K.M.G. COLLEGE OF ARTS AND SCIENCE

(AUTONOMOUS)

Approved by the Government of Tamil Nadu
Permanently Affiliated to Thiruvalluvar University, Vellore
Recognized under Section 2(f) and 12(B) of the UGC Act 1956
Accredited by NAAC (2nd Cycle) with (CGPA of 3.24/4) 'A' Grade

P.G. AND RESEARCH DEPARTMENT OF CHEMISTRY

B.Sc., CHEMISTRY

SYLLABUS

(CHOICE BASED CREDIT SYSTEM)

Under

LEARNING OUTCOMES-BASED CURRICULUM

FRAMEWORK (LOCF)

(Effective for the Batch of Students Admitted from 2024-2025)

PREFACE

The curriculum of undergraduate chemistry has been designed to explain the concepts in various branches of chemistry such as physical, inorganic, organic chemistry, etc. The purpose of the outcome-based education is meant to provide an exposure to the fundamental aspects in different branches of chemistry and its applications, keeping in mind the growing needs for higher education, employability, entrepreneurship and social responsibility. The periodical restructuring of the syllabi is carried out to fulfill the requirements of graduate attributes, qualification descriptors, programme learning outcomes and course outcomes. The outcome-based education enriches the curriculum to deliver the basic principles, synthetic strategies, mechanisms and application-oriented learning for the benefit of students. The programme also includes training to students for seminar presentation, preparation of internship reports, hands-on training in lab courses, skills to handle instruments, synthesis and its analysis, developing leadership qualities, organization and participation in the interdepartmental academic competitions. The allied papers provide a platform to strengthen the understanding of the core subjects. The non-major elective courses offer chances to learn and augment interest in other related fields. The outcome-based curriculum is intended to enrich the learning pedagogy to global standards. ICT enabled teaching-learning platforms are provided to students along with the interaction of international scientists. The seminars periodically delivered by industrialists, subject experts and former professors would certainly help the students to update with latest technology/trends in different fields of chemistry. The exposure to the industrial internship and MoUs with industries can open an avenue for a start-up and its progress would be followed regularly. The OBE based evaluation methods will reflect the true cognitive levels of the students as the curriculum is designed with course outcomes and cognitive level correlations as per BLOOM's Taxonomy.

In pursuit of the Higher Education Department Policy Note 2022-23 Demand 20, Section 1.4, Tamil Nādu State Council for Higher Education took initiative to revamp the curriculum. On 27 July 2022, a meeting was convened by the Member-Secretary Dr. S. Krishnasamy enlightening the need of the hour to restructure the curriculum of both Undergraduate and Post-graduate programmes based on the speeches at the Tamil Nādu Legislative Assembly Budget meeting by the Honourable Higher Education Minister Dr K. Ponmudy and Honourable Finance Minister Dr. P. Thiagarajan. At present there are three different modes of imparting education in most of the educational institutions throughout the globe. Outcome Based Education, Problem Based Education, and Project Based Education.

Now our Honourable Higher Education Minister announced Industry Aligned Education. During discussion, Member Secretary announced the importance of question papers and evaluation as envisaged by the Honourable Chief Secretary to Government Dr, V. Irai Anbu. This is very well imbedded in Revised Bloom's Taxonomy forms three learning domains: the cognitive (knowledge), affective (attitude), and psychomotor (skill). This classification enables to estimate the learning capabilities of students.

Briefly, it is aimed to restructure the curriculum as student-oriented, skill-based, and institution-industry interaction curriculum with the various courses under "Outcome Based Education with Problem Based Courses, Project Based Courses, and Industry Aligned Programmes" having revised Bloom's Taxonomy for evaluating students skills. Three domains:

(i)Cognitive Domain

(Lower levels: K1: Remembering; K2: Understanding; K3: Applying; Higher levels: K4: Analysing; K5: Evaluating; K6: Creating)

(ii) Affective Domain

(iii) Psychomotor Domain

ABOUT THE COLLEGE

The College was founded in the new millennium 2000 by the vision of late Shri.K.M.Govindarajan fondly known as Iyah, with a mission to offer higher education in the fields of Arts and Science to the needy and the poor middle class students of this area and make them fully employable and economically self-reliant. With a humble beginning of launching an elementary school named Thiruvalluvar Elementary School in the year 1952, Iyah groomed it into a Higher Secondary School and later into a college. Education was his soul and breath. The college has grown into a full-fledged educational hub offering 12 under graduate programmes, 8 post graduate programmes, 5 M.Phil. research programmes and 4 Ph.D. programmes. The college has been accredited with 'A' grade by NAAC in 2nd cycle and recognized under section 2(f) & 12(B) of the UGC act 1956. The College is permanently affiliated to Thiruvalluvar University. The College is also acquired the status of Autonomous from the academic year 2024-2025. The College is an associate member of ICT Academy and registered member of NPTEL and Spoken Tutorials of IIT Bombay. The college is also a member of INFLIBNET and NDL.

VISIONOF THE COLLEGE

Empower young men and women by educating them in the pursuit of excellence, character building and responsible citizen.

MISSION OF THE COLLEGE

Offer higher education in the fields of Arts, Science & Management to the needy and make them fully self-dependent.

QUALITY POLICY OF THE COLLEGE

KMG Students achieve the best learning results and personal growth with modern education that equip them for working life and a changing society to become deserving citizens.

ABOUT THE DEPARTMENT

The knowledge of basic science is essential for the sustainable development of the society. To get the basic knowledge in chemical science to young students the Department of Chemistry initiated in the academic year 2007-2008. The objective of our department is to motivate students to excel in chemistry at the global level, which is necessary for chemists getting placement as well as becoming an entrepreneur in future. The department was uplifted as the post graduate department in the year 2010-2011. The department has been recognized as a research department since 2014-15 to offer M.Phil., Followed that the Thiruvallur University accorded recognition to the Department as a centre for Doctoral research in Chemistry from 2019-2020. The focus of the department is the holistic development of the students and involves them in curricular and co-curricular activities. The Chemistry Department pledges itself to serve in the broadest, innovative and most liberal manner towards the advancement of chemistry in all of its branches through academics, research and service missions upholding the values and entrepreneurial skills. The job potential to the chemist is very high now and opportunities to provoke research in chemistry are ample. Needless to say that for a developing country likes ours, “CHEMISTRY IS OUR LIFE AND FUTURE”.

VISION OF THE DEPARTMENT

The Department is determined to educate and graduate rural students. The department is committed to produce the quality chemist with highest caliber who would engage in research, technological design and development to lend-a-hand in the national economic development.

MISSION OF THE DEPARTMENT

- To develop a basic knowledge in Chemistry with practical experience.
- To kindle the interest of students towards the development of technical skills to start their own business through mini projects and in-plant training.
- To enhance the students with the capacity of application oriented skills, which is a gateway to professional chemists.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. Professional Excellence: Graduates will demonstrate competency and excellence in their chosen fields of study, applying theoretical knowledge to practical situations effectively.

2. Character Development: Graduates will exhibit strong moral and ethical character, upholding values of integrity, honesty, and respect for others in both personal and professional endeavors.

3. Leadership and Citizenship: Graduates will emerge as responsible leaders and active citizens, contributing positively to their communities and society at large through their actions and initiatives.

4. Continuous Learning: Graduates will engage in lifelong learning and professional development activities, adapting to evolving technologies, methodologies, and societal needs.

5. Self-Dependency and Entrepreneurship: Graduates will possess the skills and mindset necessary to be self-reliant and entrepreneurial, capable of creating opportunities for themselves and others through innovation and initiative.

6. Effective Communication and Collaboration: Graduates will demonstrate proficiency in communication skills, both verbal and written, and exhibit the ability to collaborate effectively with diverse teams and stakeholders.

7. Global Perspective: Graduates will have a broad understanding of global issues and perspectives, demonstrating cultural sensitivity and adaptability in multicultural environments.

PROGRAM OUTCOMES (POs)

On successful completion of the programme, the students will be able to:

POs	Graduate Attributes	Statements
PO1	Disciplinary Knowledge	Acquire detailed knowledge and expertise in all the disciplines of the subject.
PO2	Communication Skills	Ability to express thoughts and ideas effectively in writing, listening and confidently Communicate with others using appropriate media
PO3	Critical Thinking	Students will develop aptitude Integrate skills of analysis, critiquing, application and creativity.
PO4	Analytical Reasoning	Familiarize to evaluate the reliability and relevance of evidence, collect, analyze and interpret data.
PO5	Problem Solving	Capacity to extrapolate the learned competencies to solve different kinds of non-familiar problems.
PO6	Employability and Entrepreneurial Skill	Equip the skills in current trends and future expectations for placements and be efficient entrepreneurs by accelerating qualities to facilitate startups in the competitive environment.
PO7	Individual and Team Leadership Skill	Capability to lead themselves and the team to achieve organizational goals and contribute significantly to society.
PO8	Multicultural Competence	Possess knowledge of the values and beliefs of multiple cultures and a global perspective.
PO 9	Moral and Ethical awareness/reasoning	Ability to embrace moral/ethical values in conducting one's life.
PO10	Lifelong Learning	Identify the need for skills necessary to be successful in future at personal development and demands of work place.

PROGRAM SPECIFIC OUTCOMES (PSOs)

On successful completion of the B.Sc., Chemistry, the students will be able to:

PSOs	Statements
PSO1	Apply fundamental principles across chemistry subfields to analyze and solve complex problems effectively.
PSO2	Demonstrate proficiency in laboratory techniques, data analysis, and scientific communication.
PSO3	Exhibit ethical conduct, critical thinking, and collaborative skills in addressing scientific challenges and advancing knowledge in chemistry.

Correlation Rubrics:

High	Moderate	Low	No Correlation
3	2	1	-

Mapping of PSOs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
PSO1	3	3	3	3	3	3	2	-	-	2
PSO2	3	2	3	3	3	3	2	1	-	2
PSO3	3	3	3	3	3	3	2	2	3	3

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Subject and Credit System- B.Sc., Chemistry

(Effective for the Batch of Students Admitted from 2024-2025)

Sem I	Credit	Sem II	Credit	Sem III	Credit	Sem IV	Credit	Sem V	Credit	Sem VI	Credit
1.1. Language– Tamil	3	2.1.Language– Tamil	3	3.1.Language– Tamil	3	4.1.Language- Tamil	3	5.1CoreCourse – \CC IX	4	6.1 Core Course – CCXIII	4
1.2 English	3	2.2 English	3	3.2 English	3	4.2English	3	5.2Core Course– CCX	4	6.2 Core Course – CCXIV	4
1.3 Core Course – CC I	5	2.3 Core Course– CC III	5	3.3Core Course– CCV	5	4.3Core Course– CCVII CoreIndustry Module	5	5.3.Core Course CC-XI	4	6.3 Core Course – CCXV	4
1.4 Core Course– CC II	4	2.4 Core Course– CC IV	4	3.4 Core Course– CCVI	4	4.4 Core Course– CCVIII	4	5.4.Core Course –/ Project with viva-voce CC-XII	4	6.4 Core Course– CCXVI	4
1.5 Elective I Generic/Discipline Specific	3	2.5 Elective II Generic/Discipline Specific	3	3.5 Elective III Generic/ Discipline Specific	3	4.5ElectiveIV Generic/ Discipline Specific	3	5.5ElectiveV Generic/ Discipline Specific	3	6.5Elective-VII Generic/ Discipline Specific	3
1.6Skill Enhancement Course SEC-1(NME)	2	2.6 Skill Enhancement Course SEC-2 (NME)	2	3.6 Skill Enhancement CourseSEC-4, (Entrepreneurial Skill)	1	4.6Skill Enhancement Course SEC-6	2	5.6ElectiveVI Generic/ Discipline Specific	3	6.6ElectiveVIII Generic/ Discipline Specific	3
1.7 Skill Enhancement- (Foundation Course)	2	2.7 Skill Enhancement Course–SEC-3	2	3.7 Skill Enhancement CourseSEC-5	2	4.7Skill Enhancement CourseSEC-7	2	5.7Value Education	2	6.7Extension Activity	1
				3.8 E.V.S	2			5.8Summer Internship /Industrial Training	2	6.8 Professional Competency Skill	2
	22		**22**		**23**		**22**		**26**		**25**
	Total Credit Points										**140**

Semester	Part	Category	Course Code	Course Title		Ins.Hrs/ Week	Credit	Maximum Marks		
								Internal	External	Total
SEMESTER - I	I	Language	AULT10 / AULU 10	General Tamil – I / Urdu - I		6	3	25	75	100
	II	English	AULE10	English – I		6	3	25	75	100
	III	Core – 1	AUCCH11	General Chemistry–I		5	5	25	75	100
	III	Core – 2	AUCPCH12	Practical I - Quantitative Inorganic estimation (Titrimetry) and Inorganic Preparations		4	4	25	75	100
	III	Elective-I (Choose any one)	AUEMA13	Mathematics		5	3	25	75	100
			AUEBO13	Botany	Theory	3	3	25	75	100
			AUEPBO23		Practical	2	-	-	-	-
			AUEZO13	Zoology	Theory	3	3	25	75	100
			AUEPZO23		Practical	2	-	-	-	-
	IV	Skill Enhancement	AUSCH14	Food Chemistry		2	2	25	75	100
	IV	Skill Enhancement	AUFCH15	Foundation Chemistry		2	2	25	75	100
	Semester Total					**30**	**22**			
SEMESTER - II	I	Language	AULT20 / AULU 20	General Tamil – II / Urdu - II		6	3	25	75	100
	II	English	AULE20	English – II		6	3	25	75	100
	III	Core - 3	AUCCH21	General Chemistry–II		5	5	25	75	100
	III	Core – 4	AUCPCH22	Practical II - Qualitative Organic Analysis and preparation of Organic Compounds		4	4	25	75	100
	III	Elective-II (Choose any one)	AUEMA23	Mathematics		5	3	25	75	100
			AUEBO23	Botany	Theory	3	2	25	75	100
			AUEPBO23		Practical	2	1	25	75	100
			AUEZO23	Zoology	Theory	3	2	25	75	100
			AUEPZO23		Practical	2	1	25	75	100
	IV	Skill Enhancement	AUSCH24	Dairy Chemistry		2	2	25	75	100
	IV	Skill Enhancement	AUSCH25	Cosmetics and Personal grooming		2	2	25	75	100
					Semester Total	**30**	**22**			

Semester	Part	Category	Course Code	Course Title	Ins.Hrs/ Week	Credit	Maximum Marks		
							Internal	External	Total
SEMESTER - III	I	Language	AULT30 / AULU 30	General Tamil – III / Urdu - III	6	3	25	75	100
	II	English	AULE30	English – III	6	3	25	75	100
	III	Core - 5	AUCCH31	General Chemistry–III	5	5	25	75	100
	III	Core – 6	AUCPCH32	Practical III - Qualitative Inorganic Analysis	4	4	25	75	100
	III	Elective-III	AUEPH33	Physics - I	3	3	25	75	100
			AUEPPH43	Practical - Physics	1	-	-	-	-
	IV	Skill Enhancement	AUSPCH34	Entrepreneurial Skills in Chemistry	1	1	25	75	100
	IV	Skill Enhancement	AUSCH35	Pesticide Chemistry	2	2	25	75	100
	IV	Compulsory	AUES30	Environmental Studies	2	2	25	75	100
				Semester Total	**30**	**23**			
SEMESTER - IV	I	Language	AULT40 / AULU 40	General Tamil – IV / Urdu - IV	6	3	25	75	100
	II	English	AULE40	English – IV	6	3	25	75	100
	III	Core - 7	AUCCH41	General Chemistry–IV	5	5	25	75	100
	III	Core – 8	AUCPCH42	Practical IV - Physical Chemistry Practical-I	4	4	25	75	100
	III	Elective-IV	AUEPH43	Physics - II	3	2	25	75	100
			AUEPPH43	Practical - Physics	2	1	25	75	100
	IV	Skill Enhancement Course	AUSCH44	Instrumental Methods of Chemical Analysis	2	2	25	75	100
	IV	Skill Enhancement	AUSCH45	Forensic Science	2	2	25	75	100
				Semester Total	**30**	**22**			

Semester	Part	Category	Course Code	Course Title	Ins.Hrs/ Week	Credit	Maximum Marks		
							Internal	External	Total
SEMESTER - V	III	Core – 9	AUCCH51	Organic Chemistry – I	5	4	25	75	100
	III	Core – 10	AUCCH52	Inorganic Chemistry-I	5	4	25	75	100
	III	Core – 11	AUCCH53	Physical Chemistry – I	5	4	25	75	100
	III	Core – 12	AUPCH54	Core/Project with Viva-voce	5	4	25	75	100
	III	Elective-V	AUECH55	Biochemistry	4	3	25	75	100
	III	Elective-VI	AUECH56	Industrial Chemistry	4	3	25	75	100
	IV	Compulsory	AUVE50	Value Education	2	2	25	75	100
	IV	Compulsory	AUICH57	Internship/Industrial Training (Carried out in II-Year Summer vacation) (30 hours)	-	2	100	-	100
				Semester Total	**30**	**26**			
SEMESTER - VI	III	Core – 13	AUCCH61	Organic Chemistry – II	5	4	25	75	100
	III	Core – 14	AUCCH62	Inorganic Chemistry-II	5	4	25	75	100
	III	Core – 15	AUCCH63	Physical Chemistry – II	5	4	25	75	100
	III	Elective-VII	AUECH65	Fundamentals of Spectroscopy	5	3	25	75	100
	III	Elective-VIII (Choose any one)	AUECH66A	Nano Science	4	3	25	75	100
			AUECH66B	Polymer Science					
			AUECH66C	Pharmaceutical Chemistry					
	III	Core - 16	AUCPCH64	Practical V - Physical Chemistry Practical - II	4	4	25	75	100
	IV	Compulsory	AUEA60	Extension Activity	-	1	100	-	100
	V	Professional Competency Skill	AUPCCH65	Professional Competency Skill	2	2	25	75	100
				Semester Total	**30**	**25**			

Consolidated Semester wise and Component wise Credit distribution

Parts	Semester-I	Semester-II	Semester-III	Semester-IV	Semester-V	Semester-VI	Total Credits
Part-I	03	03	03	03	-	-	12
Part-II	03	03	03	03	-	-	12
Part-III	12	12	12	12	22	22	92
Part-IV	04	04	05	04	04	01	22
Part-V	-	-	-	-	-	02	02
Total	22	22	23	22	26	25	**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 has to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.

COURSE DESCRIPTORS

Title of the Course	General Chemistry-I	**Hours/Week**	05
Course Code	AUCCH11	**Credits**	05
Category	Core-1	**Year & Semester**	I & I
Prerequisites	Higher Secondary Chemistry	**Regulation**	2024

Objectives of the course:

- 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 the chemical behavior
- Nature of chemical bonding
- Fundamental concepts of organic chemistry

UNITS	Contents	COs	Cognitive Levels
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's exclusion principle and Aufbau principle. Numerical problems involving the De-Broglie wavelength and Heisenberg's Uncertainty Principle concepts.	CO1 CO3	K1 K2 K3
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, Schrodinger wave equation (Derivation not required) - 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, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity-electronegativity scales, applications of electronegativity. Problems involving the core concepts of ionization energy, electron affinity and electronegativity.	CO1 CO2 CO3	K1 K2 K3 K4

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 polarization - polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds. Problems involving the core concept of Born Haber cycle. **Covalent bond** Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency - hybridization; VSEPR theory - shapes of molecules of the type AB_2, AB_3, AB_4, AB_5, AB_6 and AB_7. Partial ionic character of covalent bond-dipole moment application to molecules of the type A_2, AB, AB_2, AB_3, AB_4; percentage ionic character- numerical problems based on calculation of percentage ionic character.	CO3 CO4	K1 K2 K3 K5
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^{2-}, NO, HF, CO; magnetic characteristics, comparison of VB and MO theories. **Coordinate bond**-Definition, Formation of NH_4^+, H_3O^+ properties **Metallic bond**-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types and applications. **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. Effects of chemical force, melting and boiling points.	CO2 CO3 CO4	K1 K2 K3 K5

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 and nitrens. **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 **Hyperconjugation**- stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane. Introduction of different types of organic reactions- addition, substitution, elimination and Rearrangements.	CO2 CO3 CO4 CO5	K1 K2 K3 K5 K6

Recommended Text Books

1. *Madan, R. D. and Sathya Prakash, Modern Inorganic Chemistry, 2nded.; S. Chand and Company:New Delhi, 2003.*
2. *P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007..*
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, Pearson Education: 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 William Heinemann: London,1991.*
3. *Gurudeep Raj, Advanced Inorganic Chemistry, 26thed.;Goel Publishing House: 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.*
6. *Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition,2012.*

Website and e-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 Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.	K1,K2
CO2	Classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents.	K1,K2,K4
CO3	Apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δ_x, Δ_p electronegativity, percentage ionic character and bond order.	K1,K2,K3
CO4	Evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects	K1,K2,K5
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.	K1,K2,K6

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	-	-	-	-	-	3	3	3
CO2	3	1	3	2	2	1	1	1	-	1	3	3	3
CO3	2	2	3	3	2	-	-	2	-	1	3	3	3
CO4	3	1	3	1	2	1	-	-	-	-	3	3	3
CO5	3	2	2	2	2	2	-	-	1	1	3	3	3

COURSE DESCRIPTORS

Title of the Course	Quantitative Inorganic Estimation (Titrimetry) and Inorganic Preparations	**Hours/Week**	04
Course Code	AUCPCH12	**Credits**	04
Category	Core-2	**Year & Semester**	I & I
Prerequisites	Higher secondary Chemistry	**Regulation**	2024

Objectives of the course:

This course aims at providing knowledge on

- Laboratory safety
- Handling glasswares
- Quantitative estimation
- Preparation of inorganic compounds

UNITS	Contents	COs	Cognitive Levels
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)** Descriptionanduseofburette,pipette,standardflask,measuringcylinder,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.	CO1 CO2	K1 K2 K3

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)	CO1 CO2 CO3 CO5	K1 K2 K3 K4 K5
UNIT-III	**Complexometry** Estimation of hardness of water using EDTA **Estimations** Estimation of iron in iron tablets Estimation of ascorbic acid. **Preparation of Inorganic compounds-** Potashalum Tetraammine copper(II)sulphate Hexammine cobalt(III)chloride Mohr's Salt (Any 5 experiments)	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5

Recommended Text Books

1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand &Sons: New Delhi, 1997.

2. Nad, A. K.; Mahapatra, B.; Ghoshal, A.; An advanced course in PracticalChemistry, 3rd ed.; New Central Book Agency: Kolkata, 2007.

Reference Books

1. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; Vogel's Textbook of Quantitative Chemical Analysis, 6th ed.; Pearson Education Ltd: New Delhi, 2000

Website and e-learning source

1) *http://www.federica.unina.it/agraria/analytical-chemistry/volumetricanalysis*

2) *https://chemdictionary.org/titration-indicator/*

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Explain the basic principles involved in titrimetric analysis and inorganic preparations.	K1, K2
CO2	Compare the methodologies of different titrimetric analysis.	K1, K2, K3, K4
CO3	Calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.	K1, K2, K3, K5
CO4	Assess the yield of different inorganic preparations	K1, K2, K5, K6
CO5	Identify the end point of various titrations.	K1, K2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	2	1	-	-	2	3	3	2
CO2	3	2	3	3	1	2	-	-	-	1	3	3	2
CO3	3	1	3	3	2	2	1	-	-	1	3	3	3
CO4	3	1	3	3	2	3	-	-	-	-	3	3	2
CO5	3	1	3	3	2	1	-	-	-	1	3	3	3

SCHEME OF VALUATION

Quantitative Inorganic Estimation (titrimetry) and Inorganic Preparations

Internal assessment : 25 Marks

External assessment : 75 Marks

Total : 100 Marks

Max. Marks : 75 Marks

Record : 15 Marks

Volumetric Analysis : 40 Marks

Preparation : 20 Marks (Quantity- 10 Marks; Quality- 10 marks)

Volumetric Analysis : 40 Marks (Maximum)

Error upto 2 % : 40 Marks

2 to 3 % : 30 Marks

3 to 4 % : 20 Marks

4 to 5 % : 10 Marks

> 5 % : 10 Marks

Arithmetic error : Deduct 1 mark

Wrong calculation : Deduct 5 marks scored

No calculation : Deduct 40 % of marks scored

COURSE DESCRIPTORS

Title of the Course	FOOD CHEMISTRY	Hours/Week	02
Course Code	AUSCH14	Credits	02
Category	Skill Enhancement Course	Year & Semester	I & I
Prerequisites	Higher Secondary Chemistry	Regulation	2024

Objectives of the course:

The course aims at giving an overall view of the

- Types of food
- Food adulteration and poisons
- Food additives and preservation

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Food Adulteration** Sources of food, types, advantages and disadvantages. Food adulteration - contamination of wheat, rice, milk, butter, with clay stones, water and toxic chemicals - Common adulterants, Ghee adulterants and their detection by simple analytical techniques.	CO1	K1 K2
UNIT-II	**Food Poison** Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) -Chemical poisons - First aid for poison consumed victims.	CO2	K1 K2
UNIT-III	**Food Additives** Food additives -artificial sweeteners – Saccharin - Cyclomate a n d Aspartate Food flavours -esters, aldehydes and heterocyclic compounds – Food colours – Emulsifying agents – preservatives - leavening agents. Baking powder – yeast – tastemakers – MSG - vinegar.	CO3	K1 K2 K3

UNIT-IV	**Beverages** Beverages - soft drinks – soda - fruit juices - alcoholic beverages. Carbonation-addiction to alcohol – diseases of liver and social problems.	CO4	K1 K2 K3
UNIT-V	**Edible Oils** Fats and oils - Sources of oils - production of refined vegetable oils - Preservation. Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases-determination of iodine value, RM value, saponification values and their significance.	CO5	K1 K2 K3

Recommended Text Books

1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.

2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand &Co.Publishers, second edition, 2006.

3. Food chemistry, H. K. Chopra, P. S. Panesar, Narosapublishning house,2010.

4. Food Chemistry, Dr. L. Rakesh Sharma, Evincepub publishing, 2022.

5. Food processing and preservation, G. Subbulakshmi, Shobha A Udipi,Pdmini S Ghugre, New age international publishers, second edition, 2021.

Reference Books

1. H.-D. Belitz, Werner Grosch, Food Chemistry Springer Science & Business Media, 4th Edition, 2009.

2. M. Swaminathan, Food Science and Experimental Foods, Ganesh andCompany,1979.

3. Hasen huettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and their applications Springer New York 2nd ed. 2008.

4. Food Chemistry, H.-D. Belitz, W. Grosch, P. Schieberle, Springer, fourth revised and extended edition, 2009.

5. Principles of food chemistry, John M. deMan, John W. Finley, W. Jefferey Hurst, Chang Yong Lee, Springer, Fourth edition, 2018.

Website and e-learning source

1. https://ipa-pasca.unpak.ac.id/pdf/Food%20Chemistry%20by%20Fennema%203rd%20Ed.pdf
2. http://www.uprtou.ac.in/other_pdf/dvapfv_block_3.pdf
3. https://www.youtube.com/watch?v=16FtnBamrpE&list=PLCT8CYagFjMNDfuzv5CqtRGfmMq90N0i

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Explain about Food adulteration - contamination of Wheat, Rice, Milk, Butter.	K1,K2
CO2	Discuss about food poisons like natural poisons (alkaloids - nephrotoxin) pesticides, DDT, BHC, Malathion	K1,K2,K3
CO3	Explain on food additives, artificial sweeteners, Saccharin, Cyclomate and Aspartate in the food industries.	K1,K2
CO4	Acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples.	K1,K2
CO5	Differentiate about fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats –MUFA and PUFA	K1,K2,K3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	2	1	-	-	1	2	3	2
CO2	3	2	2	2	1	1	-	-	-	1	3	2	3
CO3	2	2	1	2	1	2	-	-	-	1	2	2	2
CO4	3	1	1	1	1	2	-	-	-	1	3	2	3
CO5	3	2	2	2	1	2	-	-	-	1	2	3	2

COURSE DESCRIPTORS

Title of the Course	FOUNDATION CHEMISTRY	**Hours/Week**	02
Course Code	AUFCH15	**Credits**	02
Category	Skill Enhancement Course	**Year & Semester**	I & I
Prerequisites	Higher Secondary Chemistry	**Regulation**	2024

Objectives of the course:

The course aims at giving an overall view of the

- Understand the concepts of periodic table.
- To know the naming of compounds and its nature.
- Understand the mathematical concepts.
- To describe the errors and it's minimized.
- To know the chromatography techniques.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Nomenclature & Hybridization** Covalent bond – Formation of sigma and pi bond – Differences between sigma and pi bond – Homolytic and heterolytic cleavage of covalent bond – Tetra valency of carbon. IUPAC system of nomenclature of common organic compounds (upto C-10) - Alkanes, alkenes, alkynes, cycloalkanes, and aromatic compounds - Naming of organic compounds with one functional group - Halogen compounds, alcohols, phenol, aldehydes, ketones, carboxylic acids and its derivatives .	CO1	K1 K2
UNIT-II	**Solutions** Introduction of Ideal and non-ideal solutions. Formality, normality, molarity, molality, mole ratio- stoichiometry – Chemical reaction stoichiometric calculation, oxidation number – Oxidation number calculation.	CO2	K1 K2

UNIT-III	**Thermodynamics** Gaseous state – Gas laws – Boyle's Law, Charles law, Avogadro hypothesis Thermodynamics – Definition of thermodynamics terms - Entropy, Enthalpy, Free Energy and Work Function. Statements of Thermodynamics Laws - Zeroth, first, second, third law.	CO3	K1 K2 K3
UNIT-IV	**Data Analysis** Data analysis - Theory of errors - Idea of significant figures and it's important with examples - Difference between precision and accuracy - Methods of expressing precision and accuracy. Error Analysis - Methods of minimizing errors - Problems related to mean, mode and standard deviation confidence limit.	CO4	K1 K2 K3
UNIT-V	**Chromatography** Chromatography - Introduction - Classification of chromatographic method Paper Chromatography - Principle, theory - R_f, R_x, R_g values -TLC - Principle. Adsorption Column and Ionexchange Chromatography - Principle.	CO5	K1 K2 K3

Recommended Text Books

1. *Madan.R.D. 2019. Sathyaprakash. Modern Inorganic Chemistry. 3rd ed. S. Chand and Company, New Delhi.*
2. *Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition,2012.*
3. *B. R. Puri, Sharma and Madan S. Pathania, Principles of Physical Chemistry -Vishnal Publishing Co., - 2013.*
4. *R. Gopalan, P. S. Subramanian, K. Rengarajan - Elements of Analytical Chemistry - S. Chand and sons (1997).*

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Explain about modern periodic table and its properties	K1,K2
CO2	Discover the IUPAC name of organic samples	K1,K2,K3
CO3	Determine the oxidation number of an atom and solution strength units.	K2,K3,K4,K5
CO4	Develop methods to minimizing errors in chemical analysis	K4,K5
CO5	Discuss the principles of various chromatography techniques to separate chemical compounds	K2,K3,K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	-	-	-	-	-	-	-	3	2	-
CO2	3	3	2	2	1	-	-	-	-	3	2	3	2
CO3	3	3	3	3	3	-	-	-	-	2	3	3	3
CO4	3	3	3	2	2	-	-	-	-	2	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	3	2	1

COURSE DESCRIPTORS

Title of the Course	CHEMISTRY - I (For Biochemistry – I Year/I Semester)	**Hours/Week**	05
Course Code	AUECH13	**Credits**	03
Category	Generic Elective I	**Year & Semester**	I & I
Prerequisites	Higher Secondary Chemistry	**Regulation**	2024

Objectives of the course:

The course aims at giving an overall view of the

- 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.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Chemical Bonding and Nuclear Chemistry** Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O 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.	CO1	K1 K2
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.	CO2	K1 K2

UNIT-III	**Fundamental Concepts in Organic Chemistry** Hybridization: Orbital overlap hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Polar effects: Inductive effect and consequences on Ka and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation. Reaction mechanisms: Types of reactions - aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.	CO3	K1 K2 K3
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.	CO4	K1 K2 K3
UNIT-V	**Analytical Chemistry** Introduction 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.	CO5	K1 K2 K3

Recommended Text Books

1. *Madan, R. D. and Sathya Prakash, Modern Inorganic Chemistry, 2nd ed.; S.Chand and Company: New Delhi, 2003.*
2. *P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.*
3. *P.C. Jain and Monika Jain, Engineering Chemistry, 17th Ed., Dhanpat Rai Publishing Company*
4. *Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition,2012.*
5. *Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry,2nd ed., S.Chand& company, New Delhi.*
6. *Ashutosh Kar, (2018), Medicinal chemistry, 7th ed., New ageinternational (P) Limited, Publishers, New Delhi.*
7. *R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007.*

Reference Books

1. *P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.*
2. *B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.*
3. *Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.*
4. *V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.*
5. *S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.*

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Explain the bonding nature of molecules and nuclear chemistry applications	K1,K2,K3
CO2	Discuss the important of industrial chemistry in our life	K1,K2
CO3	Predict the reaction mechanism in aromatic compounds	K2,K4
CO4	Classify the different types of drugs and their uses	K3,K4
CO5	Compare Separation and purification techniques	K2,K3,K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	-	-	3	1	1
CO2	3	3	2	-	-	-	-	-	-	-	2	2	1
CO3	3	3	3	2	-	-	-	-	-	-	3	2	2
CO4	3	3	2	-	-	-	-	-	-	-	3	2	2
CO5	3	3	-	2	-	-	-	-	-	-	1	2	2

COURSE DESCRIPTORS

Title of the Course	CHEMISTRY PRACTICAL (for Biochemistry – I Year / I,II Semester)	**Hours/Week**	02
Course Code	AUEPCH23	**Credits**	01
Category	Generic Elective I	**Year & Semester**	I & I, II
Prerequisites	Higher Secondary Chemistry	**Regulation**	2024

Objectives of the course:

The course aims at giving an overall view of the

- Basics of preparation of solutions.
- Principles and practical experience of volumetric analysis
- Identification of organic functional groups
- Different types of organic compounds with respect to their properties.
- Determination of elements in organic compounds..

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**VOLUMETRICANALYSIS** 1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Estimation of hydrochloric acid using standard oxalic acid. 3. Estimation of ferroussulphate using standard Mohr's salt. 4. Estimation of oxalic acid using standard ferroussulphate. 5. Estimation of potassium permanganate using standard sodium hydroxide. 6. Estimation of magnesium using EDTA. 7. Estimation of ferrous ion using diphenylamine as indicator.	CO1 CO2 CO3	K1,K2, K3,K4, K5
UNIT-II	**SYSTEMATICANALYSISOFORGANICCOMPOUNDS** 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.	CO4 CO5	K2,K3, K4,K5

Recommended Text Books

1. *V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles of Practical 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

COs	CO Description	Cognitive Level
CO1	Understanding of the use of standard flask and volumetric pipettes, burette.	K1,K2
CO2	Design, carry out, record and interpret the results of volumetric titration.	K2,K4,K5
CO3	Determine the strength of solution and calculate the amount.	K3,K4,K5
CO4	Analyze the organic compounds in systematic method	K2,K3,K4
CO5	Discover the functional group in the organic samples and confirm with suitable derivatives.	K2,K3,K4,K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	2	2	2	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	1	3	1
CO4	3	3	2	-	-	-	-	-	-	-	3	2	1
CO5	3	3	2	3	-	-	-	-	-	-	1	2	1

SCHEME OF VALUATION CHEMISTRY PRACTICAL FOR

PHYSICAL AND BIOLOGICAL SCIENCES

Internal assessment: 25 Marks

External assessment: 75 marks

Total: 100 marks

Max. Marks: 75

Record: 15 Marks

Volumetric Analysis: 35 Marks

Organic Analysis: 25 Marks

Volumetric Analysis :35 Marks (Maximum)
Short Procedure :5 Marks
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

Organic Analysis: 25 Marks

Preliminary Test: 3 Marks
Aliphatic or Aromatic: 3 Marks
Saturated or unsaturated: 3 Marks
Tests for elements: 9 Marks
Derivative/Coloured reaction: 7 Marks.

COURSE DESCRIPTORS

Title of the Course	ZOOLOGY - I	Hours/Week	05
Course Code	AUEZO13	Credits	03
Category	Elective I	Year & Semester	I & I
Prerequisites	Basics of Zoology.	Regulation	2024

Objectives of the course:

The course aims at giving an overall view of the

- To acquire a basic knowledge of diversity and organization of Protozoa, Coelenterata, Helminthes and Annelida.
- To acquire a basic knowledge of diversity and organization of Arthropoda, Mollusca and Echinodermata.
- To comprehend the taxonomic position and diversity among Protochordata, Pisces and Amphibia.
- To comprehend the taxonomic position and diversity among Reptilia, Aves and Mammalia.
- To acquire detailed knowledge of select invertebrate and chordate forms

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Diversity of Invertebrates–I** Principles of taxonomy. Criteria for classification – Symmetry and Coelom – Binomial nomenclature. Type study-Protozoa- Entamoeba, Porifera- Sycon. Coelenterata- Obeliageniculata. Platyhelminthes- Teaniasolium.	CO1	K1 K2 K3
UNIT-II	**Diversity of Invertebrates–II** Type study- Annelida- Earthworm, Arthropoda- Prawn, Mollusca- Fresh water mussel, Echinodermata- Sea.	CO2	K1 K2 K3
UNIT-III	**Diversity of Chordates–I** Classification and general characters of Prochordata-Classification and general characters of chordate. Type study – (includes Morphology, digestive system, respiratory system, circulatory system and urinogenital system) Prochordata: Morphology of Amphioxus. Vertebrates: Pisces– Shark.	CO3	K2 K4
UNIT-IV	**Diversity of Chordates–II** Type study of (includes Morphology, digestive system, respiratory system, circulatory system and urinogenital system) Amphibia: Frog, Reptiles: Calotes.	CO4	K3 K4

UNIT-V	Type study of (includes Morphology, digestive system, respiratory system, circulatory system and urinogenital system) Aves: Pigeon, Mammalia: Rabbit.	CO5	K1 K2 K3

Recommended Text Books

1. *Ekambaranatha Iyer,-Outlines of Zoology Viswanathan Publication.*

Reference Books

1. *Ekambaranatha Iyar and T.N.Ananthakrishnian - A Manual*
2. *Ekambaranatha Iyar and T.N.Ananthakrishnan,-A Manual of Zoology- Invertebrata Vol II: Viswanathan Publishors.*
3. *Ekambaranatha Iyar and T.N.Ananthakrishnan, Manual of Zoology: Chordata Viswanathan Publishers.*
4. *Jordan E.L. and P.S. Verma-Invertebrate Zoology, S.Chand&Co..*

Web Resources

1 www.sanctuaryasia.com.
2. www.iaszoology.com

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Recall the characteristic features invertebrates and chordates.	K1,K2
CO2	Classify invertebrates up to class level and chordates up to order level.	K2,K3
CO3	Explain and discuss the structural and functional organization of some invertebrates and chordates.	K2,K3,K4
CO4	Relate the adaptations and habits of animals to their habitat.	K2,K3
CO5	Analyze the taxonomic position of animals.	K2,K3,K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	2	1	-
CO2	3	2	1	-	-	-	-	-	-	-	3	1	1
CO3	3	3	2	-	-	-	-	-	-	-	2	2	1
CO4	3	3	1	-	-	-	-	-	-	-	3	2	1
CO5	3	3	2	2	-	-	-	-	-	-	3	2	1

COURSE DESCRIPTORS

Title of the Course	ZOOLOGY PRACTICAL (for Chemistry – I Year/I,II Semester)	**Hours/Week**	02
Course Code	AUEPZO23	**Credits**	01
Category	Elective II	**Year & Semester**	I &I, II
Prerequisites	Basic Zoology	**Regulation**	2024

Objectives of the course:

The course aims at giving an overall view of the

- To make them familiarize with basic laboratory techniques in related to Zoology.
- To make them understand the taxonomic position, body organization and evolutionary relationship of species.
- To inculcate the significance of various invertebrates and chordates in their ecosystem.
- To highlight the information on economic aspects of Zoology.
- To comprehend the theoretical and practical applications of species diversity.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**DISSECTION:** 1. Earthworm - Digestive and Nervous system. 2. Cockroach- Digestive and Nervous system. 3. Prawn – Nervous system	CO1 CO2 CO3 CO4 CO5	K1,K2, K3,K4, K5
UNIT-II	**MOUNTING:** 1. Mouth parts – honeybee, cockroach and mosquito (slide). 2. Earthworm – body setae and penial setae. 3. Fish – cycloid scale, ctenoid scale and placoid scale. 4. Pila – Radula (Slide)	CO1 CO2 CO3 CO4 CO5	K1,K2, K3,K4, K5
UNIT-III	**SPOTTERS** Invertebrata – Amoeba, Paramecium, Trypanosoma, Euglena, Plasmodium, Leucosolenia, Sycon sponge, Aurelia, Obelia, planaria, Liver fluke, Tapeworm, Cockroach, Planaria, Earthworm, Nereis, Leech, Prawn/Shrimp, Scorpion, Grasshopper, Fresh water mussel, Pila, Starfish.	CO1 CO2 CO3 CO4 CO5	K1,K2, K3,K4, K5

UNIT-IV	**SPOTTERS** Protochordata and Vertebrata Amphioxus, Shark, Catla, Frog, Salamander, Calotes, Chamaeleon, Turtle, Cobra, Viper, Pigeon, Rat, Bat, Rabbit.Sphygmomanometer, stethoscope, rain guage.	CO1 CO2 CO3 CO4 CO5	K1,K2, K3,K4, K5
UNIT-V	**SPOTTERS** Commercial important species: Apiculture (Apiary devices) - Newton's beehive, honey extracting devices, honey, wax Sericulture - Bombyxmori, cocoons, silk thread, rearing appliances. Aquaculture - Catla, Rohu, Mrigal, fresh water prawn (Macrobrachiumrosenbergii), marine shrimp– (Penaeusmonodon / Litopenaeusvannamei). Vermiculture– earthworm species - types.	CO1 CO2 CO3 CO4 CO5	K1,K2, K3,K4, K5

Recommended Text Books

1. *Ekambaranatha Iyyar and T. N. Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1, S. Viswanathan, Chennai.*
2. *Ganguly, Sinha an d A dhikari , 2 0 11 . Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.*
3. *Sinha, Chatterjee and Chattopadhyay, 2014. Advanced Practical Zoology, Books & Allied Ltd; 3rd Revised edition, 1070 pp.*
4. *Lal ,S. S, 2016 . Practical Zoology Invertebrate, Rastogi Publications.*
5. *Verma, P. S. 2010. A Manual of Practical Zoology: Invertebates, S Chand, 497pp.*
6. *Lal S S, 2009. Practical Zoology Vertebrate, Rajpal and Sons Publishing, 484pp.*

Reference Books

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science.

2. Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.

3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. I Edition, E.L.B.S. and Nelson.

4. Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students. Asia Publishing Home.

5. Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut.

Web Sources

1. *https://nbb.gov.in/*
2. *http://www.agshoney.com/training.htm*
3. *https://icar.org.in/*
4. *http://www.csrtimys.res.in/*
5. *http://csb.gov.in/*
6. *https://iinrg.icar.gov.in/*
7. *https://www.nationalgeographic.com/animals/invertebrates/*

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Practically identify species (fresh and preserved) along with its larval forms.	K1,K2, K3,K4, K5
CO2	Analyze the relationship among animals to their habitat.	K1,K2, K3,K4, K5
CO3	Recognize the diversity of invertebrate species from Protozoa to Echinodermata.	K1,K2, K3,K4, K5
CO4	Gain knowledge on significance of aquaculture and their economic role.	K1,K2, K3,K4, K5
CO5	Understand the significance of vermiculture technology and their ecological and economic importance.	K1,K2, K3,K4, K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	3	-	-	-	-	-	-	3	2	1
CO2	3	3	-	3	-	-	-	-	-	-	3	2	2
CO3	3	3	2	-	1	-	-	-	-	-	3	2	1
CO4	3	3	-	-	-	-	-	-	-	-	2	2	2
CO5	3	3	1	-	-	-	-	-	-	-	3	2	1

COURSE DESCRIPTORS

Title of the Course	BOTANY - I	**Hours/Week**	05
Course Code	AUEBO13	**Credits**	03
Category	Elective I	**Year & Semester**	I & I
Prerequisites	Basics of Botany.	**Regulation**	2024

Objectives of the course:

The course aims at giving an overall view of the

- To study morphological and anatomical adaptations of plants of various habitats.
- To demonstrate techniques of plant tissue culture.
- To familiarize with the structure of DNA, RNA.
- To carryout experiments related with plant physiology.
- To perform biochemistry experiments.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Algae and Bryophytes:** General characters of algae - Structure, reproduction and life cycle of the following genera - Anabaena and Sargassum and economic importance of algae. Generalcharacters of Bryophytes, Structure and life cycle of Funaria	CO1	K1 K2 K3
UNIT-II	**Fungi, Lichens, Bacteria and Virus:** General characters of fungi, structure, reproduction and life cycle of the following genera - Penicillium and Agaricus and economic importance of fungi. A brief account of Lichens Bacteria - general characters, structure and reproduction of Escherichia coli and economic importance of bacteria. Virus - general characters, structure of TMV, structure of bacteriophage	CO2	K1 K2 K3
UNIT-III	**Bryophytes, Pteridophytes and Gymnosperms:** General character of Bryophytes , Structure and life cycle of Funaria General character of Pteridophytes , Structure and life cycle of Lycopodium General character of Gymnosperms , Structure and life cycle of cycas.	CO3	K2 K4

UNIT-IV	**Cell Biology:** Prokaryotic and Eukaryotic cell- structure /organization. Cell organelles – ultrastructure and function of chloroplast, mitochondria and nucleus. Cell division – mitosisand meiosis	CO4	K3 K4
UNIT-V	**Genetics and Plant biotechnology** Mendelism- Law of dominance, Law of segregation, Incomplete domination. Law of independent assortment, Monohybridanddihybrid cross- Test cross-Back cross. Plant tissue culture – In vitro culturemethods. Plant tissue culture and its applicationin biotechnology.	CO5	K1 K2 K3

Recommended Text Books

1. *Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.*
2. *Bhatnagar, S.P and AlokMoitra. 2020. Gymnosperms, New AgeInternational (P) Ltd., Publishers, Bengaluru.*
3. *Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.*
4. *Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, NewDelhi.*
5. *Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany,S.Viswanathan Pvt. Ltd., Madras.*

Reference Books

1. *Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes -Surjeet Publications, Delhi.*
2. *Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.*
3. *Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms.Chand& Company Ltd, Delhi.*
4. *Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.*
5. *Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand & Company Ltd, Delhi.*
6. *Parihar, N.S. 2013. An introduction to Embryophyta –Bryophytes -Surjeet Publications, Delhi.*
7. *Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I &II,S.Chand and Co. New Delhi*

Web Resources

1. https://www.kobo.com/us/en/ebook/the-algae-world
2. http://www.freebookcentre.net/biology-books-download/Fungi-(PDF15P).html
3. http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm
4. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/
5. https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyondpine-cones-an-introduction-to-gymnosperms.pdf
6. https://www.us.elsevierhealth.com/medicine/cell-biology
7. https://www.us.elsevierhealth.com/medicine/genetics
8. https://www.kobo.com/us/en/ebook/plant-biotechnology-1

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Increase the awareness and appreciation of human friendly algae and their Economic importance.	K1,K2,K3
CO2	Develop an understanding of microbes and fungi and appreciate their adaptive strategies	K1,K2,K3
CO3	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	K2,K4
CO4	Compare the structure and function of cells and explain the development of cells.	K3,K4
CO5	Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.	K1,K2,K3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	-	-	2	1	3
CO2	3	3	2	-	-	-	-	-	-	-	2	2	1
CO3	3	3	3	2	-	-	-	-	-	-	3	2	-
CO4	3	3	2	-	-	-	-	-	-	-	2	2	1
CO5	3	3	-	2	-	-	-	-	-	-	2	1	1

COURSE DESCRIPTORS

Title of the Course	BOTANY PRACTICAL (for Chemistry – I Year/I,II Semester)	**Hours/Week**	02
Course Code	AUEPBO23	**Credits**	01
Category	Elective II	**Year & Semester**	I &I, II
Prerequisites	BasicBotany	**Regulation**	2024

Objectives of the course:

The course aims at giving an overall view of the

- To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, and fungi.
- To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.
- To be familiar with the basic concepts and principles of plant systematics.
- Understanding of laws of inheritance, genetic basis of loci and alleles.
- To learn about the physiological processes that underlie plant metabolism.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	1. Make suitable micro preparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms. 2. Micro photographs of the cell organelles ultra structure. 3. Simple genetic problems. 4. To describe in technical terms, plants belonging to any of the family prescribes and to identify the family. 5. To dissect a flower, construct floral diagram and write floral formula. 6. Demonstration experiments 1. Ganong's Light screen 2. Ganong'srespiroscope 7. To make suitable micro preparations of anatomy materials prescribed in the syllabus. 8. Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperm anatomy, Embryology, Cell biology and Biotechnology.	CO1 CO2 CO3 CO4 CO5	K1,K2, K3,K4, K5

Recommended Text Books

1. *Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.*
2. *Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.*
3. *Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.*
4. *Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.*
5. *Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.*

Reference Books

1. *Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.*
2. *Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.*
3. *Mohammed Gufran Khan, Shite Gatew and BediluBekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.*
4. *Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press & Wiley Publications.*
5. *Steward, F.C. 2012. Plant Physiology Academic Press, US*

Web Sources

1. *https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883*
2. *https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover*
3. *https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ*
4. *https://medlineplus.gov/genetocs/understanding/basics/cell/*
5. *https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf*
6. *http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf*
7. *https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4*

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Explain the internal organization of algae and fungi.	K1,K2,K3
CO2	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	K3,K4,K5
CO3	Discuss the classical taxonomy with reference to different parameters.	K2,K3,K4
CO4	Understand the fundamental concepts of plant anatomy and embryology.	K2,K3,K4
CO5	Describe the effect of various physical factors on photosynthesis.	K3,K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	2	-	-	-	-	-	-	-	3	3	1
CO3	3	3	-	1	-	-	-	-	-	-	2	1	-
CO4	3	3	-	-	-	-	-	-	-	-	2	2	1
CO5	3	3	2	1	-	-	-	-	-	-	2	1	2

COURSE DESCRIPTORS

Title of the Course	General Chemistry-II	**Hours/Week**	05
Course Code	AUCCH21	**Credits**	05
Category	Core-3	**Year & Semester**	I & II
Prerequisites	Higher Secondary Chemistry	**Regulation**	2024

Objectives of the course:

This course aims to providing an overall view of the

- Chemistry of acids, bases and ionic equilibrium
- Properties of s and p-block elements
- Chemistry of hydrocarbons
- Aromatic electrophilic substitutions and their mechanisms
- Polynuclear Aromatic hydrocarbons

UNITS	Contents	COs	Cognitive Levels
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; 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 Buffer solutions and Solubility product concepts.	CO1	K1, K2, K3, K4
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. Diagonal relationship of Li with Mg. 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.	CO2	K1, K2, K3

UNIT-III	**Chemistry of p- Block Elements (Group 15-18)** General characteristics of elements of Group 15; Chemistry of H_2N-NH_2, NH_2OH, HN_3 and HNO_3. Chemistry of PH_3, PCl_3, PCl_5, $POCl_3$, P_2O_5 and oxy acids of phosphorous (H_3PO_3 and H_3PO_4). General properties of elements of Group16 - Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - oxides of sulphur SO_2 SO_3 H_2SO_4 and selenium SeO_2 – 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 XeF_2, XeF_4, XeF_6 and $XeOF_4$; uses of noble gases - clathrate compounds.	CO2, CO3	K1, K2, K3, K4
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 – E_1 and E_2 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; **Alkynes** Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene. **Cycloalkanes:** Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations.	CO4	K3, K4, K5

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. 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.	CO5	K3, K4, K5, K6

Recommended 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, 4thed., The Macmillan Company, Newyork.

2.Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, New Delhi.

3.Lee J D, (1991), Concise Inorganic Chemistry, 4thed., ELBS William Heinemann, London.

4.Huheey J E, (1993), Inorganic Chemistry: Principles of Structure and Reactivity, 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 and e-learning source

1) https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/smblack/chem1010/lec ture_notes/4B.html
2) http://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/course/64 - atomic-structure-and-chemical-bonding
3) **MOOC components**
4) http://nptel.ac.in/courses/104101090/
5) Lecture 1: Classification of elements and periodic properties http://nptel.ac.in/courses/104101090/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Describe the different Acid - Base concepts and relation with pH	K1, K2, K3, K4
CO2	Explain the position, Anomalous behaviour, Diagonal relationship and extraction of s, p block elements.	K1, K2, K3
CO3	Discuss the General characteristics, Structure and allotropy of p block elements.	K1, K2, K3,K4
CO4	Predict the Nomenclature of hydrocarbons and their reaction mechanisms	K3,K4,K5
CO5	Determine the factors influence the electrophilic substitution reactions	K3,K4,K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	2	3	3	3	1
CO2	3	3	1	2	-	-	-	-	-	2	3	2	-
CO3	3	3	3	1	-	-	-	-	-	3	3	2	2
CO4	3	3	3	2	-	-	-	-	-	3	3	3	2
CO5	3	3	3	-	-	-	-	-	1	2	3	2	1

COURSE DESCRIPTORS

Title of the Course	Qualitative Organic Analysis and Preparation of Organic Compounds	**Hours/Week**	04
Course Code	AUCPCH22	**Credits**	04
Category	Core-4	**Year & Semester**	I & II
Prerequisites	Higher secondary Chemistry	**Regulation**	2024

Objectives of the course:

This course aims at providing knowledge on

- Laboratory safety
- Handling glass wares
- Analysis of organic compounds
- Preparation of organic compounds

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Safety rules, symbols and first-aid in chemistry laboratory. Basic ideas about Bunsen burner, its operation and parts of the flame. Chemistrylaboratory glassware –basis information and uses. Safety rules, symbols and first-aid in chemistry laboratory. Basic ideas about Bunsen burner, its operation and parts of the flame. Chemistrylaboratory glassware –basis information and uses. Safety rules, symbols and first-aid in chemistry laboratory	CO1, CO2, CO3, CO4, CO5	K1,K2,K3, K4,K5,K6

UNIT-II	**Qualitative Organic Analysis** Preliminary examination, detection of special elements - nitrogen, sulphur and halogens 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	CO1, CO2, CO3, CO4,	K1, K2, K3, K4, K5
UNIT-III	Preparation of Organic Compounds (Any 5) 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 viii. Hydrolysis of benzamide to Benzoic Acid	CO5	K4,K5,K6

Recommended Text Books

1. *Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. Basic Principles of 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's Textbook of Practical Organic Chemistry, 5th ed.; Pearson: India,1989.*

Reference Books

1. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; Vogel's Textbook ofQuantitative Chemical Analysis, 6th ed.; Pearson Education Ltd: New Delhi, 2000

Website and e-learning source

1) 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

COs	CO Description	Cognitive Level
CO1	Understand the importance of physical state, odour, colour and solubility of organic compounds in qualitative analysis.	K1, K2
CO2	Identify the special elements and functional group in organic compound to performing a systematic analysis.	K3,K4,K5
CO3	Analyze different chemical properties between primary, secondary, tertiary and mono-di functional groups of organic compounds.	K3,K4
CO4	Explain the conformation of functional groups through preparation of solid derivatives.	K3,K4
CO5	Prepare different organic compounds using several organic reactions.	K4,K5,K6

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	-	-	-	-	-	-	-	3	2	1
CO2	3	3	3	3	2	-	-	-	-	3	3	3	2
CO3	3	3	3	3	3	-	-	-	-	3	3	3	1
CO4	3	3	3	3	3	-	-	-	-	-	3	3	2
CO5	3	3	3	3	-	-	-	-	-	3	3	3	1

SCHEME OF VALUATION

QUALITATIVE ORGANIC ANALYSIS AND

PREPARATION OFORGANIC COMPOUNDS

Internal assessment: 25 Marks

External assessment: 75 marks

Total: 100 marks

Max. Marks: 75

Record: 15 Marks

Preparation: 20 (quantity: 10 & quality: 10)

Organic Analysis: 40 Marks

Organic Analysis: 40 Marks

Aliphatic or Aromatic: 6 Marks

Saturated or unsaturated: 6 Marks

Tests for elements: 9 Marks

Preliminary Test: 7 Marks

Confirmation Tests: 12 Marks.

COURSE DESCRIPTORS

Title of the Course	DAIRY CHEMISTRY	**Hours/Week**	02
Course Code	AUSCH24	**Credits**	02
Category	Skill Enhancement Course	**Year & Semester**	I & II
Prerequisites	Higher Secondary Chemistry	**Regulation**	2024

Objectives of the course:

The course aims to giving an overall view of the

- Chemistry of milk and milk products.
- Processing of milk.
- Preservation and formation of milk products.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Composition of Milk** Milk-definition-general composition of milk- constituents of milk - lipids, proteins, carbohydrates, vitamins and minerals - physical properties of milk -colour, odour, acidity, specific gravity, viscosity and conductivity - Factors affecting the composition of milk - adulterants, preservatives with neutralizer- examples and their detection- estimation of fat, acidity and total solids in milk.	CO1	K1,K2
UNIT-II	**Processing of Milk** Microbiology of milk - destruction of micro - organisms in milk, physico – chemical changes taking place in milk due to processing - boiling, pasteurization – types of pasteurization -Bottle, Batch and HTST (High Temperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization.	CO2	K1, K2, K3
UNIT-III	**Major Milk Products** Cream - definition - composition - chemistry of creaming process - gravitational and centrifugal methods of separation of cream - estimation of fat in cream. Butter - definition -composition - theory of churning – desi butter - salted butter, estimation of acidity and moisture content in butter. Ghee - major constituents - common adulterants added to ghee and their detection – rancidity - definition - prevention - antioxidants and synergists - natural and synthetic.	CO3	K1, K2, K3, K4

UNIT-IV	**Special Milk** Standardised milk - definition - merits - reconstituted milk - definition - flow diagram of manufacture - Homogenised milk - flavoured milk - vitaminised milk - toned milk -Incitation milk - Vegetable toned milk - humanized milk - condensed milk - definition, composition and nutritive value.	CO1, CO4	K2, K3, K4
UNIT-V	**Fermented and other Milk Products** Fermented milk products – fermentation of milk - definition, conditions, cultured milk - Ice cream -definition-percentage composition-types-ingredients-manufacture of ice–cream, stabilizers – emulsifiers and their role- milk powder-definition-need for making milk powder- drying process-types of drying.	CO5	K3, K4, K5

Recommended Text Books

1. *K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition, 2006.*
2. *K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia Publishing House New Delhi, 1974.*
3. *Text book of dairy chemistry, M.P. Mathur, D. Datta Roy, P. Dinakar, Indian Council of Agricultural Research, 1 st edition, 2008.*
4. *A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1 st edition,2013.*
5. *Text book of dairy chemistry, P. L. Choudhary, Bio-Green book publishers, 2021.*

Reference Books

1. *Robert Jenness and S. Patom, Principles of Dairy Chemistry, S.Wiley, New York, 2005.*
2. *F.P.Wond, Fundamentals of Dairy Chemistry,Springer,Singapore,2006.*
3. *Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980.*
4. *P.F.Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry, Springer, Second edition, 2016.*
5. *Dairy chemistry and biochemistry, P. F. Fox, T. Uniacke-Lowe, P.L.H. McSweeney, J.A. OMahony, Springer, Second edition, 2015.*

Website and e-learning source

1. http://ecoursesonline.iasri.res.in/course/index.php?categoryid=10
2. https://ecourses.icar.gov.in/e-Leaarningdownload3_new.aspx?Degree_Id=06

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Understand general composition and physical properties of milk.	K1, K2
CO2	Explain the chemical changes taking place in milk due to processing.	K1, K2, K3
CO3	Discuss the adulterants and estimation of acidity, moisture content in ghee and butter.	K1, K2, K3, K4
CO4	Analyze the different Preparation process of Special Milks	K2, K3, K4
CO5	Distinguish the Fermented Milk Products and other Milk Products	K3, K4, K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	-	-	-	-	-	-	3	3	3	2
CO2	3	3	3	-	-	-	-	-	-	-	3	3	1
CO3	3	3	2	3	3	-	-	-	-	3	3	3	2
CO4	3	3	3	1	2	-	-	-	-	2	2	1	2
CO5	3	3	3	-	-	-	-	-	-	2	3	2	2

COURSE DESCRIPTORS

Title of the Course	Cosmetics and Personal Grooming	**Hours/Week**	02
Course Code	AUFCH25	**Credits**	02
Category	Skill Enhancement Course	**Year & Semester**	I & II
Prerequisites	Higher Secondary Chemistry	**Regulation**	2024

Objectives of the course:

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

UNITS	Contents	COs	Cognitive Levels
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.	CO1	K1, K2
UNIT-II	**Hair care** Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner – types –ingredients. **Dental care** Tooth pastes – ingredients – mouth wash	CO2	K2,K3, K4
UNIT-III	**Make up** Base – foundation – types – ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouge	CO3	K1,K2,K3

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	CO4	K1,K2,K3
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	CO5	K1,K2,K3

Recommended Text Books

1. *1. Thankamma Jacob, (1997) Foods, drugs and cometics – A consumer guide, Macmillan publication, London.*

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

COs	CO Description	Cognitive Level
CO1	Understand the Nutrition, skin care and cleansing of the skin.	K1, K2
CO2	Discuss the ingredients in Shampoos, conditioner, Tooth pastes and mouth wash.	K2,K3,K4
CO3	Explain the makeup kits and their ingredients in lipstick, eyeliner, mascara, eye shadow, concealers, rouge.	K1,K2,K3
CO4	Describe the different types of Perfumes and their chemical ingredients	K1,K2,K3
CO5	Explain the different types Beauty treatments	K1,K2,K3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	-	-	-	-	-	-	3	3	2	2
CO2	3	3	1	2	-	-	-	-	-	2	2	2	1
CO3	3	3	2	-	-	-	-	-	-	2	3	1	2
CO4	3	3	3	3	-	-	-	-	-	3	2	3	3
CO5	3	3	1	-	-	-	-	-	-	2	1	2	-

COURSE DESCRIPTORS

Title of the Course	CHEMISTRY - II (For Biochemistry – I Year / II Semester)	**Hours/Week**	03
Course Code	AUECH23	**Credits**	02
Category	Generic Elective II	**Year & Semester**	I & II
Prerequisites	Higher Secondary Chemistry	**Regulation**	2024

Objectives of the course:

The course aims to giving an overall view of the

- Nomenclature of coordination compounds and carbohydrates.
- Amino Acids and Essential elements of biosystem.
- Understand the concepts of kinetics and catalysis
- Provide fundamentals of electrochemistry and photochemistry

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Co-ordination Chemistry and Water Technology** Co-ordination Chemistry**:** Definition of terms - IUPAC Nomenclature- Werner's theory - EAN rule - Pauling's theory – Postulates - Applications to $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$,$[Co(CN)_6]^{3-}$ Chelation - Biological role of Hemoglobin and Chlorophyll (elementary idea). Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques –BOD and COD.	CO1	K1,K2, K3,K4
UNIT-II	**Carbohydrates** Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Glucose-fructose inter conversion. Preparation and properties of sucrose, starch and cellulose.	CO2	K2,K3

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.	CO3	K1,K2, K3
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.	CO4	K1,K2, K3,K4, K5
UNIT-V	**Photochemistry** Photochemistry Grothus - Drapper'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).	CO5	K2,K3, K4

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

Reference Book

1. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.

2. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

3. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.

4. B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.

5. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

Websiteande-learningsource

1.1)https://sites.google.com/site/chemistryebookscollection02/home/organic-chemistry/organic

2)https://www.organic-chemistry.org/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Explain the bonding in coordination compounds and their application in water purification techniques.	K1,K2, K3,K4
CO2	Distinguish properties, preparation of glucose, fructose and starch, cellulose.	K2,K3
CO3	Discuss the biological role of transition metals, amino acids and nucleic acids.	K1,K2,K3
CO4	Explain mechanism of fuel cells, industrial applications of electroplating process.	K1,K2,K3,K4,K5
CO5	Know the principles and various photochemical processes in chemical compounds.	K2,K3,K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	-	3	2	-	-	-	-	2	2	1	1
CO2	3	2	-	1	-	-	-	-	-	-	2	1	1
CO3	3	2	-	-	-	-	-	-	-	-	2	1	1
CO4	3	2	3	2	2	-	-	-	-	3	3	2	3
CO5	3	3	1	1	-	-	-	-	-	2	2	2	1

COURSE DESCRIPTORS

Title of the Course	CHEMISTRY PRACTICAL (for Biochemistry – I Year / I,II Semester)	**Hours/Week**	03
Course Code	AUEPCH23	**Credits**	01
Category	Generic Elective I	**Year & Semester**	I & I, II
Prerequisites	Higher Secondary Chemistry	**Regulation**	2024

Objectives of the course:

The course aims at giving an overall view of the

- Basics of preparation of solutions.
- Principles and practical experience of volumetric analysis
- Identification of organic functional groups
- Different types of organic compounds with respect to their properties.
- Determination of elements in organic compounds..

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**VOLUMETRICANALYSIS** 1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Estimation of hydrochloric acid using standard oxalic acid. 3. Estimation of ferroussulphate using standard Mohr's salt. 4. Estimation of oxalic acid using standard ferroussulphate. 5. Estimation of potassium permanganate using standard sodium hydroxide. 6. Estimation of magnesium using EDTA. 7. Estimation of ferrous ion using diphenylamine as indicator.	CO1 CO2 CO3	K1,K2, K3,K4, K5
UNIT-II	**SYSTEMATICANALYSISOFORGANICCOMPOUNDS** 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.	CO4 CO5	K2,K3, K4,K5

Recommended Text Books

1.V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles of Practical 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

COs	CO Description	Cognitive Level
CO1	Understanding of the use of standard flask and volumetric pipettes, burette.	K1,K2
CO2	Design, carry out, record and interpret the results of volumetric titration.	K2,K4,K5
CO3	Determine the strength of solution and calculate the amount.	K3,K4,K5
CO4	Analyze the organic compounds in systematic method	K2,K3,K4
CO5	Discover the functional group in the organic samples and confirm with suitable derivatives.	K2,K3,K4,K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	2	2	2	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	1	3	1
CO4	3	3	2	-	-	-	-	-	-	-	3	2	1
CO5	3	3	2	3	-	-	-	-	-	-	1	2	1

SCHEME OF VALUATION CHEMISTRY PRACTICAL FOR BIOLOGICAL SCIENCES

Internal assessment: 25 Marks

External assessment: 75 marks

Total: 100 marks

Max. Marks: 75

Record: 15 Marks

Volumetric Analysis: 35 Marks

Organic Analysis: 25 Marks

Volumetric Analysis : 35 Marks (Maximum)

Short Procedure :5 Marks

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 5 marks scored

No calculation : Deduct 40 % of marks scored

Organic Analysis: 25 Marks

Preliminary Test:	*3 Marks*
Aliphatic or Aromatic:	*3 Marks*
Saturated or unsaturated:	*3 Marks*
Tests for elements:	*9 Marks*
Derivative/Coloured reaction:	*7 Marks.*

COURSE DESCRIPTORS

Title of the Course	ZOOLOGY - II	**Hours/Week**	03
Course Code	AUEZO23	**Credits**	02
Category	Elective II	**Year & Semester**	I & II
Prerequisites	Basics of Zoology.	**Regulation**	2024

Objectives of the course:

The course aims to giving an overall view of the

- Learn basic concepts relating to aspects of respiratory, circulatory, excretory nervous and sensory physiology.
- Comprehend the processes involved during development.
- Learn basic concepts of immunity and the working of immune organs and familiarize them with the recommended vaccination schedule.
- Comprehend the basic concepts of human genetics and patterns of inheritance
- Learn about aspects of animal behaviour such as foraging, courtship, nest construction, parental care and learning

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Respiration- Respiratory pigments and transport of gases. Mechanism of blood clotting. Types of excretory products – Ornithine cycle. Structure of neuron – Conduction of nerve impulse, Mechanism of vision and hearing.	CO1	K1 K2
UNIT-II	Fertilization, Cleavage, Gastrulation and Organogenesis in Frog; Placentation in mammals.	CO2	K2,K3,K4
UNIT-III	Innate and Acquired - Active and Passive; Antigens and Antibodies; Immunological responses in humans; Vaccination schedule	CO3	K2, K3, K4
UNIT-IV	Human Genetics: Human Chromosomes – Sex Determination in Humans; Patterns of Inheritance: Autosomal Dominant, Autosomal Recessive, X-linked, Y-linked, Mitochondrial, Multiple Allelic and Polygenic; Genetic Counselling	CO4	K2, K3, K4

UNIT-V	Animal Behaviour: Foraging, Courtship Behaviour, Shelter and Nest Construction, Parental Care, Learning Behaviour.	CO5	K1, K2, K3

Recommended Text Books

1. *Verma P.S. & Agarwal - Developmental Biology, Chordata embryology S. Chand & Co.*

Reference Books

1. *Owen, J. A., Punt, J. & Stranford, S. A. - Kuby Immunology. New York: W.H. Freeman & Company*
2. *Klug, W. S., Cummings, M. R. & Spencer, C - Concepts of Genetics. (12th ed.). New Jersey: Pearson Education.*
3. *Mathur, R.- Animal Behaviour. Meerut: Rastogi.*
4. *Verma P.S. & Agarwal-Developmental Biology, Chordataembryology S.Chand & Co.*

Web Resources

1 www.sanctuaryasia.com.
2. www.iaszoology.com

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Recall the parts and working of body organs and developmental stages, name the patterns of inheritance and list different types of animal behaviour.	K1,K2
CO2	Analyse the different developmental stages	K2,K3,K4
CO3	Analyse the working of body and immune systems	K2,K3,K4
CO4	Analyse the different patterns of inheritance	K2,K3,K4
CO5	Relate the behaviour of animals to physiology. Analyse the different types of behaviour	K1, K2,K3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	2	1	-
CO2	3	2	1	-	-	-	-	-	-	-	3	1	1
CO3	3	3	2	-	-	-	-	-	-	-	2	2	1
CO4	3	3	1	-	-	-	-	-	-	-	3	2	1
CO5	3	3	2	2	-	-	-	-	-	-	3	2	1

COURSE DESCRIPTORS

Title of the Course	ZOOLOGY PRACTICAL (for Chemistry – I Year/I,II Semester)	**Hours/Week**	02
Course Code	AUEPZO23	**Credits**	01
Category	Elective II	**Year & Semester**	I & I, II
Prerequisites	Basic Zoology	**Regulation**	2024

Objectives of the course:

The course aims at giving an overall view of the

- To make them familiarize with basic laboratory techniques in related to Zoology.
- To make them understand the taxonomic position, body organization and evolutionary relationship of species.
- To inculcate the significance of various invertebrates and chordates in their ecosystem.
- To highlight the information on economic aspects of Zoology.
- To comprehend the theoretical and practical applications of species diversity.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**DISSECTION:** 1. Earthworm - Digestive and Nervous system. 2. Cockroach- Digestive and Nervous system. 3. Prawn – Nervous system	CO1 CO2 CO3 CO4 CO5	K1,K2, K3,K4,K5
UNIT-II	**MOUNTING:** 1. Mouth parts – honeybee, cockroach and mosquito (slide). 2. Earthworm – body setae and penial setae. 3. Fish – cycloid scale, ctenoid scale and placoid scale. 4. Pila – Radula (Slide)	CO1 CO2 CO3 CO4 CO5	K1,K2, K3,K4,K5
UNIT-III	**SPOTTERS** Invertebrata – Amoeba, Paramecium, Trypanosoma, Euglena, Plasmodium, Leucosolenia, Sycon sponge, Aurelia, Obelia, planaria, Liver fluke, Tapeworm, Cockroach, Planaria, Earthworm, Nereis, Leech, Prawn/Shrimp, Scorpion, Grasshopper, Fresh water mussel, Pila, Starfish.	CO1 CO2 CO3 CO4 CO5	K1,K2, K3,K4,K5

UNIT-IV	**SPOTTERS** Protochordata and Vertebrata Amphioxus, Shark, Catla, Frog, Salamander, Calotes, Chamaeleon, Turtle, Cobra, Viper, Pigeon, Rat, Bat, Rabbit.Sphygmomanometer, stethoscope, rain guage.	CO1 CO2 CO3 CO4 CO5	K1,K2, K3,K4,K5
UNIT-V	**SPOTTERS** Commercial important species: Apiculture (Apiary devices) - Newton's beehive, honey extractingdevices, honey, wax Sericulture - Bombyxmori, cocoons, silk thread, rearing appliances. Aquaculture - Catla, Rohu, Mrigal, fresh water prawn (Macrobrachiumrosenbergii), marine shrimp– (Penaeusmonodon / Litopenaeusvannamei). Vermiculture– earthworm species - types.	CO1 CO2 CO3 CO4 CO5	K1,K2, K3,K4,K5

Recommended Text Books

1. *Ekambaranatha Iyyar and T. N. Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1, S. Viswanathan, Chennai.*
2. *Ganguly, Sinha an d A dhikari , 2 0 11 . Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.*
3. *Sinha, Chatterjee and Chattopadhyay, 2014. Advanced Practical Zoology, Books & Allied Ltd; 3rd Revised edition, 1070 pp.*
4. *Lal ,S. S, 2016 . Practical Zoology Invertebrate, Rastogi Publications.*
5. *Verma, P. S. 2010. A Manual of Practical Zoology: Invertebates, S Chand, 497pp.*
6. *Lal S S, 2009. Practical Zoology Vertebrate, Rajpal and Sons Publishing, 484pp.*

Reference Books

1. *Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science.*
2. *Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.*
3. *Barrington, E.J.W. (1979). Invertebrate Structure and Functions. I Edition, E.L.B.S. and Nelson.*
4. *Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students. Asia Publishing Home.*
5. *Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut.*

Web Sources

1. *https://nbb.gov.in/*
2. *http://www.agshoney.com/training.htm*
3. *https://icar.org.in/*
4. *http://www.csrtimys.res.in/*
5. *http://csb.gov.in/*
6. *https://iinrg.icar.gov.in/*
7. *https://www.nationalgeographic.com/animals/invertebrates/*

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Practically identify species (fresh and preserved) along with its larval forms.	K3,K4,K5
CO2	Analyze the relationship among animals to their habitat.	K2,K3,K4
CO3	Recognize the diversity of invertebrate species from Protozoa to Echinodermata.	K2,K3,K4
CO4	Gain knowledge on significance of aquaculture and their economic role.	K1,K2,K3
CO5	Understand the significance of vermiculture technology and their ecological and economic importance.	K2,K3,K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	3	-	-	-	-	-	-	3	2	1
CO2	3	3	-	3	-	-	-	-	-	-	3	2	2
CO3	3	3	2	-	1	-	-	-	-	-	3	2	1
CO4	3	3	-	-	-	-	-	-	-	-	2	2	2
CO5	3	3	1	-	-	-	-	-	-	-	3	2	1

COURSE DESCRIPTORS

Title of the Course	BOTANY - II	**Hours/Week**	03
Course Code	AUEBO23	**Credits**	02
Category	Elective II	**Year & Semester**	I & II
Prerequisites	Basics of Botany.	**Regulation**	2024

Objectives of the course:

The course aims to giving an overall view of the

- Familiar with the basic concepts and principles of plant systematics.
- Learn the importance of plant anatomy in plant production systems.
- Understand the mechanism underling the shift from vegetative to reproductive phase.
- Learn about the physiological processes that underlie plant metabolism.
- Know the energy production and its utilization in plants.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**MORPHOLOGY OF FLOWERING PLANTS:** Plant and its parts. Structure and function of root and stem. Leaf and its parts. Leaf types- simple and compound. Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special types. Terminology with reference to flower description.	CO1	K1,K2,K3
UNIT-II	**TAXONOMY:** Study of the range of characters and plants of economic importance in the following families: Rutaceae, Caesalpiniaceae, Asclepiadaceae, Euphorbiaceae and Cannaceae.	CO2	K1,K2,K3
UNIT-III	**ANATOMY** Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.	CO3	K2,K4

UNIT-IV	**EMBRYOLOGY** Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination -double fertilization, structure of dicotyledonous and monocotyledonous seeds.	CO4	K3,K4
UNIT-V	**PLANT PHYSIOLOGY** Absorption of water, photosynthesis - light reaction - Calvin cycle; respiration - Glycolysis - Krebs cycle - electron transport system. Growth hormones - auxins and cytokinins and their applications.	CO5	K1,K2,K3

Recommended Text Books

1. *Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.*
2. *Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi.*
3. *Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.*
4. *Salisbury, F. B.C.W. Ross.1991. Plant Physiology. Wassworth Pub. Co. Belmont.*
5. *Ting, I.P. 1982. Plant Physiology. Addison Wesley Pb. Philippines.*

Reference Books

1. *Lawrence.G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.*
2. *Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.*
3. *Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.*
4. *Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd.*
5. *Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.*
6. *Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand and Company Ltd., New Delhi.*
7. *Verma, S.K. 2006. A Textbook of Plant Physiology, S.K.Chand & Co., New Delhi.*

Web Resources

1. https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&redir_escy
2. https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFnUC&redir_e sc=y
3. https://archive.org/EXPERIMENTS/plantanatomy031773mbp
4. https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG
5. https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Understand the fundamental concepts of plant anatomy and embryology.	K1,K2,K3
CO2	Analyze and recognize the different organs of plants and secondary growth.	K1,K2,K3
CO3	Understand water relation of plants with respect to various physiological processes.	K2,K4
CO4	Classify aerobic and anaerobic respiration.	K3,K4
CO5	Classify plant systematics and recognize the importance of herbarium and virtual herbarium.	K1,K2,K3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	-	-	-	-	-	-	3	3	3	2
CO2	3	3	3	3	-	-	-	-	-	2	2	-	1
CO3	3	3	-	-	-	-	-	-	-	2	3	3	2
CO4	3	3	3	-	-	-	-	-	-	-	2	1	2
CO5	3	3	2	1	-	-	-	-	-	1	2	2	2

COURSE DESCRIPTORS

Title of the Course	BOTANY PRACTICAL (for Chemistry – I Year/I,II Semester)	**Hours/Week**	02
Course Code	AUEPBO23	**Credits**	01
Category	Elective II	**Year & Semester**	I & I, II
Prerequisites	Basic Botany	**Regulation**	2024

Objectives of the course:

The course aims at giving an overall view of the

- To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, and fungi.
- To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.
- To be familiar with the basic concepts and principles of plant systematics.
- Understanding of laws of inheritance, genetic basis of loci and alleles.
- To learn about the physiological processes that underlie plant metabolism.

Units	Contents	COs	Cognitive Levels
	1. Make suitable micro preparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms. 2. Micro photographs of the cell organelles ultra structure. 3. Simple genetic problems. 4. To describe in technical terms, plants belonging to any of the family prescribes and to identify the family. 5. To dissect a flower, construct floral diagram and write floral formula. 6. Demonstration experiments 1. Ganong's Light screen 2. Ganong'srespiroscope 7. To make suitable micro preparations of anatomy materials prescribed in the syllabus. 8. Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperm anatomy, Embryology, Cell biology and Biotechnology.	CO1 CO2 CO3 CO4 CO5	K1,K2, K3,K4, K5,K6

Recommended Text Books

1. *Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.*
2. *Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.*
3. *Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.*
4. *Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.*
5. *Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.*

Reference Books

1. *Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.*
2. *Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.*
3. *Mohammed Gufran Khan, Shite Gatew and BediluBekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.*
4. *Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press & Wiley Publications.*
5. *Steward, F.C. 2012. Plant Physiology Academic Press, US*

Web Sources

1. *https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883*
2. *https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover*
3. *https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ*
4. *https://medlineplus.gov/genetocs/understanding/basics/cell/*
5. *https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf*
6. *http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf*
7. *https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4*

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Explain the internal organization of algae and fungi.	K1,K2,K3
CO2	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	K3,K4,K5
CO3	Discuss the classical taxonomy with reference to different parameters.	K2,K3,K4
CO4	Understand the fundamental concepts of plant anatomy and embryology.	K2,K3,K4
CO5	Describe the effect of various physical factors on photosynthesis.	K3,K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	2	-	-	-	-	-	-	-	3	3	1
CO3	3	3	-	1	-	-	-	-	-	-	2	1	-
CO4	3	3	-	-	-	-	-	-	-	-	2	2	1
CO5	3	3	2	1	-	-	-	-	-	-	2	1	2

COURSE DESCRIPTORS

Title of the Course	General Chemistry–III	**Hours/Week**	05
Course Code	AUCCH31	**Credits**	05
Category	Core - 5	**Year & Semester**	II & III
Prerequisites	General Chemistry – I and II	**Regulation**	2024

Objectives of the course:

This course aims to provide a comprehensive knowledge on

- The physical properties of gases, liquids, solids and X-ray diffraction of solids.
- Fundamentals of nuclear chemistry and nuclear waste management.
- Applications of nuclear energy
- Basic Chemistry of halo-organic compounds, phenol and other aromatic alcohols.
- Preparation and properties of phenols and alcohols.

UNITS	Contents	COs	Cognitive Levels
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, 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; 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.	CO1	K1, K2, K3

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; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X – ray diffraction – Bragg's equation Packing in atomic solids – simple cubic, body centered cubic, face centered and hexagonal close packing. Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO_2 ; comparison of structure and properties of diamond and graphite; Defects in solids - stoichiometric and nonstoichiometric defects. Numerical problems involving core concepts Liquid crystals – classification and applications.	CO2	K1, K2, K3
UNIT-III	**Nuclear Chemistry** Natural radioactivity - alpha, beta and gamma 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 stability - neutron- proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and B.E., decay constant and $t_{1/2}$ 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.	CO3	K1, K2
UNIT-IV	**Halogen derivatives** **Aliphatic halogen derivatives** Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions – S_N1, S_N2 and S_Ni mechanisms with stereochemical aspects and effect of solvent. Di, Tri & Tetra Halogen derivatives: Nomenclature, classification, preparation, properties and applications of CH_2Cl_2, $CHCl_3$, CCl_4. **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.	CO4	K1, K2

UNIT-V	**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.	CO5	K1, K2, K3

Recommended Text Books

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 an K.C. Kalia Principles of Inorganic Chemistry, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009.*
3. *P.L. Soni and Mohan Katyal, Textbook of Inorganic Chemistry, Sultan Chand & amp; Sons, twentieth edition, 2006.*
4. *S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 1994.*
5. *B.S Bahl and Arun Bahl, A Textbook of Organic Chemistry, S. Chand Publishing, 2017.*
6. *R. D. Madan, Modern Inorganic Chemistry 3rd Edition, S. Chand & Company Ltd., New Delhi, 2007.*

Reference Books

1. *T. W. Graham Solomons, Organic Chemistry, John Wiley & Sons, fifth edition, 1992.*
2. *Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt., Ltd.,New Delhi, seventh edition, 2009.*
3. *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.*
6. *M. K. Jain, S. C. Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2003.*

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 Introduction to organic chemistry

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Describe the correlation between the various forces with gas molecules	K1, K2, K3
CO2	Explain the different properties of liquid and solid materials with their geometry	K1, K2, K3
CO3	Discuss the different form of radiation and basics of nuclear chemistry	K1, K2
CO4	Understand the organic reaction mechanisms with stereochemical aspects.	K1,K2
CO5	Explain the different chemical nature of phenols	K1,K2,K3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	2	3	1	2
CO2	3	3	2	1	2	-	-	-	-	2	3	1	1
CO3	3	3	2	2	2	-	2	-	-	2	3	-	2
CO4	3	3	1	1	-	-	-	-	-	3	3	2	1
CO5	3	3	2	1	-	-	-	-	-	1	3	2	1

COURSE DESCRIPTORS

Title of the Course	QUALITATIVE INORGANIC ANALYSIS	**Hours/Week**	04
Course Code	AUCPCH32	**Credits**	04
Category	Core - 6	**Year & Semester**	II & III
Prerequisites	General Chemistry	**Regulation**	2024

Objectives of the course:

This course aims to provide a comprehensive knowledge on

The skill on systematic analysis of simple inorganic salts and mixture of salts.

UNITS	Contents	COs	Cognitive Levels
	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** 5. **Analysis of a mixture - I to VI containing two cations and two anions (of which one is interfering type)**	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5

Recommended Text Books

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

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

COs	CO Description	Cognitive Level
CO1	Determine the simple acid radicals.	K1, K2, K3, K4, K5
CO2	Find the inter interfering acid radicals	K1, K2, K3, K4, K5
CO3	Identify the group of basic radicals	K1, K2, K3, K4, K5
CO4	Predict and confirm the basic radicals	K1, K2, K3, K4, K5
CO5	Investigate and report the acid and basic radicals in the inorganic mixture	K1, K2, K3, K4, K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	1	-	1	3	3	1
CO2	3	3	3	3	3	2	3	2	-	1	3	3	1
CO3	3	3	3	3	3	2	3	1	-	1	3	3	1
CO4	3	3	3	3	3	2	3	1	-	1	3	3	1
CO5	3	3	3	3	3	3	3	2	-	2	3	3	1

COURSE DESCRIPTORS

Title of the Course	ENTREPRENEURIAL SKILLS IN CHEMISTRY	**Hours/Week**	01
Course Code	AUSPCH34	**Credits**	01
Category	Skill Enhancement Course	**Year & Semester**	II & III
Prerequisites	General Chemistry	**Regulation**	2024

Objectives of the course:

This course aims to provide a comprehensive knowledge on

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

UNITS	Contents	COs	Cognitive Levels
UNIT -I	**Food Chemistry** Food adulteration-contamination of food items with clay stones, water and toxic chemicals -Common adulterants. Food additives, Natural and synthetic anti-oxidants, glazing agents (hazardous effect), food colour ants, 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	CO1 CO2 CO3	K1, K2, K3, K4
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 dyes Printing – tie and dye, batik.	CO4 CO5	K1, K2, K3, K4, K5

Recommended Text Books

- *1. George S &Muralidharan V, (2007) Fibre to Finished Fabric – A Simple Approach, Publication Division, University of Madras, Chennai.*
- *2. Appaswamy G P, A Handbook on Printing and Dyeing of Textiles.*

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

COs	CO Description	Cognitive Level
CO1	Explain the Food adulteration and contamination.	K1, K2, K3
CO2	Compare the effects of Natural and synthetic anti-oxidants.	K1, K2, K3, K4
CO3	Explain the basic methods and principles of dyeing.	K1, K2, K3
CO4	Prepare the Jam, Jelly, soap, detergents, cleaning powder and shampoos	K1, K2, K3, K4
CO5	Detection of adulterants in food items.	K1, K2, K3, K4, K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	-	-	-	-	1	3	1	2
CO2	3	3	2	3	3	-	-	-	-	1	3	2	2
CO3	3	3	2	2	1	-	-	-	-	1	3	1	2
CO4	3	3	2	3	2	-	-	-	-	1	3	1	2
CO5	3	3	2	3	3	-	-	-	-	2	3	2	2

COURSE DESCRIPTORS

Title of the Course	PESTICIDE CHEMISTRY	**Hours/Week**	02
Course Code	AUSCH35	**Credits**	02
Category	Skill Enhancement Course	**Year & Semester**	II & III
Prerequisites	Fundamentals in Chemistry	**Regulation**	2024

Objectives of the course:

This course aims to provide a comprehensive knowledge on

- The various types of pesticides and their toxicity.
- Understand the accumulation of pesticides in in the form of residues and its analysis.
- Choice of alternate and eco-friendly pesticides.

UNITS	Contents	COs	Cognitive Levels
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.	CO1 CO2 CO3	K1, K2, K3, K4,
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.	CO4	K1, K2, K3,

UNIT -III	**Biopesticides:** Pheromones, attractants, repellents – Introduction, types and application (8-Dodecen-1-ol, 10-cis-12-hexadecadienoic, Trimedlure, Cuelure, methyl eugenol, N,N- Diethyl-m-toluamide, Dimethyl phthalate, Icaridin). Baits-Metaldehyde, Iron (II) phosphate, Indoxacarb, Zinc Phosphide, Bromadiolone.	CO5	K1, K2,

Recommended Text 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.*

Reference Books

1. Roy N. K., Chemistry of Pesticides. CBS Publisher & Distributors P Ltd; 1st Ed. (2010).
2. Nollet L.M., Rathore H.S., Handbook of pesticides: methods of pesticide residues analysis. CRC press; 2016.
3. 3. Ellerbrock R.H., Pesticide Residues: Significance, Management and Analysis, 2005

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Understand the chemical properties, specific targets of pesticides and insecticides.	K1, K2
CO2	Explain the Acute and chronic toxicity in living organism.	K1, K2, K3
CO3	Analyze the metabolism, formulations, modes of action, toxicity of insecticides.	K1, K2, K3, K4
CO4	Explain the effects of pesticides on environments	K1, K2, K3
CO5	Understand the action and effects of Biopesticides	K1, K2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	3	3	2	2
CO2	3	3	2	-	-	-	-	-	-	2	3	2	2
CO3	3	3	3	2	-	-	-	-	-	3	3	3	2
CO4	3	3	2	1	-	-	-	-	-	2	3	2	2
CO5	3	3	2	-	-	-	-	-	-	2	3	2	2

COURSE DESCRIPTORS

Title of the Course	CHEMISTRY - I (For Mathematics – II Year/III Semester)	**Hours/Week**	04
Course Code	AUECH33B	**Credits**	03
Category	Generic Elective III	**Year & Semester**	II & III
Prerequisites	Higher Secondary Chemistry	**Regulation**	2024

Objectives of the course:

The course aims at giving an overall view of the

- 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.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Chemical Bonding and Nuclear Chemistry** Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O 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.	CO1	K1 K2
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.	CO2	K1 K2

UNIT-III	**Fundamental Concepts in Organic Chemistry** Hybridization: Orbital overlap hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Polar effects: Inductive effect and consequences on Ka and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation. Reaction mechanisms: Types of reactions - aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.	CO3	K1 K2 K3
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.	CO4	K1 K2 K3
UNIT-V	**Analytical Chemistry** Introduction 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.	CO5	K1 K2 K3

Recommended Text Books

1. *Madan, R. D. and Sathya Prakash, Modern Inorganic Chemistry, 2nd ed.; S.Chand and Company: New Delhi, 2003.*
2. *P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.*
3. *P.C. Jain and Monika Jain, Engineering Chemistry, 17th Ed., Dhanpat Rai Publishing Company*
4. *Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition,2012.*
5. *Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry,2nd ed., S.Chand& company, New Delhi.*
6. *Ashutosh Kar, (2018), Medicinal chemistry, 7th ed., New ageinternational (P) Limited, Publishers, New Delhi.*
7. *R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007.*

Reference Books

1. P. L. Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
2. B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.
4. V. Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.
5. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Explain the bonding nature of molecules and nuclear chemistry applications	K1,K2,K3
CO2	Discuss the important of industrial chemistry in our life	K1,K2
CO3	Predict the reaction mechanism in aromatic compounds	K2,K4
CO4	Classify the different types of drugs and their uses	K3,K4
CO5	Compare Separation and purification techniques	K2,K3,K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	-	-	3	1	1
CO2	3	3	2	-	-	-	-	-	-	-	2	2	1
CO3	3	3	3	2	-	-	-	-	-	-	3	2	2
CO4	3	3	2	-	-	-	-	-	-	-	3	2	2
CO5	3	3	-	2	-	-	-	-	-	-	1	2	2

COURSE DESCRIPTORS

Title of the Course	CHEMISTRY PRACTICAL (for Mathematics – II Year / III & IV Semester)	**Hours/Week**	02
Course Code	AUEPCH43B	**Credits**	01
Category	Generic Elective III	**Year & Semester**	II & III, IV
Prerequisites	Higher Secondary Chemistry	**Regulation**	2024

Objectives of the course:

The course aims at giving an overall view of the

- Basics of preparation of solutions.
- Principles and practical experience of volumetric analysis
- Identification of organic functional groups
- Different types of organic compounds with respect to their properties.
- Determination of elements in organic compounds..

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**VOLUMETRICANALYSIS** 1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Estimation of hydrochloric acid using standard oxalic acid. 3. Estimation of ferroussulphate using standard Mohr's salt. 4. Estimation of oxalic acid using standard ferroussulphate. 5. Estimation of potassium permanganate using standard sodium hydroxide. 6. Estimation of magnesium using EDTA. 7. Estimation of ferrous ion using diphenylamine as indicator.	CO1 CO2 CO3	K1,K2, K3,K4, K5
UNIT-II	**SYSTEMATICANALYSISOFORGANICCOMPOUNDS** 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.	CO4 CO5	K2,K3, K4,K5

Recommended Text Books

1. *V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles of Practical 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

COs	CO Description	Cognitive Level
CO1	Understanding of the use of standard flask and volumetric pipettes, burette.	K1,K2
CO2	Design, carry out, record and interpret the results of volumetric titration.	K2,K4,K5
CO3	Determine the strength of solution and calculate the amount.	K3,K4,K5
CO4	Analyze the organic compounds in systematic method	K2,K3,K4
CO5	Discover the functional group in the organic samples and confirm with suitable derivatives.	K2,K3,K4,K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	2	2	2	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	1	3	1
CO4	3	3	2	-	-	-	-	-	-	-	3	2	1
CO5	3	3	2	3	-	-	-	-	-	-	1	2	1

SCHEME OF VALUATION CHEMISTRY PRACTICAL FOR

PHYSICAL AND BIOLOGICAL SCIENCES

Internal assessment: 25 Marks

External assessment: 75 marks

Total: 100 marks

Max. Marks: 75

Record: 15 Marks

Volumetric Analysis: 35 Marks

Organic Analysis: 25 Marks

Volumetric Analysis :35 Marks (Maximum)
Short Procedure :5 Marks
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

Organic Analysis: 25 Marks

Preliminary Test: 3 Marks
Aliphatic or Aromatic: 3 Marks
Saturated or unsaturated: 3 Marks
Tests for elements: 9 Marks
Derivative/Coloured reaction: 7 Marks.

COURSE DESCRIPTORS

Title of the Course	**General Chemistry–IV**	**Total Hours**	05
Course Code	AUCCH41	**Credits**	05
Category	Core - VII	**Year &Semester**	II & IV
Prerequisites	Basic Chemistry	**Regulation**	2024

Objectives of the course:

The course aim to give knowledge about

- Thermodynamic concepts on chemical processes and applied aspects.
- Thermo chemical calculations.
- Transition elements with reference to periodic properties and group study of transition metals.
- The Chemistry of ethers, aldehydes and ketones.
- The Chemistry of carboxylic acids.

UNITS	Contents	COs	Cognitive Levels
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.	CO1	K1, K2, K3
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.	CO2	K1, K2, K3

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	CO3	K1, K2, K3, K4
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 $LiAH_4$ Thioethers - nomenclature, structure, preparation, properties and uses. **Aldehydes and Ketones** Nomenclature, 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 $LiAlH_4$ and $NaBH_4$. Addition reactions of unsaturated carbonyl compounds: Michael addition.	CO4	K1, K2, K3
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, Hunsdiecker reaction. 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 and γ hydroxy acids.	CO5	K1, K2, K3, K4

Recommended Text Books

1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., thirty three edition, 1992.
2. K. L. Kapoor, A Textbook of Physical chemistry, (volume-2 and 3), Macmillan, India Ltd, third edition, 2009.
3. P.L. Soni and Mohan Katyal, Textbook of Inorganic Chemistry, Sultan Chand & 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. 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 William Heinemann: London, 1991.
3. Gurudeep Raj, Advanced Inorganic Chemistry, 26thed. Goel Publishing House: 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 and e-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

COs	CO Description	Cognitive Level
CO1	Explain the terms, processes and various laws of thermodynamics.	K1, K2, K3
CO2	Discuss the application of heat engine and heat capacity measurement.	K1, K2, K3
CO3	Investigate the chemistry of transition elements with respect to various periodic properties.	K1, K2, K3, K4
CO4	Discuss the reaction mechanism of named organic reactions in ethers, epoxides and carbonyl compounds.	K1, K2, K3
CO5	Describe the derivatives and chemical reactions of carboxylic acids, halogen substituted acids and hydroxyl acids.	K1, K2, K3, K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	1	2	1	1
CO2	3	3	3	3	-	-	-	-	-	3	3	2	2
CO3	3	3	3	3	-	-	-	-	-	2	2	1	1
CO4	3	3	3	3	-	-	-	-	-	2	2	2	1
CO5	3	3	3	3	-	-	-	-	-	1	2	2	2

COURSE DESCRIPTORS

Title of the Course	**Physical Chemistry Practical-I**	**Total Hours**	04
Course Code	AUCPCH42	**Credits**	04
Category	Core - VIII	**Year &Semester**	II & IV
Prerequisites	Basic Chemistry	**Regulation**	2024

Objectives of the course:

The course aims at providing an understanding of

- The laboratory experiments in order to understand the concepts of physical changes in Chemistry.
- The rates of chemical reactions.
- Colligative properties and adsorption isotherm.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**UNIT-I: Chemical kinetics** 1. Determination of rate constant of acid catalysed hydrolysis of an ester (methyl acetate). 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.	CO1	K1, K2, K3 K4, K5
UNIT-II	**UNIT-II: Thermochemistry** 4. Determination of heat of neutralisation of a strong acid by a strong base. 5. Determination of heat of hydration of copper sulphate	CO2	K1, K2, K3 K4, K5
UNIT-III	**UNIT-III: Electrochemistry – Conductance measurements** 6. Determination of cell constant 7. Determination of molar conductance of strong electrolyte 8. Determination of dissociation constant of acetic acid	CO3	K1, K2, K3, K4
UNIT-IV	**UNIT-IV: Colligative property** 9. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent **Adsorption** 10. Construction of Freundlich isotherm for the adsorption of acetic acid on activated charcoal	CO4	K1, K2, K3 K4, K5

UNIT-V	**Colorimetry** 11. Determination of concentration of copper sulphate solution. 12. Determination of concentration of Ferrous sulphate solution	CO5	K1, K2, K3, K4

Recommended Text Books

1. Physical Chemistry Practical Manual, by PG and Research Department of Chemistry, KMG College of Arts and Science (Autonomous), Gudiyatham.
2. Sindhu, P.S. Practicals in Physical Chemistry, Macmillan India : New Delhi, 2005.
3. Khosla, B. D.Garg,V. C.; Gulati, A.; Senior Practical Physical Chemistry, R.Chand : New Delhi, 2011.
4. 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

COs	CO Description	Cognitive Level
CO1	Determine of rate constant and order of chemical reactions	K1, K2, K3, K4, K5
CO2	Determine of heat energy changes of neutralization and hydration reactions	K1, K2, K3, K4, K5
CO3	Find the cell constant, molar conductance and dissociation constant using Conductance measurements	K1, K2, K3, K4
CO4	Calculate the molecular weight of substance with the help of Colligative property	K1, K2, K3, K4, K5
CO5	Find the concentration of given colour solution using Colorimeter	K1, K2, K3, K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	-	-	-	2	3	3	2
CO2	3	3	3	3	3	1	-	-	-	2	3	3	2
CO3	3	3	3	3	3	2	-	-	-	3	3	3	2
CO4	3	3	3	3	3	1	-	-	-	2	3	3	2
CO5	3	3	3	3	3	2	-	-	-	3	3	3	2

SCHEME OF VALUATION

Internal assessment: 25 Marks

External assessment: 75 Marks

Total: 100

External assessment: 75 Marks

Marks Record: 15 Marks

Experiment: 45 Marks

Manipulation, Tabulation and Calculation: 15 Marks

Experiment: 45 Marks

1. Kinetics
    - Graph: 10 Marks
    - Below a factor of 10: 35 Marks
    - By a factor of 10: 25 Marks
    - More than a factor of 10: 15 Marks

2. Molecular weight
    - Error upto 10 %: 45 Marks
    - Error upto 20 %: 35 Marks
    - Error upto 30 %: 25 Marks
    - Error > 30 % : 15 Marks

3. Effect of electrolyte on CST
    - Graph: 10 Marks
    - Error upto 10 %: 35 Marks
    - Error upto 20 %: 25 Marks
    - Error upto 30 %: 15 Marks
    - Error > 30 % : 10 Marks

4. Conductance Equivalent conductance: 25 Marks

   Error upto 10 %: 25 Marks

   Error upto 15 % : 15 Marks

   Error >15 % : 10 Marks

   Cell constant : 20 Marks

   Error upto 10 % : 20 Marks

   Error Upto 15 % : 15 Marks

   Error >15 % : 10 Marks

5. Conductometric titration

   Graph: 10 Marks

   Error Upto 2 % : 35 Marks

   Error 2.1 to 3 % : 30 Marks

   Error 3.1 to 4 % : 25 Marks

   Error 4.1 to 5 % : 20 Marks

   Error > 5% : 15 Marks

COURSEDESCRIPTORS

Title of the Course	Instrumental Methods of Chemical Analysis	**Total Hours**	02
Course Code	AUSCH44	**Credits**	02
Category	Skill Enhancement Course	**Year &Semester**	II & IV
Prerequisites	Basic Instrumental Methods of Chemical Analysis	**Regulation**	2024

Objectives of the course:

The course aim to give knowledge about

- Operation and troubleshooting of chemical instruments.
- Fundamentals of analytical techniques and its application in the characterization of compounds.
- Theory of chromatographic separation and theory of thermo / electro analytical techniques.
- Stoichiometry and the related concentration terms.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**UNIT-I** **Qualitative and Quantitative Aspects of Analysis** 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, Ttest. The Least Square Method for Deriving Calibration plots. Principles of gravimetric analysis-characteristics of precipitating agents-choice of precipitants-conditions of precipitation-specific and selective precipitants-DMG, cupferron, salicylaldehyde, ethylene diamine-use of sequestering agent-co-precipitation.	CO1	K1 K2 K3 K5
UNIT-II	**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.	CO2	K1 K2 K3

UNIT-III	**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. Infrared Spectroscopy: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques.	CO3	K1 K2 K3
UNIT-IV	**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 and applications, Cyclic Voltammetry – principle and applications.	CO4	K1 K2 K3 K5
UNIT-V	**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. Rf value.	CO5	K1 K2 K3

Recommended Text Books

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. 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.
5. 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. 3. Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley & Sons, New York, 2004.
4. 4. Mikes, O. &Chalmes, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London.
5. 5. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, sixth edition Pearson Education, 2000

Website and e-learning source

1. https://www.youtube.com/watch?v=F6AOx6GQ_6Q
2. http://eric.ed.gov/?id=EJ386287
3. http://www.sjsu.edu/faculty/watkins/diamag.htm
4. http://www.britannica.com/EBchecked/topic/108875/separationand-purification
5. https://nptel.ac.in/courses/103108100

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Interpret analytical data by using different statistical tools.	K2, K3, K4, K5
CO2	Understand the basic principles of atomic absorption spectroscopy and its role in trace metal analysis.	K1, K2
CO3	Discuss applications of thermal and electrochemical techniques	K1, K2, K3
CO4	Interpret thermograms and explain factors influencing thermal decomposition.	K2, K3, K4, K5
CO5	Explain different separation techniques and its uses in chemical analysis.	K1, K2, K3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	-	-	-	3	3	2	3
CO2	3	3	2	3	2	3	-	-	-	2	2	3	3
CO3	3	3	3	3	3	3	-	-	-	3	3	2	2
CO4	3	3	2	3	3	2	-	-	-	2	3	3	2
CO5	3	3	2	3	2	3	-	-	-	3	2	3	3

COURSEDESCRIPTORS

Title of the Course	FORENSIC SCIENCE	**Total Hours**	02
Course Code	AUSCH45	**Credits**	02
Category	SEC - VII Skill Enhancement Course	**Year &Semester**	II & IV
Prerequisites	General Chemistry	**Regulation**	2024

Objectives of the course:

This course aims at giving an overall view of

- Crime detection through analytical instruments
- Forgery and its detection
- Medical aspects involved

UNITS	Contents	COs	Cognitive Levels
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 sea foods - Treatment in cases of poisoning – use of antidotes for common poisons.	CO1	K2, K3, K4
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 and other security measures for VVIP-composition of bullets and detecting powder burns.	CO2	K4
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 – checking silver line water mark in currency notes - detection of gold purity in 22 carat ornaments – detecting gold plated jewels -authenticity of diamond.	CO3	K3

UNIT-IV	**Tracks and Traces** Tracks and traces - small tracks and police dogs - foot prints - 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.	CO4	K3
UNIT-V	**Medical Aspects** Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Ballistics - classification - internal and terminal ballistics - small arms -laboratory examination of barrel washing and detection of powder residue by chemical tests.	CO5	K4, K5

Recommended Text Books

1. *SA Iqbal, M Liviu, Textbook of forensic chemistry, Discovery publishing house private limited, 2021.*

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., Basic principles of Forensic chemistry, Humana Press, first edition, 2012.

4. Bapuly AK, (2006) Forensic Science – Its application in crime investigation, Paras Medical Publisher, Hyderabad.

5. Sharma B.R., (2006) Scientific Criminal Investigation, Universal Law Publishing Co. Pvt. Ltd, New Delhi.

Reference Books

1. Siegel, J. A. (2020). Criminalistics: An Introduction to Forensic Science *(13th ed.). Pearson.*

2. Wilson, J., & Long, B. B. (2025). Introduction to Forensic Chemistry. *Krueger Brentt Publishers UK.*

3. Chhabra, P., Tripathy, D. B., Gupta, A., Shukla, S., Kumar, R., & Bhati, K. (2024). Advances in Analytical Techniques for Forensic Investigation. Wiley-Blackwell.

4. Reffner, J. A., & Kammrath, B. W. (2023). Solving Problems with Microscopy: Real-life Examples in Forensic, Life, and Chemical Sciences. *Wiley-Blackwell.*

5. Gall, J. A. M., & Payne-James, J. (2022). Current Practice in Forensic Medicine, Volume 3.

Website and e-learning source

1. www.coursera.org/learn/forensic-science
2. www.futurelearn.com/courses/introduction-to-forensic-science
3. www.forensicscience.ufl.edu/programs/graduate-certificate/forensic-drug-chemistry/
4. www.ashworthcollege.edu/career-diplomas/forensic-science-training/
5. www.asuonline.asu.edu/online-degree-programs/undergraduate/forensic-science-degree/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Identify types of poisons, their symptoms and treatments.	K2, K3, K4
CO2	Analyze methods and tools used in crime detection and explosives	K4
CO3	Apply techniques to detect forgery and verify authenticity of valuables.	K3
CO4	Examine tracks, traces, and biological evidence for investigation.	K3
CO5	Evaluate medical and ballistic aspects in forensic cases	K4, K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	–	3	2	–	–	–	2	–	2	3	2
CO2	2	2	2	2	3	2	2	–	1	2	3	3	3
CO3	3	2	1	3	2	2	2	–	2	1	2	2	2
CO4	3	2	2	2	3	1	2	–	2	2	3	3	3
CO5	2	2	–	3	3	2	2	–	3	1	3	2	2

COURSEDESCRIPTORS

Title of the Course	ORGANIC CHEMISTRY - I	**Total Hours**	05
Course Code	AUCCH51	**Credits**	04
Category	CORE - IX	**Year & Semester**	III & V
Prerequisites	Basic Concept of Organic Chemistry	**Regulation**	2024

Objectives of the course:

This course aims to provide knowledge on

- Draw Fischer, Newman, and Sawhorse projections and convert one form into another.
- Analyze the basicity and chemical behavior of amines.
- Distinguish between primary, secondary, and tertiary amines.
- Explain aromaticity in five-membered heterocycles.
- Synthetic applications of heterocyclic compounds.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Stereochemistry** Stereochemistry – Fischer, Newmann and Sawhorse Projection formulae and their inter conversions. Geometrical isomerism: cis–trans isomerism, syn-anti isomerism and E/Z notations. Optical Isomerism: Optical activity, specific rotation, asymmetry, enantiomers and diastereomers, meso structures - molecules with one and two chiral centers. Racemization – methods of Racemization. Resolution – methods Resolution. C.I.P rules for R and S notations to one and two chirality (stereogenic) centers. Molecules without asymmetric carbon atoms – allenes and biphenyls. Conformational analysis of ethane and butane.	CO1	K1, K2 K3, K4 K5
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, 2,4,6-Trinitrotoluene (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.	CO2	K1, K2 K3, K4

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. **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 contents - Dyes Industry, Food colour and additives.	CO3	K1, K2 K3, K4
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.	CO4	K1, K2 K3, K4
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.	CO5	K1, K2 K3, K4

Recommended Text Books

1. Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S. Chand& Company Pvt. Ltd., Multi colour edition, 2012.
2. P. L. Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.
3. K.S. Tewari and N.K. Vishnoi, A Textbook of Organic Chemistry, 4th Edition, Vikas Publishing House, 2018.
4. Rakesh K. Parashar and V.K. Ahluwalia, Textbook of Organic Chemistry, Viva Books Originals, 2018.

Reference Books

1. Morrison and Boyd, Organic Chemistry, 6th Edition, Pearson Education India, 2010.
2. D. Nasipuri, Stereochemistry of Organic Compounds, 2nd Edition, New Age International, 2010.
3. I.L. Finar, Organic Chemistry, Volume 1, 6th Edition, Pearson Education India, 2013.
4. D. Nasipuri, Stereochemistry of Organic Compounds, New Age International, 2nd Edition, 2010.
5. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009.

Website and e-learning source

1. https://ncert.nic.in/textbook/pdf/kech202.pdf
2. https://kpu.pressbooks.pub/organicchemistry/
3. https://chem.ucr.edu/curricular-materials/textbook
4. https://nptel.ac.in/courses/104106119

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Determine the different projection conversion and RS notation.	K1, K2, K3, K4, K5
CO2	Discuss the different properties of aliphatic and aromatic nitro compounds.	K1, K2, K3, K4
CO3	Differentiate the properties primary, secondary and tertiary amines.	K1, K2, K3, K4
CO4	Describe the preparation and properties of five-membered heterocyclic compounds, such as pyrrole, furan and thiophene.	K1, K2, K3, K4
CO5	Analyze the substitution reactions in six-membered heterocyclic compounds.	K1, K2, K3, K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	-	-	-	-	3	3	3	3
CO2	3	1	3	3	2	1	-	-	-	2	3	3	3
CO3	3	2	3	3	2	1	-	-	-	2	3	3	3
CO4	3	1	3	3	2	-	-	-	-	1	3	3	3
CO5	3	2	3	3	2	1	-	-	-	2	3	3	3

COURSEDESCRIPTORS

Title of the Course	**INORGANIC CHEMISTRY - I**	**Total Hours**	05
Course Code	AUCCH52	**Credits**	04
Category	CORE - X	**Year & Semester**	III & V
Prerequisites	Basic Concept of Inorganic Chemistry	**Regulation**	2024

Objectives of the course:

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
- Inner transition elements (Lanthanoids and actinoids)
- Preparation and properties of inorganic polymers

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Co-ordination Chemistry - 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 coordination 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.	CO1	K1, K2, K3, K4
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.	CO2	K1, K2, K3, K4, K5

UNIT-III	**Organometallic compounds** **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	CO3	K1, K2, K3, K4
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.	CO4	K1, K2, K3
UNIT-V	**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.	CO5	K1, K2, K3, K4

Recommended Text Books

1. R Gopalan and V Ramalingam, Concise Coordination Chemistry, Vikas Publishing, New 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. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31st Edition, Milestone Publishers & Distributors, Delhi.
4. Lee J D, (1991), Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London.
5. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, S. Chand and Company Ltd.

Reference Books

1. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.
2. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed., S.Chand and Company, New Delhi.
3. Gopalan R, (2009) Inorganic Chemistry for Undergraduates, 1st Edition, University Press (India) Private Limited, Hyderabad.
4. Sivasankar B, (2013) Inorganic Chemistry. 1st Edition, Pearson, Chennai.
5. Alan G. Sharp (1992), Inorganic Chemistry, 3rd Edition, Addition- Wesley, England.
6. 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

COs	CO Description	Cognitive Level
CO1	Describe the Nomenclature and geometry of coordination compounds.	K1, K2, K3, K4
CO2	Evaluate the Crystal field stabilization energy of coordination compounds.	K1, K2, K3, K4, K5
CO3	Discuss about the preparation methods and properties of metal carbonyls.	K1, K2, K3, K4
CO4	Explain about the properties of inner transition elements	K1, K2, K3
CO5	Classified the inorganic polymers based on element in the backbone skeleton.	K1, K2, K3, K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	1	1	1	1	2	3	1	-
CO2	3	3	3	3	3	2	1	-	-	2	3	3	2
CO3	3	3	2	3	3	-	-	-	-	1	3	1	1
CO4	3	3	2	3	2	-	-	-	-	1	3	2	1
CO5	3	3	3	3	3	2	1	2	1	3	3	3	1

COURSEDESCRIPTORS

Title of the Course	**PHYSICAL CHEMISTRY -I**	**Total Hours**	05
Course Code	AUCCH53	**Credits**	04
Category	CORE - XI	**Year & Semester**	III & V
Prerequisites	Basic Concept of Physical Chemistry	**Regulation**	2024

Objectives of the course:

The course aims to provide knowledge on

- Free energy and work functions, 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

UNITS	Contents	COs	Cognitive Levels
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.	CO1	K1, K2, K3, K4
UNIT-II	**Chemical Kinetics** Rate of reaction - Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction. 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. Determination of order - Volumetry 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.	CO2	K1, K2, K3, K4, K5

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.	CO3	K1, K2, K3, K4
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 Macromolecules: Molecular weight of Macromolecules-Number average molecular weight- average molecular weight, Determination of Molecular weight of molecules.	CO4	K1, K2, K3
UNIT-V	**Photochemistry** Laws of photo chemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – rate law – Kinetics of H_2-Cl_2, H_2-Br_2 and H_2-I_2 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	CO5	K1, K2, K3, K4

Recommended Text Books

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. Arun Bahl, 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, Shoban Lal Nagin 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, Macmillan India Ltd, third edition, 2009.
5. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shoban lal Nagin Chand and Co. Jalendhar, forty first, edition, 2001.

Website and e-learning source

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

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Discuss about the thermochemical properties of Free energy, work functions and chemical potential.	K1, K2, K3, K4
CO2	Predict Rate, order and molecularity of different chemical reactions.	K1, K2, K3, K4, K5
CO3	Analyze the different kinetic mechanism of catalytic process.	K1, K2, K3, K4
CO4	Explain about different preparation methods of Colloids.	K1, K2, K3
CO5	Distinguish the kinetic mechanism of thermal and photochemical reactions.	K1, K2, K3, K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	3	3	2	2
CO2	3	3	3	3	3	-	-	-	-	2	3	3	1
CO3	3	2	3	3	3	-	-	-	-	3	3	2	2
CO4	3	3	2	2	2	-	-	-	-	1	3	1	1
CO5	3	3	3	3	3	-	-	-	-	3	3	2	2

COURSEDESCRIPTORS

Title of the Course	Core Project with Viva Voce	**Total Hours**	05
Course Code	AUPCH54	**Credits**	04
Category	Core-XII	**Year & Semester**	III & V
Prerequisites	Basic knowledge of Chemistry	**Regulation**	2024

- Group of Students (Maximum 5 members) will do the project work on a title approved by the respective project supervisor. Students should maintain daily records and present oral reports while doing project preparation. All the above processes will be duly assessed by the project supervisor to award the internal mark.
- The Project report and their viva voce examinations will be evaluated by two examiners at the end of fifth Semester.
- Internal Mark – 25
- External Mark – 75

Project Report – 50

Viva Voce - 25

Format for the preparation of project work:

(a) Title page

(b) Bonafide Certificate

(c) Acknowledgement

(d) Table of contents

CONTENTS

COURSEDESCRIPTORS

Title of the Course	**BIOCHEMISTRY**	**Total Hours**	04
Course Code	AUECH55	**Credits**	03
Category	ELECTIVE – V	**Year & Semester**	III & V
Prerequisites	Basic Concept of Organic Chemistry	**Regulation**	2024

Objectives of the course:

The course aims to provide knowledge on

- 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

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Logic of Living Organisms** Relationship of Biochemistry and Medicine. Blood - Composition of Blood, Blood Coagulation – Mechanism. Hemophilia and Sickle Cell Anaemia. Maintenance of pH of Blood – Bicarbonate Buffer, Acidosis, Alkalosis	CO1	K1, K2, K3
UNIT-II	**Amino acids, Peptides and Proteins** **Amino acids** – nomenclature, classification – essential and Nonessential; Synthesis - Gabriel Phthalimide, Strecker; properties – zwitter ion 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 brief outline); urea cycle.	CO2	K1, K2, K3, K4

UNIT-III	**Enzymes and Vitamins** Nomenclature and classification, characteristics, factors influencing enzyme activity – mechanism of enzyme action – Lock and key hypothesis, Koshland's induced fit model. Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme regulation. Vitamins as coenzymes – functions of TPP, lipoic acid, NAD, NADP, FMN, FAD, pyridoxal phosphate, CoA, folic acid, biotin, cyanocobalamin.	CO3	K1, K2, K3
UNIT-IV	**Nucleic acids and Hormones** Components of nucleic acids - nitrogenous bases and pentose sugars, structure of nucleosides and nucleotides, DNA- structure & functions; RNA –types– structure - functions; biosynthesis of proteins. Hormones - Adrenalin and thyroxine — chemistry, structure and functions (No structure elucidation).	CO4	K1, K2, K3, K4
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.	CO5	K1, K2

Recommended Text Books

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/EnzymeKinetics.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

COs	CO Description	Cognitive Level
CO1	Explain about the relation between Biochemistry and Medicine.	K1, K2, K3
CO2	Distinguish the amino acids, peptides and proteins	K1, K2, K3, K4
CO3	Discuss about the functions of Enzymes and Vitamins.	K1, K2, K3
CO4	Analyze the structure of nucleosides and nucleotides	K1, K2, K3, K4
CO5	Explain about the chemical composition, properties of lipids.	K1, K2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	-	-	2	3	1	1
CO2	3	3	3	3	3	-	-	-	-	1	3	2	-
CO3	3	3	2	1	1	-	-	-	-	1	3	1	1
CO4	3	3	3	3	3	-	-	-	-	3	3	2	2
CO5	3	3	2	2	2	-	-	-	-	2	3	1	1

COURSEDESCRIPTORS

Title of the Course	**INDUSTRIAL CHEMISTRY**	**Total Hours**	04
Course Code	AUECH56	**Credits**	03
Category	ELECTIVE - V	**Year & Semester**	III & V
Prerequisites	Basic Concept of Chemistry	**Regulation**	2024

Objectives of the course:

The course aims 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

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**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).	CO1	K1, K2, K3, K4
UNIT-II	**Cosmetics** **Skin care:** powders, ingredients; creams and lotion-cleansing, moisturising, all purposes 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-ambergris, 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.	CO2	K1, K2, K3

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.	CO3	K1, K2, K3, K4
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 – pretanning 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.	CO4	K1, K2, K3, K4
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	CO5	K1, K2, K3, K4

Recommended Text Books

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, Khushdeep Dharni, *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. 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

COs	CO Description	Cognitive Level
CO1	Discuss about different types of fuels compositions and its calorific values.	K1, K2, K3, K4
CO2	Explain the ingredients and properties of Cosmetics, Soaps, Detergents.	K1, K2, K3
CO3	Analyze the Food standards and hazards of using food additives.	K1, K2, K3, K4
CO4	Describe the Manufacturing process in Leather and Paper Industries	K1, K2, K3, K4
CO5	Distinct Intellectual Property Rights (IPR) of Patents and trademarks.	K1, K2, K3, K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	-	-	-	2	3	3	3
CO2	3	3	2	2	2	2	-	-	-	2	3	2	1
CO3	3	3	3	3	3	-	-	-	-	2	3	1	1
CO4	3	3	3	3	3	2	-	-	-	1	3	2	2
CO5	3	3	3	3	3	-	-	-	-	3	3	1	1