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 2024-2025 Onwards)

Contents

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 2024-2024, i.e., for students who are to be admitted to the first year of the course during the academic year 2024-2024 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: 3 x 5 = 15 (Answer any two questions)

(One question from each unit with internal choice)

Part C: 5 x 9= 45 (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 2024-2025 Onwards)

Sl. No	Nature of the Course	Course Code	Name of the Course	Hours / Week	Credits	Marks		
						CIA	ESE	Total
SEMESTER I								
1	Language	24UTA1F01	Tamil - I	5	3	25	75	100
2	Language	24UEN1F01	English – I	6	3	25	75	100
3	Core-I	24UCH1C01	General Chemistry -I	5	5	25	75	100
4	Core practical-I	24UCH1P01	Quantitative Inorganic Estimations (Titrimetry) and Inorganic Preparations	3	3	40	60	100
5	Foundation Course	24UCH1FC01	Foundation Course in Chemistry	2	2	25	75	100
6	Allied I	24UMA1A01	Allied Mathematics-I	4	4	25	75	100
		24UZO1A01	Allied Zoology-I					
7	Allied Practical-I	24UMA2AP01	Allied Mathematics Practical -I	3	-	-	-	-
		24UZO2AP01	Allied Zoology Practical -I					
8	NMEC-I	24UCH1N01	Skill Enhancement Course: (Non-Major Elective-I)	2	2	25	75	100
Total				**30**	**22**	**190**	**510**	**700**
SEMESTER II								
9	Language-II	24UTA2F02	Tamil - II	5	3	25	75	100
10	Language-II	24UEN2F02	English – II	6	3	25	75	100
11	Core-II	24UCH2C02	General Chemistry II	5	5	25	75	100
12	Core practical-II	24UCH2P02	Qualitative Organic Analysis and Preparation of Organic Compounds	3	3	40	60	100
13	NMEC-II	24UCH2N02	Skill Enhancement Course (Non-Major Elective-I)	2	2	25	75	100
14	SEC-1	24UCH2S01	Skill Enhancement Course : Cosmetics and Personal Care Products	2	2	25	75	100
15	Allied II	24UMA2A02	Allied Mathematics-II	4	4	25	75	100
		24UZO2A02	Allied Zoology-II					
16	Allied Practical-I	24UMA2AP01	Allied Mathematics Practical -I	3	2	40	60	100
		24UZO2AP01	Allied Zoology Practical -I					
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	24UTA3F03	Tamil - III	6	3	25	75	100
18	Language-III	24UEN3F03	English – III	6	3	25	75	100
19	Core-III	24UCH3C03	General Chemistry III	5	5	25	75	100
20	Core practical-III	24UCH3P03	Qualitative Inorganic Analysis	3	3	40	60	100
21	Allied	24UPH3A01	Allied Physics-I	4	3	25	75	100
22	Allied Practical-I	24UPH3AP01	Allied Physics Practical-I	2	2	40	60	100
23	SEC-2	24UCH3S02	Skill Enhancement Course Entrepreneurial skills in Chemistry	1	1	100	-	100
24	SEC-3	24UCH3S03	Skill Enhancement Course : Dye Chemistry	2	2	25	75	100
25	EVS	24UES401	EVS	1	-	-	-	-
Total				**30**	**22**	**305**	**495**	**800**
SEMESTER IV								
26	Language-IV	24UTA4F04	Tamil - IV	6	3	25	75	100
27	Language-IV	24UEN4F04	English – IV	6	3	25	75	100
28	Core-IV	24UCH4C04	General Chemistry- IV	4	5	25	75	100
29	Core practical-IV	24UCH4P04	Physical Chemistry Practical- I	3	3	40	60	100
30	Allied -II	24UPH4A02	Allied Physics-II	4	3	25	75	100
31	Allied Practical-II	24UPH4AP02	Allied Physics Practical-II	2	2	40	60	100
32	SEC-4	24UCH4S04	Skill Enhancement Course: Instrumental methods of Chemical Analysis	2	2	25	75	100
33	SEC-5	24UCH4S05	Skill Enhancement Course: Forensic Science	2	2	25	75	100
34	EVS	24UES401	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-V	24UCH5C05	Organic Chemistry -I	5	4	25	75	100
36	Core-VI	24UCH5C06	Inorganic Chemistry - I	4	4	25	75	100
37	Core-VII	24UCH5C07	Physical Chemistry -I	5	4	25	75	100

38	Elective-I	24UCH5E01	Biochemistry	4	3	25	75	100
39	Elective-II	24UCH5E02	Industrial Chemistry	4	3	25	75	100
40	Core Practical-V	24UCH5P05	Physical Chemistry Practical-II	3	2	40	60	100
41	Project	24UCH5PR1	Project with viva-voce	3	2	40	60	100
42	Value Education	24UVE501	Value Education	2	2	25	75	100
43	Internship	24UCH5IN01	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-VIII	24UCH6C08	Organic Chemistry -II	5	3	25	75	100
45	Core-IX	24UCH6C09	Inorganic Chemistry - II	4	3	25	75	100
46	Core-X	24UCH6C10	Physical Chemistry –II	5	3	25	75	100
47	Elective-III	24UCH6E03	Fundamentals of Spectroscopy	5	3	25	75	100
48	Elective-IV	24UCH6E04	Nano science	4	3	25	75	100
		24UCH6E05	Polymer science					
		24UCH6E06	Pharmaceutical Chemistry					
49	Extension Activity	24UEX01	Extension Activity	-	1	-	-	-
50	Core practical-VI	24UCH6P06	Gravimetric Estimation Practical	5	3	40	60	100
51	Competency	24UCH6PC01	Professional Competency Skill	2	2	25	75	100
Total				**30**	**21**	**190**	**510**	**700**
CUMULATIVE TOTAL				**180**	**140**	**1400**	**3300**	**4700**

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	24
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:** 24UCH1C01		**Course Title:** General Chemistry – I	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	5	75	5	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); and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom;The 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;

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 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.

UNIT-III: Structure and bonding - I

Ionic bond-Lewis dot structure of ionic compounds; properties of 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 Covalent bond-Shapes of orbitals, overlap of orbitals – σ and Π bonds; hybridization; VSEPR theory - shapes of molecules of the type AB2, AB3. Partial ionic character of covalent bond-dipole moment, application to molecules of the type A2, AB.

UNIT-IV: Structure and bonding - II

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

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

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 andnitrobenzene, bond lengths;

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				
Foundation course	**Course Code:** 24UCH2FC01		**Course Title: Foundation Course in Chemistry**	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	2	30	2	100

Course Objectives

1. Understand the lab safety measures
2. Outline the basic concepts of organic chemistry
3. Describe the importance of periodic table
4. Explain the fundamentals of physical properties
5. Understand the importance of redox chemistry

Unit-I : Chemistry Lab-General Awareness and First Aid Techniques

Safety in chemistry lab- introduction to laboratory glass wares-storage and handling of chemicals-carcinogenic chemicals - handling of ethers - toxic and poisonous chemicals.

Burns and damages due to organic substances- acids, alkalies - burns in the eye-inhalation of toxic vapours-hazardous chemicals-dealing with bromine, phenol and hot objects.

Unit-II: Introduction to Organic Chemistry

Catenation-Classification - Homologous Series - General Molecular Formula- Functional Groups - General and IUPAC Nomenclature - Modern concept of bonding in organic molecules, sp^3, sp^2 and sp hybridization in carbon by taking methane, ethane and benzene as examples.

Unit-III : Introduction to Inorganic Chemistry

Atomic orbitals and concept of atomic orbitals - shape of s,p and d orbitals- periodic table and the classification of elements - Electronic configuration of elements up to atomic number 30, Types of Chemical bonds - Schematic Illustration of bonds

Unit-IV: Introduction to Physical Chemistry

Units - Fundamental units - derived units and SI Units - Significant Figures- States of matter - types - properties of solids, liquids and gases - solid state - types of solids - amorphous and crystalline solids - properties of liquids and gases.

Unit-V: Basic concepts of Redox Chemistry

Definition - oxidation and reduction reactions-calculation of oxidation numbers-Equivalent weight-definition-calculation of equivalent weight of acids, bases and salts. Reduction potential and electrochemical series.

Text Books

1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, 33rd Edition, Milestone Publishers and Distributors, New Delhi, India (2020)
2. Arub Bahl, B.S. Bahl, A Text Book of Organic Chemistry, 22nd Edition, S. Chand & Co (2019).
3. B.R. Puri, L.R. Sharma & M.S. Pathania, Principles of Physical Chemistry, 48th Edition, Vishal Publishing Co (2020).

Course outcomes

Skills acquired from this course

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

Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC and others to be solved

	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 Practical – I	**Course Code:** 24UCH1P01		**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 (internal indicator)

Iodometry

Estimation of copper in copper sulphate using standard dichromate

Preparation of Inorganic compounds-

Potash alum

Tetraammine copper (II) sulphate

Hexamminecobalt (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/

SCHEME OF VALUATION

Quantitative Inorganic Estimation (titrimetry) and Inorganic Preparations
Internal assessment: 40 Marks
External assessment: 60 marks
Total: 100 marks
Max. Marks: 60
Record: 10 Marks
Volumetric Analysis: 30 Marks
Preparation: 20 Marks (Quantity- 10 Marks; Quality- 10 marks)
Volumetric Analysis : 40 Marks (Maximum)
Error upto 2 % : 30 Marks
2 to 3 % : 25 Marks
3 to 4 % : 20 Marks
4 to 5 % : 15 Marks
> 5 % : 10 Marks
Arithmetic error : Deduct 1 mark
Wrong calculation : Deduct 20 % of marks scored
No calculation : Deduct 40 % of marks scored

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

Program: B.Sc. Chemistry				
Core –II	**Course Code:** 24UCH2C02		**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;, 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

Alkali metals: Comparative study of the elements with respect to hydroxides, halides. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, Na2CO3, KBr,.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.

UNIT-III

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

General characteristics of elements of Group 15; chemistry of H2N-NH2, NH2OH, Chemistry of PH3, PCl3, oxy acids of phosphorous (H3PO3 and H3PO4).
General properties of elements of group16 - Structure and allotropy of elements - chemistry of ozone.
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, Inter-halogen compounds (ICl, ClF_3), 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, **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 - Hofmann and Saytzeff rules. – Markownikoff's rule, Kharasch effect

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.

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

UNIT-V

Hydrocarbon Chemistry - II

Benzene: Source, structure of benzene, stability of benzene ring, 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. Polynuclear Aromatic hydrocarbons: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, Anthracene – Haworth synthesis; physical properties; reactions - Diels-Alder reaction,

Text Books:

1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed, 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,8th ed., 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 I		Course Code: 24UCH2S01	Course Title : Cosmetics and Personal Care Products	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	2	30	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:** 24UCH2P02		**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. Methyl benzoate to Benzoic acid
v. Salicylic acid from Methyl Salicylate
vi. Rearrangement - Benzil to Benzilic Acid

SCHEME OF VALUATION

QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS

Internal assessment: 40 Marks
External assessment: 60 marks
Total: 100 marks
Max. Marks: 60
Record: 10 Marks
Preparation: 20 (quantity: 10 & quality: 10)
Organic Analysis: 30 Marks

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: 24UCH3C03	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 gasequation; TheMaxwell –Boltzmann distribution of speed of molecules-average,root mean square and most probable velocity and average kinetic energy. Collision frequency; collision diameter; mean free path andviscosityofgases.

Real gases:Deviations from ideal gas behaviour,(Andrew'sandAmagat'splots); Boyletemperature

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; symmetry elements – plane, centre and axis; Miller indices, unit ; cla systems; Bravais lattices; X – ray diffraction – Bragg's equation

Packing in atomic solids – simple cubic, body centered cubic, face centered and hexagonal clo packing; Co-ordination number in typical structures - NaCl, ZnS, comparison of structure an properties of diamond and graphite;..

Liquid crystals – classification and applications

UNIT-III

Nuclear Chemistry

Natural radioactivity – α, β and γ rays; half-life period; Geiger–Nattal rule; isotopes, isobars, isotones, radioactive decay series; binding energy; mass defect. Simple calculations involving mass defect and B.E.

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 hazard 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 &: 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;

UNIT-V

Phenols

Nomenclature; classification, Preparation from diazonium salts, Dow's process, properties – acidic character and effect of substitution on acidity.Reactions – Fries, claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Resorcinol, quinol,– 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, oxidation – substitution on the benzene nucleus, uses.

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				
Core Practical-III		**Course Code:** 24UCH3P03	**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, chloride, bromide,
2. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate,
3. Elimination of interfering acid radicals and Identifying the group of basic radicals
4. Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, iron, aluminium, zinc,manganese, nickel, cobalt, calcium, magnesium, ammonium

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 II		Course Code: 24UCH3S02	Course Title : Entrepreneurial Skills in Chemistry	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	1	15	1	100

Objectives of the course

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 -III		**Course Code:** 24UCH3S03	**Course Title** Dye 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

1.1 Introduction, Definition- Dye, colour, chromophore, auxochrome, bathochromic effect and hypso chromic effect

1.2.Classification- acid, base, azo, vat and reactive dyes.

UNIT-II

2.1.Various methods of dyeing- Direct, vat, mordant and disperse.

2.2.Anthroquinone and Mordant Dyes- synthesis and applications of Alizarin

UNIT III

3.1. Diphenylmethane Dyes- synthesis and application of Auramine-

3.2. Triphenylmethane Dyes- Malachite Green, Crystal Violet,Pararosaniline-Preparation and applications.

3.3.Indigo Dyes-Preparation and application of Indigo.Derivatives of Indigo-Synthesis and uses of Indigosol and tetrabromo indigo-(Ciba blue).

UNIT-IV

4.1.Phthalein Dyes-Phenolphthalein- Preparation and applications

4.2.Xanthein Dyes-Rhodamine B, Fluorescein - Preparation and applications.

4.3.Acridine dyes- synthesis and application of Acridine orange NO

4.4 .Reactive dyes – synthesis and applications of Procion Blue HB.

UNIT-V

5.1.Textile Effluent-Characteristics,effect of untreated effluent,degradability of wastes. Effluent treatment plants-Aerated lagoon,photo oxidation process

Skills acquired from this course

Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills on dye stuffs and treatment of effluents.

TEXT BOOKS:

1. K. Venkataraman, The chemistry of synthetic dyes Part I & II, Academic Press, New York, 1952.

2. V. A. Shenai, Introduction to Chemistry of Dyesuffs, Sevak Prakashan Pub., Mumbai, 1991.

REFERENCE BOOKS:

1. V. A. Shenai, Chemistry of Dyes and Principles of Dyeing Vol.-II,

Sevak Prakashan, Mumbai, 1987.
2. V. A. Shenai, Ecology and Textiles, Sevak Publications, Mumbai, 1997.
3. D. M. Nunn, The Dyeing of Synthetic Polymer and Acetate Fibres, Dyers Company, Publication Trust, 1979.
4. V. A. Shenai, Toxicity of Dyes and Intermediates, Sevak Publications, Mumbai, 1998.
5. Directory of safe dyes conforming to German Consumer Goods Ordinances, The Dyestuff Manufacturers Association of India, 1996.

Course Outcomes

1. Apply principles of diffusion & mass transfer to basic engineering systems
2. Analyze various mass transfer systems.
3. Knowledge of important reagents used in chemical industries.
4. Understand the reaction mechanism of various name reactions..
5. Commercial manufacturing process technology of various chemicals and solvents.

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				
Core - IV		Course Code: 24UCH4C04	Course Title : GENERAL CHEMISTRY-IV	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	4	60	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;isolated, closed and open systems; isothermal, isobaric, ,cyclic, reversible and irreversible processes; First law of thermodynamics –Concept and significance of heat(q),work(w),internalenergy(E), enthalpy(H); 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; 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, Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, volume and pressure, entropy and disorder.

Free energy and work 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,

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

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, Comparative study of transition elements and non transition elements –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 method of estimation of methoxygroup.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 - Aldol, Cannizzaro's reaction, Perkin reaction, , Haloform reaction, Knoevenagel reaction.Oxidation of aldehydes.. Reduction: Clemmensen reduction, Wolf - Kishner reduction, , reduction with LiAlH4 and NaBH4.

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,

Reactions of dicarboxylic acids, hydroxy acids and unsaturated acids.

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

Active methylene compounds: Keto – enoltautomerism. Preparation and synthetic applications of diethyl malonate

Halogen substituted acids – nomenclature; preparation by direct halogenation, iodination from unsaturated 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*, 26thed.; 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

Program: B.Sc. Chemistry				
Core practical-IV		**Course Code:** 24UCH4P04	**Course Title : Physical Chemistry Practical – I**	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	3	45	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. Determination of heat of neutralisation of a strong acid by a strong base.

UNIT II

Electrochemistry – Conductance measurements

4. Determination of cell constant
5. Determination of dissociation constant of acetic acid

Colorimetry

6. Determination of concentration of copper sulphate solution

UNIT III

Colligative property

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

Skillsacquired fromthiscourse

Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills

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 -IV		**Course Code:** 24UCH4S04	**Course Title : 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.IUnits,DistinctionbetweenMassandWeight.Moles,Millimoles,Milli equivalence, Molality, Molarity, Normality, Percentage by WeightandVolume, Sampling,evaluationofanalyticaldata,Errors– TypesofErrors,Accuracy,Precision,MinimizationofErrors.SignificantFigures.MethodsofExpressing Precision:Mean,Median,AverageDeviation,StandardDeviation,CoefficientofVariation,ConfidenceLimits,

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.

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

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, HPLC- 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				
SEC -V		Course Code: 24UCH4S05	Course Title : FORENSIC 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