powder burns.

UNIT-III

Forgery and Counterfeiting

Documents - different types of forged signatures - simulated and traced forgeries -inherent signs of forgery methods - writing deliberately modified
- uses of ultraviolet rays -comparison of type written letters – checking silver line water mark in currency notes – alloy analysis using AAS to detect counterfeit coins – detection of gold purity in 22 carat ornaments – detecting gold plated jewels -authenticity of diamond.

UNIT-IV

Tracks and Traces

Tracks and traces - small tracks and police dogs - foot prints - costing of foot prints - residue prints, walking pattern or tyre marks – miscellaneous traces and tracks – glass fracture - tool marks - paints - fibres - Analysis of biological substances - blood, semen, saliva, urine and hair - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses.

UNIT-V

Medical Aspects

Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum - Gas chromatography-Arson - natural fires and arson - burning characteristics and chemistry of combustible materials - nature of combustion. Ballistics - classification - internal and terminal ballistics - small arms -laboratory examination of barrel washing and detection of powder residue by chemical tests.

RecommendedText

1. SA Iqbal, M Liviu, Textbook of forensic chemistry, Discoverypublishing house private limited, 2011.

2. Kelly M. Elkins, Introduction to Forensic Chemistry, CRC Press,Taylor & Francis Group, 2019.
3. Javed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr., Basicprinciples of Forensic chemistry, Humana Press, first edition, 2012.
4. Bapuly AK, (2006) Forensic Science – Its application in crimeinvestigation, Paras Medical Publisher, Hyderabad.
5. Sharma B.R., (2006) Scientific Criminal Investigation, Universal Law Publishing Co. Pvt. Ltd, New Delhi.

Reference Books

1. Richard Saferst in and Criminalistics-An Introduction to Forensic Science (College Version), Sopfestein, Printice hall, eighth edition,2003
2. Suzanne Bell, Forensic Chemistry, Pearson, second international edition, 2014.
3. Jay Siegel, Forensic chemistry: Fundamentals and applications, Wiley-Blackwell, first edition, 2015.
4. Max M. Houck & Jay A. Segal, (2006) Fundamentals of ForensicScience, Elsevier Academic press.
5. Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, (2006) HenryLee's Crime Scene Book Elsevier Academic press.

Website ande-learning sources

1. http://www.library.ucsb.edu/ist/03-spring/internet.html
2. http://www.wonder howto.com/topic/forensic-science/

Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to

CO 1: learn about the Poisons - types and classification of poisons in the living and the deadorganisms and also get information about Postmortem.

CO 2: get awareness on Human bombs, possible explosives (gelatin sticks and RDX) and metal defector devices and other security measures for VVIP - composition of bulletsand detecting powder burns

CO 3: detect the forgery documents, different types of forged signatures

CO4: have an idea about how to tracks and trace using police dogs, foot prints identificationand gain the knowledge in analyzing biological substances - blood, semen, saliva, urine and hair - DNA Finger printing for tissue identification in dismembered bodies

CO 5: get the awareness on Aids - causes and prevention and also have an exposure on handling fire explodes.

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	M	S	S	S	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Program: B.Sc. Chemistry		
Core-IX	Course Code: 23UCHCC09	Course Title: ORGANIC CHEMISTRY-I

Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	5	75	4	100

Course Objective

This course aims to provide an understanding of

- stereoisomerism in chirals and geometric isomerism in olefins,conformations of ethane and butane
- preparation and properties of aromatic and aliphatic nitrocompounds and amines
- preparation of different dyes, food colour and additives
- preparation and properties of five membered heterocycles likepyrrole, furan and thiophene
- preparation and properties of six membered heterocycles like
- pyridine, quinoline and isoquinoline.

UNIT I

Stereochemistry

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism:cis–trans, syn-anti isomerism, E/Z notations.

Optical Isomerism: Optical activity, specific rotation, asymmetry, enantiomers, distereoisomers, meso structures - molecules with one and two chiral centres, racemisation-methods of racemisation; resolution- methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres.

Molecules with no asymmetric carbon atoms – allenes and biphenyls.Conformational analysis of ethane and butane.

UNIT II

Chemistry of Nitrogen Compounds – I

Nitroalkanes

Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions – reduction, halogenations, Grignard reagent, Pseudo acid character. Nitro - aci nitro tautomerism.

Aromatic nitro compounds

Nomenclature, preparation – nitration, from diazonium salts, physical properties; reactions - reduction of nitrobenzene in different medium,

Electrophilic substitution reactions, TNT.

Amines: Aliphatic amines

Nomenclature, isomerism, preparation – Hofmanns' degradation reaction, Gabriel's phthalimide synthesis, Curtius Schmidt rearrangement.

Physical properties, reactions – alkylation, acylation, carbylamine reaction, Mannich reaction, oxidation, basicity of amines.

UNIT III

Chemistry of Nitrogen Compounds – II

Aromatic amines – Nomenclature, preparation – from nitro compounds, Hofmann's method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation.

Distinction between primary, secondary and tertiary amines - aliphatic and aromatic

Diazonium compounds
Diazomethane, Benzene diazonium chloride - preparations and synthetic applications.
Dyes
Theory of colour and constitution; classification based on structure and application; preparation –Martius yellow, aniline yellow, methyl orange, alizarin, indigo, malachite green.
Industry oriented content
Dyes Industry, Food colour and additives

UNIT IV

Heterocyclic compounds

Nomenclature and classification. General characteristics - aromatic character and reactivity.
Five-membered heterocyclic compounds
Pyrrole – preparation - from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening.
Furan – preparation from mucic acid and pentosan; reactions – hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction.
Thiophene synthesis - from acetylene; reactions –reduction; oxidation;

UNIT V

Six-membered heterocyclic compounds

Pyridine – synthesis - from acetylene, Physical properties; reactions - basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution- uses
Condensed ring systems
Quinoline – preparation - Skraup synthesis and Friedlander's synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction
Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.

Skills acquired from this course

Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

RecommendedText

1.M.K. Jain, S.C.Sharma, Modern Organic Chemistry, VishalPublishing, fourth reprint, 2009.
2.S.M. Mukherji, and S.P. Singh, Reaction Mechanism in OrganicChemistry, Macmillan India Ltd., third edition, 2009.
3. ArunBahl and B.S. Bahl, Advanced organic chemistry, New Delhi,S.Chand& CompanyPvt. Ltd., Multicolour edition, 2012.
4.P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry,Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.
5.C.N.Pillai, Text Book of Organic Chemistry, Universities Press(India) Private Ltd., 2009.

Reference Books

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, sixth edition, 2012.
2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons, eleventh edition, 2012
3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventh edition,2009.
4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, sixth edition, 2006.

5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: assign RS notations to chirals and EZ notations to olefins and explain conformations of ethane and butane.

CO2: explain preparation and properties of aromatic and aliphatic nitro compounds and amines

CO3: explain colour and constitution of dyes and food additives

CO4: discuss preparation and properties of five membered heterocycles like pyrrole, furan and thiophene

CO5: discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	M	S	S	S	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry

Core-X		Course Code: 23UCHCC10	Course Title: INORGANICCHEMISTRY-I	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	4	75	4	100

Course Objective

The course aims to provide knowledge on

- nomenclature, isomerism and theory of coordination compounds, and chelate complexes
- crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect
- preparation and properties of metal carbonyls
- Lanthanoids and actinoids
- preparation and properties of inorganic polymers

UNIT-I

Co-ordinationChemistry-I

IUPAC Nomenclature of coordination compounds, Isomerism in coordination compounds. Werner's coordination theory – effective atomic number –interpretation of geometry and magnetic properties by Pauling's theory – geometry of co-ordination compounds with co-ordination number 4 &6.

Chelates – types of ligands forming chelates – stability of chelates, applications of chelates in qualitative and quantitative analysis– application of DMG and oxine in gravimetric analysis – estimation of hardness of water using EDTA, metal ion indicators. Role of metal chelates in living systems – haemoglobin and chlorophyll

Unit-II

Co-ordination Chemistry - II

Crystal field theory –Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectrochemical series - calculation of CFSE in octahedral and tetrahedral complexes - factors influencing the magnitude of crystal field splitting, crystal field effect on ionic radii, lattice energies, heats of ligation with water as a ligand (heat of hydration), interpretation of magnetic properties, spectra of $[Ti(H_2O)_6]^{3+}$ - Jahn – Teller effect. Stability of complexes in aqueous solution, stability constants- factors affecting the stability of a complex ion, thermodynamic and kinetic stability (elementary idea). Comparison of VBT and CFT.

UNITIII

Organometalliccompounds -Metal Carbonyls

Mono and polynuclear carbonyls, General methods of preparation of carbonyls – general properties of binary carbonyls – bonding in carbonyls – structure and bonding in carbonyls of Ni, Fe, Cr, Co, Mn, Ru and Os. EAN rule as applied to metal carbonyls.

Ferrocene-Methods of preparation, physical and chemical properties.

UNIT-IV

Inner transition elements (Lanthanoids and Actinoids)

General characteristics of f-block elements - Comparative account of lanthanoids and actinoids - Occurrence, Oxidation states, Magnetic properties, Colour and spectra - Lanthanoids and Actinoids, Separation by ion-Exchange and Solvent extraction methods - Lanthanoids contraction- Chemistry of thorium and Uranium-Occurrence, Ores, Extraction,

properties and uses - Preparation, Properties and uses of ceric ammonium sulphate, thorium dioxide and uranyl acetate.

UNITV

Inorganic polymers

General properties – classification of inorganic polymers based on element in the backbone (Si, S, B and P) - preparation and properties of silicones (polydimethylsiloxane and polymethylhydrosiloxane) phosphorous based polymer (polyphosphazines and polyphophonitrilic chloride), sulphur based polymer (polysulfide and polymeric sulphur nitride), boron based polymers (borazine polymers) – industrial applications of inorganic polymers.

Recommended Text

1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31thEdition, Milestone Publishers & Distributors, Delhi.
2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi
3. Lee J D, (1991), Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London.
4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, S. Chand and Company Ltd.
5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.

Reference Books

1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed ., S.Chand and Company, New Delhi.
2. Gopalan R, (2009) Inorganic Chemistry for Undergraduates, Ist Edition, University Press (India) Private Limited,Hyderabad
3. Sivasankar B, (2013) Inorganic Chemistry.Ist Edition, Pearson, Chennai
4. Alan G. Sharp (1992), Inorganic Chemistry, 3rd Edition, Addition- Wesley, England
5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry Oxford University Press, sixth edition, 2014.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to
CO1: explain isomerism, Werner's Theory and stability of chelate complexes
CO2: discuss crystal field theory, magnetic properties and spectral properties of complexes.
CO3: explain preparation and properties of metal carbonyls
CO4: give a comparative account of the characteristics of lanthanoids and actinoids
CO5:explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	M	S	S	S	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Core-XI		Course Code: 23UCHCC11	Course Title: PHYSICAL CHEMISTRY-I	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	5	75	4	100

The course aims at providing an overall view of

- Gibbs free energy, Helmholtz free energy, Ellingham's diagram and partial molar properties
- chemical kinetics and different types of chemical reactions
- adsorption, homogeneous and heterogeneous catalysis
- colloids and macromolecules
- photochemistry, fluorescence and phosphorescence

UNIT I

Thermodynamics - III

Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application.

Partial molar properties – chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure, chemical potential of a system of ideal gases, Gibbs-Duhem-Margules equation.

UNIT II

Chemical Kinetics

Rate of reaction - Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of reaction. order and molecularity of simple and complex reactions, Rate laws - Rate constants – derivation of rate constants and characteristics for zero, first order, second and third order (equal initial concentration)

– Derivation of time for half change with examples. Methods of determination of order of Volumetry, manometry and polarimetry.

Effect of temperature on reaction rate – temperature coefficient - concept of activation energy - Arrhenius equation. Theories of reaction rates – Collision theory – derivation of rate constant of bimolecular gaseous reaction – Failure of collision theory. Lindemann's theory of unimolecular reaction. Theory of absolute reaction rates – Derivation of rate constant for a bimolecular reaction – significance of entropy and free energy of activation. Comparison of collision theory and ARRT.

Complex reactions – reversible and parallel reactions (no derivation and only examples)

– kinetics of consecutive reactions – steady state approximation.

UNIT III

Adsorption – Chemical and physical adsorption and their general characteristics- distinction between them Different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations – BET theory, kinetics of enzyme catalysed reaction –Michaelis- Menten and Briggs- Haldene equation – Lineweaver- Burk plot – inhibition – reversible – competitive, noncompetitive and uncompetitive (no derivation of rate equations)

Catalysis – general characteristics of catalytic reactions, auto catalysis, promoters, negative catalysis, poisoning of a catalyst – theories of homogenous and heterogeneous catalysis – Kinetics of Acid – base and enzyme catalysis. Heterogenous catalysis

UNIT IV

Colloids and Surface Chemistry

Colloids: Types of Colloids, Characteristics Colloids (Lyophilic and Lyophobic sols), Preparation of Sols- Dispersion methods, aggregation methods, Properties of Sols- Optical properties, Electrical properties - Electrical double layer, Electro Kinetic properties- Electro-osmosis, Electrophoresis, Coagulation or precipitation, Stability of sols, associated colloids, Emulsions, Gels-preparation of Gels, Applications of colloids

UNIT V

Photochemistry

Laws of photo chemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – rate law – Kinetics of H2-Cl2, H2-Br2 and H2-I2 reactions, comparison between thermal and photochemical reactions.

Fluorescence – applications including fluorimetry – sensitised fluorescence, phosphorescence – applications - chemiluminescence and photosensitisation – examples Chemistry of Vision – 11 cis retinal – vitamin A as a precursor - colour perception of vision

Recommended Text

1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., forty eighth edition, 2021.
2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.
3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co.
4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.
5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986

Reference Books

1. J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics, Pearson, 1st edition, 2013.
2. Keith J. Laidler, Chemical kinetics, third edition, Pearson, 2003.
3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002.
4. K. L. Kapoor, A Textbook of Physical Chemistry, MacmillanIndia Ltd, third edition, 2009

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain Gibbs and Helmholtz free energy functions, partial molar quantities and Ellinghams

CO2: apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation.

CO3: compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogenous and heterogeneous catalysis.

CO4: demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules.
CO5: utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	M	S	S	S	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Elective-VI		Course Code: 23UCHEC06	Course Title: INDUSTRIAL CHEMISTRY	
Semester V	Hours/Week 3	Total Hours 45	Credits 3	Total Marks 100

Course Objective

This course is designed to provide knowledge on

- classifications and characteristics of fuels
- preparation of cosmetics
- manufacture of sugar, paper, cement and leather and food processing
- applications of abrasives, lubricants and other industrial products
- intellectual property rights

UNIT I

Survey of Indian Industries and mineral resources in India

Fuels: Classification, characteristics of fuels. Solid fuels: coal - classification; analysis of coal- proximate analysis and ultimate analysis; calorific value-determination, carbonisation of coal.

Liquid fuels: Petroleum - characteristics; Gasoline aviation petrol- knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number, cetane number.

Gaseous fuel: advantages over solid and liquid fuels; water gas, producer gas, carburetted water gas - preparations - uses.

Natural gas: LPG-composition, advantages, application; gobar gas- production, composition, advantages, application. Propellants – rocket fuels (basic idea)

UNIT II

Cosmetics

Skin care: powders, ingredients; creams and lotion-cleansing, moisturising, all purpose shaving cream, sunscreen; make up preparations.

Dental care: tooth pastes – ingredients.

Hair care: shampoos-types, ingredients; conditioners-types, ingredients. Perfumes: natural-plant origin-parts of the plant used, chief constituents;

animal origin-amber gries, civetone and musk; synthetic-classification- esters-amylsalicylate alcohols-citronellol; terpeneols-gereniol and nerol; ketones-muskone, coumarin; aldehydes-vanilin.

Soaps and Detergents

Soaps-properties, manufacture of soap-batch process; types-transparent soap, toilet soap, powder soap and liquid soap – ingredients.

Detergents-definition, properties-cleansing action; soapless detergents- anionic, cationic and non-ionic (general idea only); uses of detergents as surfactants. Biodegradability of soaps and detergents.

UNIT III

Sugar Industry Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar.

Food Preservation and processing

Food spoilage – causes; Food preservation - methods – high temperature, low temperature, drying, radiation; Food additives – preservatives, flavours, colours, anti-oxidants, sweetening agents; hazards of using food additives; Food standards – Agmark and Codex alimentarius

UNIT IV

Abrasives

Definition, characteristics, types-natural and synthetic; natural abrasives – diamond, corundum, emery, garnet, quartz – composition, uses; synthetic abrasives – carborundum, aluminium carbide, boron carbide, boron nitride, synthetic graphite – composition and uses.

Leather Industry

Structure and composition of skin, hide; Manufacture of leather – pre- tanning process – curing, liming, beating, pickling; methods of tanning- vegetable, chrome – one bath, two bath process; finishing.

Paper Industry

Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paper- beating, refining, filling, sizing, colouring, calendaring; cardboard.

UNIT V

Lubricants Definition, classification-liquid, semi-solid, solid and synthetic; properties-viscosity index, flash point, cloud point, pour point, aniline point and drop point; greases-properties, types; cutting fluids, selection of lubricants.

Cement Industry

Cement – types, raw materials; manufacture-wet process, constituent of cement, setting of cement; properties of cement-quality, setting time, soundness, strength; mortar, concrete, RCC; curing and decay of concrete.

Intellectual Property Rights

Introduction to Intellectual Property Rights – Patents - Factors for patentability - Novelty, Non obviousness, Industrial applications - Patent offices in India: Trademark - Types of trademarks- Certification marks, logos, brand names, signatures, symbols and service marks

Recommended Text

1. Sharma, B.K. Industrial Chemistry, 9th ed.; Goel Publishing House: Meerut, 1998.
2. Wilkinson, J.B.E. Moore, R.J. Harry's Cosmeticology, 7th ed.; Chemical Publishers : New York, 1982.
3. Alex V. Ramani, Food Chemistry, MJP publishers: Chennai, 2009.
4. Jayashree Ghosh, Applied Chemsitry, S. Chand : New Delhi, 2006.
5. Srilakshmi, B. Food Science, 4th ed.; New Age International Publication, 2005.

Reference Books

1. Jain, P.C.; Jain, M. Engineering Chemistry, 16th ed.; Dhanapet Rai: Delhi, 1992
2. George Howard, Principles and Practice of Perfumes and Cosmetics, Stanley Therones, Cheltenham: UK, 1987.
3. Thankamma Jacob, Foods, Drugs and Cosmetics - A Consumer Guide, Macmillan : London, 1997.
4. ShankuntalaManay, N.; Shadaksharaswamy, M. Food Facts and Principles, 3rd ed.; New Age Publication, 2008.
5. Neeraj Pandey, KhushdeepDharni, Intellectual Property Rights, PHI Learning, 2014.

Website and e-learning source

1. http://www.sciencecases.org/irradiation/irradiation_notes.asp
2. http://discovery.kcpc.usyd.edu.au//9.5.5/

3. https://www.wipo.int/about-ip/en/
4. 4.www.nptel.ac.in
5. http:/swayam.gov.in

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: summarize the properties of fuels which include petroleum, water gas, natural gas and propellents

CO2: evaluate cosmetic products, soaps, detergents.

CO3: explain manufacture of sugar, food spoilages and food additives

CO4: explain properties of abrasives, manufacture of leather and paper

CO5: explain properties and manufacture of lubricants and cement, and intellectual property rights

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	M	S	S	S	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Elective-V		**Course Code:** 23UCHEC05	**Course Title:** BIOCHEMISTRY	
Semester V	**Hours/Week** 4	**Total Hours** 60	**Credits** 3	**Total Marks** 100

Objective of the course

- relationship between biochemistry and medicine, composition of blood
- structure and properties of amino acids, peptides, enzyme, vitamins and proteins
- biological functions of proteins, enzymes, vitamins and hormones
- biochemistry of nucleic acids and lipids
- metabolism of lipids

UNIT I

Logic of Living OrganismsRelationship of Biochemistry and Medicine

Blood - Composition of Blood, Blood Coagulation – Mechanism. Hemophilia Sickle and Cell Anaemia Maintenance of pH of Blood – Bicarbonate Buffer, Acidosis, Alkalosis.

UNIT II

Peptides and Proteins

Amino acids – nomenclature, classification – essential and Non-essential; Synthesis - Gabriel Phthalimide, Strecker; properties – zwitterion and isoelectric point, electrophoresis and reactions.

Peptides – peptide bond – nomenclature – synthesis of simple peptides –solution and solid phase. Determination of structure of peptides, N-terminal analysis – Sanger's & Edmann method; C terminal analysis -Enzymic method.

Proteins – classification based on composition, functions and structure;properties and reactions – colloidal nature, coagulation, hydrolysis,oxidation, denaturation, renaturation; colour tests for proteins; structure of proteins – primary, secondary, tertiary and quaternary

Metabolism of Amino acids – general aspects of metabolism (a briefoutline); urea cycle.

UNIT III

Enzymes and VitaminsNomenclature and classification, characteristics, factors influencing enzyme activity – mechanism of enzyme action – Lock and keyhypothesis, Koshland's induced fit model.Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzymeregulation.

Vitamins as coenzymes – functions of TPP, lipoic acid, NAD, NADP,FMN, FAD, pyridoxal phosphate, CoA, folic acid, biotin, cyanocobalamin

UNIT IV

Amino acids

Components of nucleic acids - nitrogenous bases and pentose sugars, structure of nucleosides and nucleotides, DNA- structure & functions

RNA –types– structure - functions; biosynthesis of proteins

HormonesAdrenalin and thyroxine — chemistry, structure and functions (No structure elucidation).

UNIT V

Lipids

Occurrence, biological significance of fats, classification of lipids. Simple lipids – Oils and fats, chemical composition, properties, reactions – hydrolysis, hydrogenation, trans-esterification, saponification, rancidity; analysis of oils and fats – saponification number, iodine number, acid value, R.M. value. Distinction between animal and vegetable fats.
Compound lipids – Lipoproteins - VLDL, LDL, HDL, chylomicrons – biological significance.
Cholesterol – occurrence, structure, test, physiological activity. Metabolism of lipids: β-oxidation of fatty acids.

Recommended Text

1. Bahl, B. S.; Bhal, A. Advanced Organic Chemistry, 3rd ed.; S. Chand:New Delhi, 2003.
2. Jain, M.K.; Sharma, S.C. Modern Organic Chemistry, Vishal Publications: New Delhi, 2017.
3. Shanmugam, A. Fundamentals of Biochemistry for Medical Students, 6th ed.; Published by the author, 1999.
4. Veerakumari, L. Biochemistry, 1st ed.; MJP Publications: Chennai, 2004.
5. Jain, J. L.; Fundamentals of Biochemistry, 2nd ed.; S.Chand: New Delhi, 1983

Reference Books

1. Conn, E. E.; Stumpf, P. K. Outline of Biochemistry, 5th ed.; Wiley Eastern: New Delhi, 2002.
2. West, E. S.; Todd, W. R.; Mason, H. S.; Van Bruggen, J. T. Text Book of Biochemistry, 4th ed.; Macmillan: New York, 1970.
3. Lehninger, A. L. Principles of Biochemistry, 2nd ed.; CBS Publisher: Delhi, 1993.
4. Rastogi, S. C. Biochemistry, 2nd ed.; Tata McGraw-Hill: New Delhi, 2003.
5. Chatterjea, M. N.; Shinde, R. Textbook of Medical Biochemistry, 5th ed.; Jaypee Brothers: New Delhi, 2002.

Website and e-learning source

1) http://library.med.utah.edu/NetBiochem/nucacids.html
2)http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EnzymeKine tics.html
3) https://swayam.gov.in/courses/4384-biochemistry Biochemistry
4) https://onlinecourses.nptel.ac.in/noc19_cy07/preview Experimental Biochemistry

Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to

CO1: explain molecular logic of living organisms, composition of blood and blood coagulation
CO2: explain synthesis and properties of amino acids, determination of structure of peptidesand proteins
CO3: explain factors influencing enzyme activity and vitamins as coenzymes
CO4: explain RNA and DNA structure and functions
CO5: explain biological significance of simple and compound lipids

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage ofCourse Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Core-XII		**Course Code:** 23UCHCC12	**Course Title:** PHYSICAL CHEMISTRY PRACTICAL – II	
Semester V	**Hours/Week** 3	**Total Hours** 45	**Credits** 2	**Total Marks** 100

Course Objective

This course aims at providing
- basic principles of physical chemistry experiments
- hands on experience in carrying out the experiments

UNIT I

Phase diagrams

1. Simple eutectic - determination of eutectic temperature and composition of naphthalene-diphenyl amine or naphthalene-diphenyl system
2. Determination of transition temperature of a salt hydrate.
3. Determination of upper critical solution temperature of phenol – water system
4. Effect of an electrolyte on miscibility temperature of phenol – water system
5. Determination of concentration of sodium chloride using phenol- sodium chloride system

UNIT II

Distribution law

6. Determination of the distribution coefficient of iodine between carbon tetrachloride and water.
7. Determination of equilibrium constant of the reaction
8. Determination of concentration of the given potassium iodide solution using the above equilibrium constant

UNIT III

Electrochemistry

9. Conductometric titration of hydrochloric acid against sodium hydroxide
10. Potentiometric titration of ferrous ion against potassium dichromate using quinhydronde electrode.

Reference Books

1. Sindhu, P.S. *Practicals in Physical Chemistry*, Macmillan India : New Delhi, 2005.
2. Khosla, B. D. Garg,V. C.; Gulati, A. *Senior Practical Physical Chemistry,* R. Chand : New Delhi, 2011.
3. Gupta, Renu, *Practical Physical Chemistry*, 1st Ed.; New Age International : New Delhi, 2017.

Website and e-learning source

https://www.vlab.co.in/broad-area-chemical-sciences

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO1: Describe the principles and methodology for the practical work.
CO2: Explain the procedure, data and methodology for the practical work

CO3: Apply the principles of phase rule and electrochemistry for carrying out the practical work
CO4: Demonstrate laboratory skills for safe handling of the equipment and chemicals

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Core-XIV		Course Code: 23UCHCC14	Course Title: ORGANIC CHEMISTRY – II	
Semester VI	Hours/Week 5	Total Hours 75	Credits 3	Total Marks 100

Course Objective

This course aims at providing knowledge on
- classification, isolation and discussing the properties of alkaloids and terpenes
- preparation and properties of saccharides
- biomolecules
- different molecular rearrangement
- preparation and properties of organometallic compounds

Unit-I

Alkaloids

Classification, isolation, general properties- Hofmann Exhaustive Methylation; Structure elucidation – Coniine, piperine, nicotine.

Terpenes: Classification, Isoprene rule, isolation and structural elucidation of Citral, alpha terpineol, Menthol, Geraniol and Camphor.

UNIT II

Carbohydrates

Definition and Classification of Carbohydrates with examples. Relative configuration of sugars. Determination of configuration (Fischer's Proof). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples.

Monosaccharides– configuration – D and L hexoses – aldohexoses and ketohexoses. Glucose, Fructose – Occurrence, preparation, properties, reactions, structural elucidation, uses.

Interconversions of sugar series – ascending, descending, aldose to ketose and ketose to aldose.

Disaccharides – sucrose, lactose, maltose - preparation, properties and uses (no structural elucidation).

Polysaccharides – Source, constituents and biological importance of homopolysaccharides-starch and cellulose, heteropolysaccharides – hyaluronic acid, heparin.

UNIT III

Molecular rearrangements:Molecular Rearrangement: Type of rearrangements, Mechanism for Benzidine, Favorskii, Clasien, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement

UNIT IV

Special reagents in organic synthesisAIBN, 9BBN, BINAP/BINOL, BOC, DABCO, DCC, DIBAL, DMAP, NBS/NCS, NMP, PCC,TBHP, TEMPOOrganometallic compounds in Organic Synthesis

Preparation, Properties and applications:Grignard Reagents, Organo Lithium Compounds, Ziegler – Natta, Wilkinson, Metal Carbonyl, Zeiss's Salt

UNIT V

Green Chemistry: Principles, chemistry behind each principle and applications in chemical synthesis. Green reaction media – green solvents, green reagents and catalysts; tools used like microwave and ultra-sound in chemical synthesis.

Recommended Text

1. M.K.Jain, S. C.Sharma, Modern Organic Chemistry, Vishal Publishing, 4th reprint,2009.
2. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan IndiaLtd., 3rd edition,2009
3. Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& Company Pvt. Ltd., Multicolour edition,2012.
4. P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, 29th edition, 2007.
5. C Bandyopadhya; An Insight into Green Chemistry; Published on 2020

Reference Books

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia,6th edition, 2012.
2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons,11th edition, 2012.
3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi,7th edition,2009.
4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, 6th edition, 2006.
5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, 5thEdition, 2010.

Website and e-learning source

1.www.epgpathshala.nic.in
2.www.nptel.ac.in
3.http:/swayam.gov.in
4. Virtual Textbook of Organic Chemistry
5. https://vlab.amrita.edu/

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO1: explain isolation and properties of alkaloids and terpenes
CO2: explain preparation and reactions of mono and disachharides
CO3: classify biomolecules and natural products based on their structure, properties, reactions and uses.
CO4: explain molecular rearrangements like benzidine, Hoffmann etc.,
CO5: preparation and properties of organolithium compounds

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	M	S	S	S	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Core-XV		**Course Code:** 23UCHCC15	**Course Title:** INORGANIC CHEMISTRY – II	
Semester VI	**Hours/Week** 4	**Total Hours** 75	**Credits** 3	**Total Marks** 100

Course Objective

The course aims to provide knowledge on
- tracer elements and their role in the biological system.
- iron transport and storage
- metallo enzymes, oxygen transport.
- silicates and their applications
- industrial applications of refractories, alloys, paints and pigments

UNIT I

Bioinorganic Chemistry

Essential and trace elements: Role of Na+, K+, Mg2+, Ca2+, Fe3+, Cu2+ and Zn2+ in biological systems. Effect of excess intake (Toxicity) of Metal ions – trace elements - As, Cd, Pb, Hg

UNIT II

Metal ion transport and storage

Iron – storage, transport - Transferrin and Ferretin; Iron-porphyrins – myoglobin, haemoglobin – oxygen transport - Bohr effect; Sodium/potassium pump, calcium pump; transport and storage - copper and zinc.

UNIT III

Metallo enzymes

Isomerase and synthetases, structure of cyanocobalamin (Vitamin B12), nature of Co-C bond; Metalloenzymes - functions of carboxy peptidase A, zinc metalloenzyme – mechanism and uses, Zn-Cu enzyme - structure and function, carbonic anhydrase, Vitamin B-12 as transferase and isomerase - Iron-sulphur proteins - 2Fe-2S – rubredoxin, 4Fe-2S – ferridoxin, Iron sulphur cluster enzymes. Invivo and Invitro nitrogen fixation – biological functions of nitrogenase and molybdo enzymes.

UNIT IV

Silicates

Introduction – general properties of silicates, structure – types of silicates– ortho silicates(zircon), pyrosilicates (thortveitite), chain silicates(pyroxenes), ring silicates(beryl), sheet silicates(talc, mica, asbestos), silicates having three dimensional structure (feldspars, zeolites, ultramarines)

UNIT V

Industrial Applications of Inorganic Compounds Refractories, pyrochemical, explosives. Alloys, Paints and pigments - requirements of a good paint; classification, constituents of paints – pigments, vehicles, thinners, driers, extenders, anti-knocking agents, anti-skinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels.Nanocomposite Hydrogels: synthesis, characterization and uses.

Industrial visits and internship mandatory.

Recommended Text

1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31th ed., Milestone Publishers & Distributors, Delhi.
2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advancd Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi
3. Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London.
4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, Schand and Company Ltd.
5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992

Reference Books

1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded., S.Chand and Company, New Delhi.
2. Gopalan R, (2009) Inorganic Chemistry for Undergraduates, Ist Edition, University Press (India) Private Limited, Hyderabad
3. Sivasankar B, (2013) Inorganic Chemistry. Ist Edition, Pearson, Chennai
4. Alan G. Sharp (1992), Inorganic Chemistry, 3rd Edition, Addition- Wesley, England
5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.

Website and e-learning source

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO1: ability to explain the importance of tracer elements on biological system.
CO2: explain the metal ion transport, Bohr effect, Na, K, Ca pump.
CO3: explain the function of Vitamin B_{12}, Zn-Cu enzyme, ferredoxin, cluster enzymes.
CO4: classification and structure of silicates.
CO5: explain the manufacture of refractories, explosives, paints and pigments

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	M	S	S	S	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Core-XVI		**Course Code:** 23UCHCC16	**Course Title:** PHYSICAL CHEMISTRY – II	
Semester VI	**Hours/Week** 5	**Total Hours** 75	**Credits** 3	**Total Marks** 100

Course Objective

The course aims at providing an overall view of the
- phase diagram of one and two component systems
- chemical equilibrium,
- separation techniques for binary liquid mixtures.
- electrical conductance and transport number.
- galvanic cells, EMF and significance of electrochemical series.

UNIT-I

Phase rule

Definition of terms; derivation of phase rule ; application to one component systems – water and sulphur - super cooling, sublimation ; two component systems – solid liquid equilibria-simple eutectic (lead - silver and bismuth - cadmium), freezing mixtures (potassium iodide-water), compound formation with- congruent melting points (magnesium – zinc and ferric chloride – water system), peritectic change (sodium – potassium), solid solution (gold-silver); copper sulphate – water system.

UNIT II

Chemical equilibrium

Law of mass action – thermodynamic derivation – relationship between Kpand Kc – application to the homogeneous equilibria – dissociation of PCl5 gas,N2O4 gas –equilibrium constant and degree of dissociation - formation of HI, NH3 ,and SO3 –heterogeneous equilibrium – decomposition of solid calcium carbonate –Lechatelier principle – van't Hoff reaction isotherm – temperature dependence of equilibrium constant – van't Hoff reaction isochore – Clayperon equation – ClausiusClayperon equation and its applications

UNIT III

Binary liquid mixtures Ideal liquid mixtures – non ideal solutions – azeotropic mixtures – fractional distillation – partially miscible mixtures – phenol-water,triethylamine-water, nicotine-water – effect of impurities on critical solution temperature; immiscible liquids-steam distillation; Nernst distribution law – applications.

UNIT IV

Electrical Conductance and Transference

Arrhenius theory of electrolytic dissociation – Ostwald's dilution law, limitations of Arrhenius theory; behavior of strong electrolytes – interionic effects – Debye Huckel theory – Onsager equation (no derivation), significance of Onsager equation, Debye Falkenhagen effect, Wien effect. Ionic mobility – Discharge of ions on electrolysis (Hittorf's theoretical device), transport number –determination – Hittorf's method, moving boundary method – factors affecting transport number – determination of ionic mobility; Kohlrausch's law-applications; molar ionic conductance and viscosity (Walden's rule); applications of

conductance measurements – determination of - degree of dissociation of weak electrolyte, dissociation constant of weak acid and weak base, ionic product of water, solubility and solubility product of sparingly soluble salts - conductometric titrations – acid base titrations.

UNIT V

Galvanic Cells and Applications

Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement – standard cell; relationship between electrical energy and chemical energy; sign of EMF and spontaneity of a reaction, thermodynamics and EMF – calculation of ΔG, ΔH, and ΔS from EMF data; reversible electrodes, electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes – metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series – applications of electrochemical series.Chemical cells with and without transport, concentration cells with and without transport; Applications of EMF measurements-applications of EMF measurements – determination of activity. coefficient of electrolytes, transport number, valency of ions, solubility product, pH using hydrogen gas electrode, quinhydrone electrode and glass electrode, potentiometric titrations – acid base titrations, redox titrations, precipitation titrations, ionic product of water and degree of hydrolysis; redox indicators - use of diphenylamine indicator in the titration of ferrous iron against dichromate. Industrial component Galvanic cells- lead storage, Ni-Cd, Li and Zn-air, Al-air batteries Fuel cells – H2-O2 cell – efficiency of fuel cells. corrosion –mechanism, types and methods of prevention.

Recommended Text

1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, ShobanLalNagin Chand and Co., forty eighth edition, 2021.
2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.
3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co.
4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.
5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.

Reference Books

1. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition,2009.
2. Gilbert. W. Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985.
3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002.
4. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001
5. D.N.Bajpai, Advanced Physical Chemistry, S.Chand&Co., 2001

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO1: construct the phase diagram for one component and two component systems, explain the properties of freezing mixture, component with congruent melting points and solid solutions.

CO2: apply the concepts of chemical equilibrium in dissociation of PCl_5, N_2O_4 and formation of HI, NH_3, SO_3 and decomposition of calcium carbonate. Demonstrate important principles such as Le chatelier principle, van't Hoff reaction isotherm and Clausius-Clayperon equation.
CO3: Identify an appropriate distillation method for the separation of binary liquid mixtures such as azeotropic mixtures, partially miscible mixtures and immiscible liquids.
CO4: Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch's law in conductance.
CO5: Construct electrochemical cell with the help of electrochemical series and calculate cell EMF. Demonstrate the applications of EMF and significance of potentiometric titrations.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Program: B.Sc. Chemistry				
Elective-VII		**Course Code:** 23UCHEC07	**Course Title:** FUNDAMENTALS OF SPECTROSCOPY	
Semester VI	**Hours/Week** 5	**Total Hours** 75	**Credits** 3	**Total Marks** 100

Course Objective

This course is designed to provide knowledge on
- electrical and magnetic properties of organic and inorganic compounds
- basic principles of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry
- instrumentation of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry
- applications of various spectral techniques in structural elucidation
- solving combined spectral problems

UNIT I

Electrical and Magnetic properties of molecules Dipole moment – polar and nonpolar molecules – polarisability of molecules. Application of dipole moments in the study of organic and inorganic molecules.

Magnetic permeability, volume susceptibility, mass susceptibility and molar susceptibility; diamagnetism, paramagnetism – determination of magnetic susceptibility using Guoy balance, ferromagnetism, anti ferromagnetism

Microwave spectroscopy

Rotation spectra - diatomic molecules (rigid rotator approximation) selection rules – determination of bond length, effect of isotopic substitution – instrumentation and applications

UNIT II

Ultraviolet and Visible spectroscopy

Electronic spectra of diatomic molecules (Born Oppenheimer approximation) - vibrational coarse structure – rotational fine structure of electronic vibration transitions – Frank Condon principle – dissociation in electronic transitions – BirgeSponer method of evaluation of dissociation energy – pre-dissociation transition - σ -σ *, π-π*, n-σ*, n-π* transitions. Applications of UV-Woodward – Fieser rules as applied to conjugated dienes and α, β - unsaturated ketones. Elementary Problems. Colorimetry - principle and applications (estimation of Fe3+)

UNIT III

Infrared spectroscopy

Vibration spectra –diatomic molecules – harmonic oscillator andanharmonic oscillator; Vibration – rotation spectra – diatomic molecule as rigid rotator and anharmonic oscillator (Born-Oppenheimer approximation oscillator) - selection rules, vibrations of polyatomic molecules – stretching and bending vibrations – applications – determination of force constant, moment of inertia and internuclear distance – isotopic shift – application of IR spectra to simple organic and inorganic molecules – (group frequencies) Raman Spectroscopy Rayleigh scattering and Raman scattering of light – Raman shift –

classical theory of Raman effect – quantum theory of Raman effect – Vibrational Raman spectrum – selection rules – mutual exclusion principle – instrumentation (block diagram) – applications.

UNIT IV

Nuclear magnetic resonance spectroscopy:PMR – theory of PMR – instrumentation - number of signals – chemical shift – peak areas and proton counting – spin-spin coupling – applications. Problems related to shielding and deshielding of protons, chemical shifts of protons in hydrocarbons, and in simple monofunctional organic compounds; spin-spin splitting of neighbouring protons in vinyl and allyl systems.

UNIT V

Mass spectrometry Principle – different kinds of ionisation – instrumentation – the mass spectrum – types of ions – determination of molecular formula-fragmentation and structural elucidation – McLafferty rearrangement; Retro Diels Alder reaction - illustrations with simple organic molecules. Solving structure elucidation problems using multiple spectroscopic data (NMR, MS, IR and UV-Vis).

Recommended Text

1. Gopalan, R.; Subramaniam, P. S.; Rengarajan, K. Elements of Analytical Chemistry; S Chand: New Delhi, 2003.
2. Usharani, S. Analytical Chemistry, 1sted.; Macmillan: India, 2002.
3. Banwell, C.N.; Mc Cash, E. M. Fundamentals of Molecular Spectroscopy, 4th ed.; Tata McGraw Hill, New Delhi, 2017.
4. U.N.Dash, Analytical Chemistry Theory and Practice, Sultan Chand &Sons,2nd Ed., 2005
5. B.K.Sharma, Spectroscopy,22nd ed., Goel Publishing House, 2011.

Reference Books

1. Srivastava, A. K.; Jain, P. C. Chemical Analysis an Instrumental Approach, 3rded.; S.Chand, New Delhi, 1997.
2. Robert D Braun. Introduction to Instrumental Analysis; Mc.Graw Hill: New York, 1987.
3. Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. Fundamentals of Analytical Chemistry, 9thed.; Harcourt college Publishers: USA, 2013.
4. Madan, R. L.; Tuli, G. D. Physical Chemistry, 2nded.; S.Chand: New Delhi, 2005.
5. Puri, B. R.; Sharma, L. R.; Pathania, M.S. Principles of Physical Chemistry, 43rd ed.; Vishal Publishing: Delhi, 2008.

Website and e-learning source

1. http://vallance.chem.ox.ac.uk/pdfs/SymmetryLectureNotes2004.pdf
2.http://chemistry.rutgers.edu/undergrad/chem207/SymmetryGroupThe ory.html
3. www.epgpathshala.nic.in
4. www.nptel.ac.in
5.. http:/swayam.gov.in

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain electrical and magnetic properties of materials and microwave spectroscopy
CO2: explain theory, instrumentation and applications of Infrared and Raman spectroscopy
CO3: apply selection rules to understand spectral transitions, explain Woodward – Fieser's rule for the calculation of wavelength maximum of conjugated dienes
CO4: explain theory, instrumentation and applications of NMR spectroscopy

CO5: explain theory, instrumentation and applications of Mass spectrometry

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Elective -VIII		Course Code: 23UCHEC08A	Course Title: NANOSCIENCE	
Semester VI	Hours/Week 4	Total Hours 75	Credits 3	Total Marks 100

This course aims at providing knowledge on
- introduction to nanoparticles/clusters and nanocomposites
- properties of nanomaterials
- characterization of nanomaterials by different methods
- synthesis of carbon nanotubes, graphene, quantum dots, self- assembled nanomaterials
- applications of nanomaterials as sensors

UNIT I

Introduction to nanoscience

Definition of terms – nanoscience, nanoparticles, clusters, quantum dots, nanostructures and nanocomposites. Electron behaviour in free space, bulk material and nanomaterials. Synthesis and stabilization of nanomaterialsTop down approach (physical methods), mechanical dispersion – ball milling, methods based on evaporation of a precursor-inert gas condensation, ion sputtering, spray pyrolysis, aerosol synthesis-nanolithography. Bottom–up approach (chemical methods) - solvothermal synthesis, photochemical method, gamma radiolysis, sonochemical synthesis, electro deposition, sol-gel method, nanomaterials via chemical routes- solvents reducing agents, capping agents-stabilization of nanoparticles - electrostatic and steric stabilization, common stabilizers, nanoparticle growth in solution, templated growth, Langmuir – Blodgett (L-B) method, reverse micelles- emulsion method.

Unit II

Properties of materials on a nanoscale Optical properties of metal and semiconductor nanomaterials- surface Plasmon resonance (SPR), surface enhanced Raman spectra (SERS), quantum confinement effect, tuning of optical spectrum. Magnetic properties - Fe_3O_4 particle, supra magnetic properties, electronic properties, Chemical properties- chemical process on the surface of nanoparticles, catalysis, mechanical properties

UNIT III

Techniques employed for characterisation of nanomaterials Spectrocopy – UV-visible, Photoelectron spectroscopy – Electron microscopy – Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning probe microscopy (SPM) –Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Optical microscopy – confocal microscopy, X-ray diffraction (XRD) [Principle and Block diagram only].

UNIT IV

Special nanomaterials

Carbon Nano Structures Carbon nanotubes: Introduction - types - zigzag,armchair, helical, synthesis by CVD, Functionalization of CarbonNanotubes, Reactivity of Carbon Nanotubes, Field emission, Fuel Cells,Display devices .Other Important Carbon based materials: Preparation and
Characterization Fullerene, Graphene, properties, DLC and nanodiamonds and Applications

Semiconductor nanoparticles: Quantum dots, synthesis – chemical synthesis using clusters, properties, porous silicon – electrochemical etching, aerogel – types – silica aerogel, resorcinol formaldehyde (RF) aerogels, zeolites – applications. Self Assembled Nanomaterials: Self Assembled Monolayers (SAMS) – inorganic, organic molecules.

UNIT V

Application of nanomaterials Biomedical Applications- drug, drug delivery, biolabelling, artificial implants, cancer treatment. Sensors – Natural nanoscale sensors, chemical sensors, biosensors, electronic noses. Optics & Electronics – Nanomaterials in the next generation computer technology, high definition TV, flat panel displays, quantum dot laser, single electron transistors [SET]. Nanotechnology in agriculture – Fertilizer and pesticides nanomaterials for water purification, nanomaterials in food and packaging materials, fabric industry.Impacts of Nanotechnology – human & environmental safety risks.

Recommended Text

1. Sulabha K. Kulkarni, *Nanotechnology: Principles and Practices*, Capital Publishing Co., New Delhi.
2. Pradeep. T, *Nano: The Essentials, Understanding Nanoscience and Nanotechnology*; Tata McGraw-Hill Publishing Company Limited, NewDelhi, 2007.
3. Shah. M.A.; Tokeer Ahmad, *Principles of Nanoscince and Nanotechnology*; Narosa Publishing House, New Delhi, 2010.
4. Murthy. B.S; Shankar. P, Baldev Raj.; Rath. B.B. JamesMurday, *Textbook of Nanoscience and Nanotechnology*;Universities press, India Ltd ,Hyderabad. 2012.

Reference Books

1. Sharma. P.K., *Understanding Nanotechnology*; Vista International Publishing House, Delhi. 2008.
2. Charles P. Poole Jr.; Frank J. Owens. *Introduction to Nanotechnology;* A John Wiley & Sons, INC., Publication, 2003.
3. Viswanathan B., *Nano Materials;*Narosa Publishing House, New Delhi, 2009.
4. Edited by C.N.R. Rao; Mu¨ller.A; Cheetham. A.K.*Nanomaterials Chemistry Recent Developments and New Directions*, WILEY-VCH Verlag GMBH & Co.,KGaA, Darmstad.
5. Jing Zhong Zhang, *Optical properties and spectroscopy of Nanomaterials*; World Scientific Publishing Pvt. Ltd., Singapore

Website and e-learning source

1) http://www.nanotechnology.com/docs/wtd015798.pdf
2) http://nccr.iitm.ac.in/Nanomaterials.pdf

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO1: explain the general concepts and physical phenomena of relevance within the field of nanoscience.
CO2: describe the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications.
CO3: examine the structure, properties, applicability and characterization of nanomaterials.
CO4:analyze various synthesis procedures, characterizations and uses of carbon nanotubes, fullerene and graphene
CO5: discuss applications of nanomaterials of sensors and in optics and electronics

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Elective -VIII		**Course Code:** 23UCHEC08B	**Course Title:** POLYMER SCIENCE	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
VI	4	75	3	100

The course aims at providing an overall view of
- classification of polymers, preparation of polymers
- kinetics of polymerization and characterization of polymers
- analytical techniques used to characterize polymers
- reactions of polymers
- speciality polymers like PVC, PMMA

UNIT I

Introduction

Difference between polymer and macromolecule – classification –synthetic and natural, organic and inorganic, thermoplastic and thermosetting. Plastics, elastomers, fibres and liquid resins.

Techniques of polymerization

Bulk, solution, emulsion and suspension polymerization

Unit – II

Kinetics of polymerization

Kinetics of condensation and addition polymerisation; ionic, free radical, copolymerisation and coordination polymerisation – reactivity ratios – block and graft copolymers. Characterisation of polymers Appearance, feel and hardness, density, effect of heat, solubility, combustion, tensile strength, shear, stress, impact strength, mechanical, thermomechanical and rheological properties of polymers in viscoelastic state.

UNIT III

Molecular Weight and Properties of Polymers

Molecular Weight of Polymers-Number Average and Weight Average, Molecular Weight Distribution, Determination of Molecular Weight polydispersity index – membrane and vapour phase osmometry, light scattering - Zimm plot, ultracentrifuge – sedimentation velocity and sedimentation equilibrium – viscometry – gel permeation chromatography Thermal properties of polymers – Glass Transition Temperature-State of Aggregation and State of Phase Transitions, Factors Influencing Glass Transition Temperature, Importance of Glass Transition Temperature, Heat Distortion Temperature, TGA / DTA,Crystallinity of Polymers: Crystalline Behaviour, Degree of Crystallinity

UNIT IV

Reactions of Polymers-Hydrolysis, Acidolysis, Aminolysis, Addition and Substitution Reactions (One Example Each) Cyclisation, Cross-Linking and Reactions of Specific Functional Groups in the Polymer Polymer technology

Processing of polymers – casting, thermoforming, moulding –extrusion, compression, blow moulding – foaming, lamination, reinforcing – processing of fibres – melt, wet and dry spinning

UNIT V

Speciality polymers

Polyelectrolytes, conducting polymers, polymeric supports for solid phase synthesis, biomedical polymers, liquid crystalline polymers, electroluminescent polymers – two examples of each of these polymers. Polyethylene, PVC, PMMA, polyester; rubber – synthetic and natural, vulcanisation of rubber.

Polymer Degradation

Types of Degradation - Thermal, Mechanical, Ultra Sound, Photo Radiation and Chemical Degradation Methods.

Rubber-Natural and Synthetic-Structure, Mechanism of Vulcanisation Biodegradable and Non-Biodegradable Polymers

Recommended Text

1. Gowariker V.R, N.V. Viswanthan and Jayadev Sreedhar. Polymer Science.
2. New Delhi: New Age International, 2015
3. Misra G.S. Introductory Polymer Chemistry. New Delhi: Wiley Eastern, 2010.
4. Bahadur P and Sastry N V. Principles of Polymer Science. New Delhi: Narosa Publishing House, 2005
5. Ahluwalia, V.K. Anuradha Mishra, Polymer Science A Text Book, Ane Books India: New Delhi, 2008.
6. Morrison, R. R.; Boyd, R. N.; Bhattacharjee, S. K. Organic Chemistry, 7th ed.; Pearson: New Delhi, 2011.

Reference Books

1. Billmeyer, F.W. Polymer Science. India: Wiley-Interscience, 2007.
2. Seymour, R. B.; CarraherJr.C.E. Polymer Chemistry: An Introduction, Marcel Dckker Inc : New York, 1981.
3. Sinha, R. Outlines of Polymer Technology, Prentice Hall of India: New Delhi, 2000.
4. Joel R. Fried, Polymer Science and Technology, 3rd ed.; Prentice Hall of India: New Delhi, 2014.

Website and e-learning source

1. https://polymerdatabase.com
2. http://amrita.vlab.co.in/?sub=2&brch=190&sim=603&cnt=1
3.http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/polymers. htm
4.http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+weigh ts+of+polymers.pdf

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO1: explain classification of polymers, elastomers, fibres and liquid resins
CO2: explain addition and condensation polymerization, mechanical properties of polymers
CO3: determine the molecular weight of polymers, and explain the thermal properties of polymers
CO4:explain reactions of polymers and polymer processing
CO5:discuss speciality polymers like PVC, PMMA, rubbers, biodegradable polymers

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Elective-VIII		**Course Code:** 23UCHEC08C	**Course Title:** PHARMACEUTICAL CHEMISTRY	
Semester VI	**Hours/Week** 4	**Total Hours** 75	**Credits** 3	**Total Marks** 100

The course aims at providing an overall view of
- drugs design and drug metabolism
- important Indian medicinal plants, common diseases and antibiotics
- analgesics and antipyretic agents
- significance of clinical tests

UNIT I
Introduction
Important terminologies – drug, pharmacognosy, pharmacy, pharmacology, pharmacodynamics, pharmacokinetics, clinical pharmacology, pharmacotherapeutics, chemotherapy, toxicology, pharmacophore, antimetabolites, mutation, bacteria, virus, fungi, actinomycetes, vaccines, pharmacopeia, posology and therapeutic index.
Sources of drugs – dosage forms – bio availability – routes of administration – absorption, distribution and elimination of drugs – drug metabolism – prescription terms.
Structure and pharmacological activity
Effect of – unsaturation, chain length, isomerism; groups - halogens amino, nitro, nitrite, cyano, acidic, aldehydic, keto, hydroxyl and alkyl groups.
Development of Drugs
Development of a drug – classic steps- lead compounds- comparison of traditional and modern methods of development of drugs – drug design by method of variation – disjunction and conjunction methods.

Unit II
Indian medicinal plants
Some important Indian medicinal plants – tulsi, neem, kizhanelli, mango, semparuthi, adadodai, turmeric and thoothuvalai – uses.
Common diseases and their treatment
Causes, prevention and treatment of the following diseases:
Insect borne diseases– malaria, filariasis, plague;Air borne diseases– diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis; Water borne diseases – cholera, typhoid , dysentery.
Digestive system – jaundice; Respiratory system – asthma; Nervous system – epilepsy.
Antibiotics
Definition – classification – structure and therapeutic uses of chloramphenicol, penicillins , structure activity relationship of chloramphenicol ; therapeutic uses of ampicillin, streptomycin,erythromycin, tetracycline, rifamycin

UNIT III
Drugs for major diseases

Cancer – common causes – chemotherapy – anti neoplastic agents - classification –adverse effects of cytotoxic agents ; alkylating agents – chlorambucil ; anti metabolites – methotrexate, fluouracil ;Vinca alkaloids – vincristine, vinblastine.Diabetes– types management of diabetes – insulin ; oral hypoglycemic agents - sulphonyl ureas – chlorpropamide ; biguanides - metformin – thiazolidinediones .Cardiovascular drugs– cardio glycosides ; anti arrhythmic agents – quinidine, propranolol hydrochloride ; anti-hypertensive drugs - Aldomet, pentoliniumtartarate; vasodilator- tolazoline hydrochloride, sodium nitroprusside.AIDS – causes, symptoms and prevention – anti HIV drugs - AZT, DDC.

UNIT IV

Analgesics and antipyretic agents

Classification – action of analgesics – narcotic analgesics –morphine; synthetic analgesics – pethidine, methadone; antipyretic analgesics – salicylic acid derivatives, indolyl derivatives, p-aminophenol derivatives.

Anaesthetics

Definition, characteristics, classification - general anaesthetics – volatile anaesthetics – nitrous oxide, ethers, cyclopropane, chloroform, halothane, trichloro ethylene– storage, advantages and disadvantages ; non volatileanaesthetics – thiopental sodium ; local anaesthetics – requisites – advantages- esters – cocaine, benzocaine ; amides – lignocaine, cinchocaine.

Blood and haemotological agents

Blood– composition, grouping – physiological functions of plasma proteins – mechanism of clotting; Coagulants – vitamin K, protamine sulphate, dry thrombin; Anti coagulants – coumarins, citric acid and heparin; antifibrinolytic agents – aminocaproic acid and tranexamic acid.

Anaemia– causes, types and control – anti anaemic drugs.

UNIT V

Clinical Chemistry

Blood tests – blood count – complete haemotogram – Hb, RBC, GTT,
TC, DC, platelets, PCV, ESR; bleeding and clotting time – glucose tolerance test.

Significance of Clinical Tests

Serum electrolytes - blood Glucose - orthotoluidine method; Renal
functions tests - blood urea, creatinine; liver function tests - serum proteins, albumin globulin ratio, serum bilirubin, enzymes SGOT, SGPT; lipid profile – cholesterol, triglycerides, HDL, LDL, coronary risk index. Urine examination – pH, tests for glucose, albumin and bile pigment.

Recommended Text

1. Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry, 2nd ed., S.Chand& company, New Delhi.
2. Lakshmi S, (2004), Pharmaceutical chemistry, 3rd ed., Sultan chand& sons, Delhi.
3. Tripathi K D, (2018), Essentials of medical pharmacology, 8th ed., Jaypee brothers medical publishers (P) Limited, New Delhi.
4. Ashutosh Kar, (2018), Medicinal chemistry, 7th ed., New age international (P) Limited, Publishers, New Delhi.

Reference Books

1. Chatwal G R, (2013), Pharmaceutical chemistry, inorganic (vol-I) 6thed ., Himalaya publishing house, Bombay.
2. Chatwal G R, (1991), Pharmaceutical chemistry, organic (vol-II)., Himalaya publishing house, Bombay.
3. Patrick G, (2002), Instant Notes Medicinal Chemistry, Viva Books Private Limited, New Delhi.
4. Intellectual Property Rights, NeerajPandey, Khushdeep Dharni. Publisher: PHI Learning Pvt. Ltd., 2014 ISBN: 812034989X, 9788120349896

Website and e-learning source

1. http://www.pharmacy.umaryland.edu/faculty/amackere/courses/phar531_delete/lectures/qsar_1.pdf
2. http://www.indianmedicinalplants.info/
3. https://www.wipo.int/about-ip/en/

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO1: Define the pharmaceutical terminologies; describe the principles in pharmacological activity, drug development, clinical chemistry, hematology, therapeutic drugs and treatment of diseases; list the types of IPR and trademarks.

CO2: Discuss the development of drugs, structural activity, disease types, physio-chemical properties of therapeutic agents, significance of medicinal plants,clinical tests and factors for patentability.

CO3: Apply the principles involved in structural activity and drug designing, functions ofhaematological agents; estimation of clinical parameters and therapeutic application of drugs for major diseases.

CO4: explain classification of analgesics and anasthetics, and physiological functions of plasma protiens

CO5: explain the significance of clinical tests like blood urea, serum proteins and coronary risk index

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3

CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Category: **Generic Elective I** (For Mathematics & Physics)		**Course Code:** 23UCH3A01	**Course Title :** Allied Chemistry – I (Inorganic, Organic and Physical Chemistry-I)	
Semester III	**Hours/Week** 5	**Total Hours** 75	**Credits** 3	**Total Marks** 100

Course Objectives

This course aims to provide knowledge on the

- basics of atomic orbitals, chemical bonds, hybridization
- concepts of thermodynamics and its applications.
- concepts of nuclear chemistry
- importance of chemical industries
- Qualitative and analytical methods

UNIT-I Chemical Bonding and Nuclear Chemistry

Chemical Bonding**:** Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.

Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy -

mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes – carbon dating, rock dating and medicinal applications.

UNIT-II Industrial Chemistry

Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones.

Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK

fertilizer, superphosphate, triple superphosphate

UNIT-III Fundamental Concepts in Organic Chemistry

Hybridization: Orbital overlap, hybridization and geometry of CH4, C2H4, C2H2 and C6H6. Electronic effects: Inductive effect and consequences on Ka and Kb of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric- examples.

Reaction mechanisms: Types of reactions–aromaticity (Huckel's rule)– aromatic electrophilic substitution; nitration, halogenation, Friedel- Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

UNIT-IV Thermodynamics and Phase Equilibria

Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics.Carnot's cycle and efficiency of heat engine. Entropy and **its** significance. Free energy change and its importance (no derivation).Conditions for spontaneity in terms of entropy and Gibbs free energy.Relationship between Gibbs free energy and entropy.

Phase Equilibria: Phase rule - definition of terms in it. Applications of phase rule to water system. Two component system - Reduced phaserule and its application to a simple eutectic system (Pb-Ag).

UNIT-V Analytical Chemistry

Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques – extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography

Text Books:

1. V.Veeraiyan, Text book of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.
2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.
3. S.ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, NewDelhi, twenty third edition, 2012.
4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninthedition, 2007..

Reference Books

5. P.L.Soni,MohanKatyal,TextbookofInorganicchemistry;SultanChan dandCompany,New Delhi, twentieth edition, 2007.
6. B.R.Puri,L.R.Sharma,M.S.Pathania,TextbookPhysicalChemistry;V ishalPublishingCo., New Delhi, fortyfortyseventh edition, 2018.
7. B.K,Sharma,IndustrialChemistry;GOELpublishinghouse,Meerut,sixteenth edition, 2014.

Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to

CO 1: gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.
CO 2: evaluate the efficiencies and uses of various fuels and fertilizers
CO 3: explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
CO 4: apply various thermodynamic principles, systems and phase rule.
CO 5: explain various methods to identify an appropriate method for the separation of chemical components

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Generic Elective–II (For Mathematics & Physics)		**Course Code:** 23UCH4A02	**Course Title :** Allied Chemistry – II (Inorganic, Organic and Physical Chemistry-II)	
Semester IV	**Hours/Week** 5	**Total Hours** 75	**Credits** 3	**Total Marks** 100

Course Objectives

This course aims at providing knowledge on the
- Co-ordination Chemistry and Water Technology
- Carbohydrates and Amino acids
- basics and applications of electrochemistry
- basics and applications of kinetics and catalysis
- Various photochemical phenomenon

UNIT-I Co-ordination chemistry (15 Hours)

Co-ordination Chemistry and Water Technology

Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature - Werner'stheory - EAN rule - Pauling's theory – Postulates - Applications to [Ni(CO)4], [Ni(CN)4]2-,[Co(CN)6]3- Chelation - Biological role of Haemoglobin and Chlorophyll (elementary idea) – Applications in qualitative and quantitative analysis.

Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques-

BOD, COD.

UNIT-II Carbohydrates and Amino acids

Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose –fructose interconversion. Properties of starch and cellulose.

Amino acids: Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).

UNIT-III Electrochemistry

Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells -fuel cells-corrosion and its prevention**.**

UNIT-IV Kinetics and Catalysis

Pseudo first order reaction, methods of determining order of a reaction – Half-life period – Catalysis - homogeneous and heterogeneous, catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.

UNIT-V Photochemistry

Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).

Text Books:

1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.
2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.

3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.
4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference Books

1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
2. R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO 1: write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology
CO 2: explain the preparation and property of carbohydrate, amino acids and nucleic acids.
CO 3: apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.
CO 4: identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst.
CO 5: outline the various type of photochemical process.

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Category: **Generic Elective III** (For Zoology)		**Course Code:** 23UCH1A01	**Course Title :** Allied Chemistry – I (Inorganic, Organic and Physical Chemistry-I)	
Semester I	**Hours/Week** 5	**Total Hours** 75	**Credits** 3	**Total Marks** 100

Course Objectives

This course aims at providing knowledge on

- basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry
- nuclear chemistry and industrial chemistry
- importance of speciality drugs and
- separation and purification techniques.

UNIT-I Chemical Bonding and Nuclear Chemistry

Chemical Bonding**:** Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.

Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes – carbon dating, rock dating and medicinal applications.

UNIT-II Industrial Chemistry

Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones.

Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate

UNIT-III Fundamental Concepts in Organic Chemistry

Hybridization: Orbital overlap, hybridization and geometry of CH4, C2H4, C2H2 and C6H6. Electronic effects: Inductive effect and consequences on Ka and Kb of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric- examples.

Reaction mechanisms: Types of reactions–aromaticity (Huckel's rule)– aromatic electrophilic substitution; nitration, halogenation, Friedel- Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

UNIT-IV Drugs and Speciality Chemicals

Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon**..**

UNIT-V Analytical Chemistry

Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques – extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography

Text Books:

1. V.Veeraiyan, Text book of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.
2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.
3. S.ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, NewDelhi, twenty third edition, 2012.
4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninthedition, 2007..

Reference Books

5. P.L.Soni,MohanKatyal,TextbookofInorganicchemistry;SultanChan dandCompany,New Delhi, twentieth edition, 2007.
6. B.R.Puri,L.R.Sharma,M.S.Pathania,TextbookPhysicalChemistry;V ishalPublishingCo., New Delhi, fortyfortyseventh edition, 2018.
7. B.K,Sharma,IndustrialChemistry;GOELpublishinghouse,Meerut,sixteenth edition, 2014.

Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to

CO 1: gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.
CO 2: evaluate the efficiencies and uses of various fuels and fertilizers
CO 3: explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
CO 4: apply various thermodynamic principles, systems and phase rule.
CO 5: explain various methods to identify an appropriate method for the separation of chemical components

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Generic Elective–IV (For Zoology)		**Course Code:** 23UCH2A02	**Course Title :** Allied Chemistry – II (Inorganic, Organic and Physical Chemistry-II)	
Semester II	**Hours/Week** 5	**Total Hours** 75	**Credits** 3	**Total Marks** 100

Course Objectives

This course aims at providing knowledge on the

- Co-ordination Chemistry and Water Technology
- Carbohydrates and Amino acids
- basics and applications of electrochemistry
- basics and applications of kinetics and catalysis
- Various photochemical phenomenon

UNIT-I Co-ordination chemistry (15 Hours)

Co-ordination Chemistry and Water Technology

Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature - Werner'stheory - EAN rule - Pauling's theory – Postulates - Applications to [Ni(CO)4], [Ni(CN)4]2-,[Co(CN)6]3- Chelation - Biological role of Haemoglobin and Chlorophyll (elementary idea) – Applications in qualitative and quantitative analysis.

Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques-

BOD, COD.

UNIT-II Carbohydrates and Amino acids

Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose –fructose interconversion. Properties of starch and cellulose.

Amino acids: Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).

UNIT-III

Amino Acids and Essential elements of biosystem

Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins- classification – structure - Colour reactions – Biological functions – nucleosides - nucleotides – RNA and DNA – structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.

UNIT-IV Electrochemistry

Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells -fuel cells-corrosion and its prevention**.**

UNIT-V Photochemistry

Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).

Text Books:

1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.
2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.
3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.
4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference Books

1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
2. R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO 1: write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology
CO 2: explain the preparation and property of carbohydrate, amino acids and nucleic acids.
CO 3: apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.
CO 4: identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst.
CO 5: outline the various type of photochemical process.

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Generic Elective–V (For First Year B.Sc Zoology,Second Year B.Sc. Botany, Mathematics & Physics)		**Course Code:** 23UCH1AP01 / 23UCH3AP01	**Course Title:** Allied Chemistry Practical - I	
Semester I & III	**Hours/Week** 3	**Total Hours** 90	**Credits** 3	**Total Marks** 100

Course Objectives

This course aims to provide knowledge on the

- basics of preparation of solutions.
- principles and practical experience of volumetric analysis

VOLUMETRIC ANALYSIS

1. Estimation of sodium hydroxide using standard sodium carbonate.
2. Estimation of hydrochloric acid using standard oxalic acid.
3. Estimation of ferrous sulphate using standard Mohr's salt.
4. Estimation of oxalic acid using standard ferrous sulphate.
5. Estimation of potassium permanganate using standard sodium hydroxide.
6. Estimation of magnesium using EDTA.
7. Estimation of ferrous ion using diphenyl amine as indicator

Reference Books

V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles ofPractical Chemistry; Sultan Chand & sons, Second edition, 1997.

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette.
CO 2: design, carry out, record and interpret the results of volumetric titration.
CO 3: apply their skill in the analysis of water/hardness.
CO4: analyze the chemical constituents in allied chemical products

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Program: B.Sc. Chemistry				
Generic Elective–VI (For First Year B.Sc Zoology, Second Year B.Sc. Botany, Mathematics & Physics)		**Course Code:** 23UCH2AP01 / 23UCH4AP01	**Course Title:** Allied Chemistry Practical - II	
Semester II & IV	**Hours/Week** 3	**Total Hours** 90	**Credits** 3	**Total Marks** 100

Course Objectives

This course aims to provide knowledge on
- identification of organic functional groups
- different types of organic compounds with respect to their properties.
- determination of elements in organic compounds

SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS

The analysis must be carried out as follows:
(a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].
(b) Detection of elements (N, S, Halogens).
(c) To distinguish between aliphatic and aromatic compounds.
(d) To distinguish – Saturated and unsaturated compounds

Reference Books

V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles ofPractical Chemistry; Sultan Chand & sons, Second edition, 1997.

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette.
CO 2: design, carry out, record and interpret the results of volumetric titration.
CO 3: apply their skill in the analysis of water/hardness.
CO4: analyze the chemical constituents in allied chemical products

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0