HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)
Re-Accredited with A++ Grade by NAAC (3rd Cycle)
Uthamapalayam - 625 533.

DEPARTMENT OF CHEMISTRY

BACHELOR OF SCIENCE – CHEMISTRY

SYLLABUS

Choice Based Credit System – CBCS

(As per TANSCHE/MKU Guidelines)

with

Outcome Based Education (OBE)

(with effect from the Academic year 2023-2024 onwards)

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College Vision and Mission

Vision

Our vision is to provide the best type of higher education to all, especially to students hailing from minority Muslim community, rural agricultural families and other deprived, under privileged sections of the society, inculcating the sense of social responsibility in them. Our college is committed to produce talented, duly-bound citizens to take up the challenges of the changing times.

Mission

Our mission is to impart and inculcate social values, spirit of service and religious tolerance as envisioned by our beloved Founder President Hajee Karutha Rowther.

The Vision beckons ....the Mission continuous forever.

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Department Vision and Mission

Vision

Generate knowledgeable Chemists and scientists to enhance services to the society.

Mission

- Enable the students to excel in the subject, research and services.
- Elevate students to international standards.
- Encourage the students to take up competitive examinations.

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

PROGRAMME OUTCOMES (PO) OF B.SC DEGREEPROGRAMME IN CHEMISTRY

- Students will possess basic subject knowledge required for higher studies, professional and applied courses
- Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the science & humanities stream.
- Students will develop scientific aptitude Integrate skills of analysis, critiquing,application and creativity.
- Students will employ appropriate digital tools and techniques necessary in analysingdata and creative design.
- Students will gain competence to pursue higher learning, research and careers or will beable toopt for entrepreneurship
- Students will interact meaningfully with others displaying leadership and coordination inexecuting projects.
- Students will demonstrate responsibility as citizens committed to national developmentthrough community outreach, wellness of self and a sustainable environment.

PROGRAMME SPECIFIC OUTCOMES

PSO1: Students acquire in-depth knowledge of the fundamental concepts in all disciplines of chemistry.
PSO2: Students can disseminate the basics of chemistry and advanced topics and analytical skills in organic, inorganic and physical chemistry.
PSO3: Students will be able develop creativity in academics and research.

PSO4: Students will be able apply digital tools to collect, analyse and interpret data andpresent scientific findings.

PSO5: gain competence to pursue higher education and career opportunities in chemistry and allied fields.

PSO6: exhibit leadership qualities to work individually and within a team in organizingcurricular, co-curricular and extracurricular activities.

PSO7: apply the concepts of chemistry to solve problems in the community, entrepreneurial and research pursuits.

PSO8: exhibit competence in educational, industrial and research pursuits that contribute towards the holistic development of self and community.

Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, enable the students to provide solutions to industry / real life situations. The curriculum also facilitates peer learning and research aptitude in the final semester by providing an opportunity do a project.
- The General Studies and Chemistry based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial internship is newly introduced in the fourth semester, to expose the

  students to real life working environment and train the students to face challenges
- The Internship during the second year vacation will help the students gain valuable work

- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting an experiment collecting and interpreting data and finally presenting the findings is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses,

covering conventional topics to the latest - Nanoscience

Value additions in the Revamped Curriculum: Outcome / Benefits

I	**Foundation Course** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning chemistry.	Instil confidence among students Create interest for the subject
I, II, III,IV	**Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial)	Industry ready graduates Skilled human resource Students are equipped with essential skills to makethem employable
		Training on entrepreneurial skills enable the students to gain knowledge and make them ready for start-up. Provides an opportunity for independent livelihood. Generates self – employment. Creates small scale entrepreneurs. Training to girls leads to women empowerment.
		Skill enhancement courses help the students to gain internships, apprenticeships, field work involving data collection, compilation, analysis etc. Enables the students to learn the operations of instruments. Improves self-confidence. Learns different analytical techniques.
		Discipline specific course helps to recognise, identify, examine and testify any and every kind of physical evidence mostly found in crime scenes. It improves the technical knowhow of solving real life problems.

I, II, III, IV, V &VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	Strengthening the domain knowledge Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature Students are exposed to latest topics on Computer Science / IT, physics and mathematics. Emerging topics in higher education / industry /
		communication network / health sector etc. areintroduced with hands-on-training. Exposure to industry moulds students into solution providers. Generates Industry ready graduates. Employment opportunities enhanced.
II year Vacation activity	Internship / Industrial Training	Practical training at the Industry/ Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.
V	Project with Viva – voce	Self-learning is enhanced. Application of the concept to real situation is conceived resulting in tangible outcome. Helps to explore industries and to have first-hand experience in industrial background.(when studentscarry out projects in industries) Instil confidence and problem solving approach.
VI	Introduction of Professional Competency component	Curriculum design accommodates all category of learners; 'Training for Competitive Examinations' – caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, NDA, Banking Services, CAT, JAM, TNPSC group services, etc.
Extra Credits: For Advanced Learners / Honorsdegree		To cater to the needs of peer learners / research aspirants
Skills acquired from the Courses		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

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

Programme Scheme

Eligibility

A Pass in +2 examination conducted by Board of Higher Secondary Education, Government of Tamilnadu or equivalent with chemistry as one of the subject.

For Programme Completion

A Candidate shall complete:

- Part I - Language papers – Tamil/Arabic in semesters I, II, III and IV respectively
- Part II - Language papers - English in semesters I, II, III, IV respectively
- Part III - Core papers in semesters I, II, III, IV, V and VI respectively
- Part III - Elective papers (Discipline / Generic) in semesters I, II, III, IV, V and VI respectively
- Part IV – Skill Enhancement Course (NME) papers in semesters I and II respectively
- Part IV - Skill Enhancement Course papers in semesters I, II, III, and IV respectively
- Part IV - Skill Enhancement Course (Foundation Course) paper in semester I respectively

- Part IV - Skill Enhancement Course (Professional Competency Skill) in semester VI respectively
- Part IV - Value Education paper in semester V respectively
- Part IV - Environmental Studies paper in semesters III and IV respectively
- Part IV – Summer Internship/Industrial Training paper in semester V respectively
- Part V - Extension activity in semester VI respectively

Scheme of Examinations under Choice Based Credit System

Term End Examinations (TEE)	- 75 Marks
Continuous Internal Assessment Examinations (CIAE)	- 25 Marks
Total	- 100 Marks

Pattern of Continuous Internal Assessment Examinations (CIAE)

Average of Two Internal Tests (each 20 marks)	- 20 Marks
Assignments	- 05 Marks
Total	- 25 Marks

Pattern of Term End Examination (Max. marks: 75 / Time: 3 Hours)

External Examinations Question Paper Pattern for Part I & III and Part IV

(Elective & Skill Enhancement Course)

Section – A (10 X 1 = 10 Marks) Answer ALL questions.
- Questions 1 - 10
- Two questions from each unit
- Multiple choice questions and each question carries Four choices

Section – B (5 X 7 = 35 Marks)
Answer ALL questions choosing either A or B.
- Questions 11 - 15
- Two questions from each unit (either…. or…. type)
- Descriptive Type

Section – C (3 X 10 = 30 Marks)

Answer any THREE out of five questions.

- Questions 16 - 20
- One question from each unit
- Descriptive Type

External Examinations Question Paper Pattern for Environmental Studies and Value Education

Section – A: (5 X 6 = 30 Marks)

Answer ALL questions choosing either A or B.

- Questions 1 - 5
- Two questions from each unit (either…. or…. type)
- Descriptive Type

Section – B (3 X 15 = 45 Marks)

Answer any THREE out of five questions.

- Questions 6 – 10
- One question from each unit
- Descriptive Type

Part V (Extension Activities)

- Internal Evaluation

Passing Marks

Minimum 27 for External Exam
Eligibility for the degree – passing minimum is **40%**

Practical Examination

Internal – 40 marks

External – 60 marks

Total – 100 marks

Passing minimum is **40%**

Semester-I

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part I	23UTALL11	பொதுத்தமிழ் - 1 தமிழ் இலக்கிய வரலாறு - 1	6	25	75	100	3
	23UARLL11	Paper I : Prose					
	23UMMLL11	Prose, Composition and Translation					
Part II	23UENLL11	General English - I	6	25	75	100	3
Part – III	23UCHCC11	General Chemistry–I	5	25	75	100	5
	23UCHCC1P	Quantitative Inorganic Estimation (titrimetry) and Inorganic Preparations	3	40	60	100	3
	23UBYGE11/ 23UZYGE11	Allied Botany - I / Allied Zoology I	4	25	75	100	3
	23UBYGE2P/ 23UZYGE2P	Allied Botany Practical / Allied Zoology Practical	2	-	-	-	-
Part – IV	23UCHSE11	Food Chemistry	2	25	75	100	2
	23UCHFN11	Role of Chemistry in daily life	2	25	75	100	2
Total			**30**				**21**

Semester-II

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part – I	23UTALL21	பொதுத்தமிழ்- 2தமிழ் இலக்கிய வரலாறு- 2	6	25	75	100	3
	23UARLL21	Paper II : Grammar					
	23UMMLL21	Office Communication Malayalam					
Part – II	23UENLL21	General English- II	6	25	75	100	3
Part – III	23UCHCC21	General Chemistry–II	5	25	75	100	5
	23UCHCC2P	Qualitative Organic Analysis and preparation of Organic Compounds	3	40	60	100	3
	23UBYGE21/ 23UZYGE21	Allied Botany - II / Allied Zoology II	4	25	75	100	3
	23UBYGE2P/ 23UZYGE2P	Allied Botany Practical / Allied Zoology Practical	2	40	60	100	2
Part – IV	23UCHSE21	Dairy Chemistry	2	25	75	100	2
	23UCHSE22	Cosmetics and Personal care Products	2	25	75	100	2
Total			**30**				**23**

Course Code	Course Title	Category	Credits	Inst. Hours	Marks		
					CIAE	External	Total
23UCHCC11	General Chemistry-I	Core	5	5	25	75	100

Learning Objectives		
L1	Various atomic models and atomic structure.	
L2	Wave particle duality of matter.	
L3	Periodic table, periodicity in properties and its application in explaining the chemical behaviour.	
L4	Nature of chemical bonding.	
L5	Fundamental concepts of organic chemistry.	
UNIT	**Contents**	**No. of Hours**
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 core concepts.	15
II	**Introduction to Quantum mechanics** Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wave functions, Formulation of Schrodinger wave equation-Probability and electron density- visualizing the orbitals - Probability density and significance of Ψ and Ψ^2. **Modern Periodic Table** Cause of periodicity; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity-electronegativity scales, applications of	15

	electronegativity.	
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 salvation energy; Ion polarisation– polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds; problems involving the core concepts. **Covalent bond** Shapes of orbitals, overlap of orbitals – σ and π bonds; directed valency-hybridization; VSEPR theory - shapes of molecules of the type 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.	**15**
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 non bonding orbitals, bond order; MO diagrams of H_2,C_2,O_2,O_2^+,O_2^-,O_2^{2-}, N_2, NO, HF, CO; magnetic characteristics, comparison of VB and MO theories. Coordinate bond: Definition, Formation of BF_3, NH_3, NH_4^+, H_3O^+ - properties. Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor– types, applications of semiconductors. Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding – Types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boiling points.	**15**
V	**Basic concepts in Organic Chemistry and Electronic effects** Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents-electrophiles, nucleophiles, free radicals; reaction intermediates–carbanions, carbocations, carbenes, arynes and nitrynes.	**15**

	Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects. Resonance–resonance energy, conditions for resonance-acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free radicals, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene, bond lengths; steric inhibition to resonance. Hyperconjugation-stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane. Types of organic reactions -addition, substitution, elimination and rearrangements.	
	Total	**75**
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.	K1,K2,K3,K4
2	Classify the elements in the periodic table, types of bonds, reaction intermediates, electronic effects in organic compounds, types of reagents.	K1,K2,K3,K4 ,K5,K6
3	Apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δx, Δp electronegativity, percentage ionic character and bond order.	K1,K2,K3,K4 ,K5,K6
4	Evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects.	K1,K2,K3,K4 ,K5,K6
5	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,K3,K4 ,K5

Textbooks

1	Madan, R. D. and Sathya Prakash, ***Modern Inorganic Chemistry,*** 2nd ed.; S. Chand and Company: New Delhi, 2003.
2	Rao, C. N. R. University General Chemistry, Macmillan Publication: New Delhi, 2000.
3	Puri, B. R. and Sharma, L. R. ***Principles of Physical Chemistry,*** 38 thed.; Vishal Publishing Company: Jalandhar, 2002.
4	Bruce, P. Y. and Prasad K. J. R. ***Essential Organic Chemistry***, Pearson Education: New Delhi, 2008.
5	Dash UN, Dharmarha OP, ***Soni P.L. Text book 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,*** 4thed.; 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***, 10thed.; Oxford University Press:NewYork,2014.
5	Huheey, J. E. ***Inorganic Chemistry: Principles of Structure and Reactivity***, 4thed .; Addison, Wesley Publishing Company: India,1993.
Web Resources	
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/

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Inst. Hours	Marks		
					CIAE	External	Total
23UCHCC1P	**Quantitative Inorganic Estimation (titrimetry) and Inorganic Preparations**	**Core**	**3**	**3**	**40**	**60**	**100**

Learning Objectives		
L1	Laboratory safety.	
L2	Handling glass wares.	
L3	Quantitative estimation.	
L4	Preparation of inorganic compounds.	
UNIT	**Contents**	**No. of Hours**
I	**Chemical Laboratory Safety in Academic Institutions** Introduction-importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers-types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal. **Common Apparatus Used in Quantitative Estimation (Volumetric)** Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand. Principle of Quantitative Estimation (Volumetric) Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox, complexometric, iodimetric and iodometric titrations; indicators–types, theory of acid–base, redox, metal ion and adsorption indicators, choice of indicators.	15

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).	15
III	**Complexometry** Estimation of hardness of water using EDTA. **Estimations** Estimation of iron in iron tablets. Estimation of ascorbic acid. **Preparation of Inorganic compounds** Potash alum. Tetraammine copper (II) sulphate. Hexammine cobalt (III) chloride. Mohr's Salt.	15
	Total	**45**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Explain the basic principles involved in titrimetric analysis and inorganic preparations.	K1,K2,K3, K4
2	Compare the methodologies of different titrimetric analysis.	K1,K2,K3, K4, K5,K6
3	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, K4, K5,K6
4	Assess the yield of different inorganic preparations and identify the end point of various titrations.	K1,K2,K3, K4, K5,K6

5	Determine the hardness of water using EDTA by Complexometry	K1,K2,K3, K4, K5
Textbooks		
1	Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. ***Basic Principles of Practical Chemistry***, 2nded.; Sultan Chand & Sons: New Delhi, 1997.	
2	Nad, A.K.; Mahapatra, B.; Ghoshal, A.; ***An advanced course in Practical Chemistry***, 3rded.; 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***, 6thed.; Pearson Education Ltd: New Delhi, 2000.	
Web Resources		
1	http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis	
2	https://chemdictionary.org/titration-indicator/	

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	3	3	3	3	3	3	2	2	2

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Inst. Hours	Marks		
					CIAE	External	Total
23UBYGE11	ALLIED BOTANY-I	Core-Allied-I	3	4	25	75	100

Learning Objectives		
L1	To study morphological and anatomical adaptations of plants of various habitats.	
L2	To demonstrate techniques of plant tissue culture.	
L3	To familiarize with the structure of DNA, RNA.	
L4	To carryout experiments related with plant physiology.	
L5	To perform biochemistry experiments.	
UNIT	**Contents**	**No. of Hours**
I	**Algae:** General characters of algae - Structure, reproduction and life cycle of the following genera - *Anabaena* and *Sargassum* and economic importance of algae.	12
II	**Fungi, Bacteria and Virus:** General characters of fungi, structure, reproduction and life cycle of the following genera – *Penicillium* and *Agaricus* and economic importance of fungi. Bacteria - general characters, structure and reproduction of *Escherichia coli* and economic importance of bacteria. Virus - general characters, structure of TMV, structure of bacteriophage.	12
III	**Bryophytes, Pteridophytes and Gymnosperms:** General characters of Bryophytes, Structure and life cycle of *Funaria*. General characters of Pteridophytes, Structure and life cycle of *Lycopodium*. General characters of Gymnosperms, Structure and life cycle of *Cycas*.	12
IV	**Cell Biology:** Prokaryotic and Eukaryotic cell- structure /organization. Cell organelles - ultra structure and function of chloroplast, mitochondria and nucleus. Cell division - mitosis and meiosis.	12
V	**Genetics and Plant Biotechnology:** Mendelism - Law of dominance, Law of segregation,	12

	Incomplete dominance. Law of independent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - *In vitro* culture methods. Plant tissue culture and its application in biotechnology.	
	Total	**60**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Increase the awareness and appreciation of human friendly algae and their economic importance.	K1,K2,K3,K4
2	Develop an understanding of microbes and fungi and appreciate their adaptive strategies	K1,K2,K3,K4,K5,K6
3	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	K1,K2,K3,K4,K5,K6
4	Compare the structure and function of cells and explain the development of cells.	K1,K2,K3,K4,K5,K6
5	Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.	K1,K2,K3,K4,K5

Textbooks	
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 Age International (P) Ltd., Publishers, Bengaluru
3	Sharma,O.P.2017. Bryophyta, MacMillanIndiaLtd.Delhi.
4	Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
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-(PDF-15P).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-beyond-pine-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

Mapping with Programme Outcomes

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	3	3	3	-	-	-
CO 2	3	3	3	3	3	-	-	-
CO 3	2	3	3	3	3	-	-	-
CO 4	3	3	2	3	3	-	-	-
CO 5	3	2	2	2	2	-	-	-

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	1	3	3	3	3
CO4	3	2	3	2	3
CO5	2	2	1	2	1

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Inst. Hours	Marks		
					CIAE	External	Total
23UZYGE11	**Allied Zoology- I**	**Core**	**3**	**4**	**25**	**75**	**100**

Learning Objectives		
L1	To acquire a basic knowledge of diversity and organization of Protozoa, Coelenterata, Helminthes and Annelida	
L2	To acquire a basic knowledge of diversity and organization of Arthropoda, Mollusca and Echinodermata	
L3	To comprehend the taxonomic position and diversity among Protochordata, Pisces and Amphibia	
L4	To comprehend the taxonomic position and diversity among Reptilia, Aves and Mammalia	
L5	To acquire detailed knowledge of select invertebrate and chordate form	
UNIT	**Contents**	**No. of Hours**
I	**Diversity of Invertebrates–I** Principles of taxonomy. Criteria for classification–Symmetry and Coelom–Binomial nomen clature-General characters of Invertebrates- General characters of the phyla with examples: i) Protozoa ii)Porifera iii)Coelenterata iv)Platyhelminthes v)Nematoda *vi)*Annelida, vii) Arthropoda viii)Mollusca, ix) Echinodermata,- Amoeba–External characters and Nutrition.	12
II	Obelia colony – Structural Organization,Fasciola and Earthworm External characters ,Structure of Pearl oyster - formation of pearl-types of culture-Starfish - External Morphology, Water vascular System	12
III	Diversity of Chordates: Fishes and Amphibians: Salient features of Hemichordata / Urochordata / Cephaloch or data with one example each – General characters of Phylum Chordata and classification upto class level with one example-External features of Amphioxus Shark and Frog.	12
IV	Reptiles and Birds: Identification of poisonous and non - poisonous snakes—Causes of Extinction of dinosaurs- Migration of Birds and Flight adaptation in Birds.	12
V	Mammals : Rabbit - External features – Digestive system, Respiratory system--Dentition in mammals -adaptations of aquatic mammals.	12

	Total	60
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Recall the characteristic features invertebrates and chordates.	K1,K2,K3,K4
2	Classify invertebrates up to class level and chordates upto Order level	K1,K2,K3,K4,K5,K6
3	Explain and discuss the structural and functional organization of some invertebrates and chordates	K1,K2,K3,K4,K5,K6
4	Relate the adaptations and habits of animals to their habitat	K1,K2,K3,K4,K5,K6
5	Analyze the taxonomic position of animals.	K1,K2,K3,K4,K5
Textbooks		
1	Ekambaranatha Iyar and T.N.Ananthakrishnian – A Manual of Zoology Invertebrata – VolI: Viswanathan Publishers.	
Reference Books		
1.	Ekambaranatha Iyar and T.N.Ananthakrishn an,- A Manualof Zoology-Invertebrata–VolII:Viswanath an Publishors.	
2.	Ekambaranatha Iyar and T.N.Ananthakrishnan, - A Manual of Zoology:Chordata Viswanathan Publishers.	
3.	Ekambaranatha Iyar and T.N.Ananthakrishnan,- A Manual of Zoology: Chordata Viswanathan Publishers	
4.	Jordan E.L. and P.S.Verma –Invertebrate Zoology, S.Chand & Co.	
Web Resources		
1.	www.sanctuary asia. com	
2.	www.ias zoology.com	

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	3	2	3	2	1	3
CO 2	2	3	3	3	3	2	2	3
CO 3	3	3	2	3	3	3	1	2
CO 4	3	2	3	3	3	2	1	2
CO 5	3	2	3	3	2	2	1	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Inst. Hours	Marks		
					CIAE	External	Total
23UCHSE11	Food Chemistry	NME	2	2	25	75	100

Learning Objectives		
L1	Types of food.	
L2	Food adulteration and poisons.	
L3	Food additives and preservation.	
UNIT	**Contents**	**No. of Hours**
I	**Food Adulteration** Sources of food, types, advantages and disadvantages. Food adulteration contamination of wheat, rice, milk, butter etc. with clay stones, water and toxic chemicals - Common adulterants, Ghee adulterants and their detection. Detection of adulterated foods by simple analytical techniques.	6
II	**Food Poison** Food poisons-natural poisons (alkaloids-nephrotoxin)-pesticides, (DDT, BHC, Malathion)-Chemical poisons-First aid for poison consumed victims.	6
III	**Food Additives** Food additives-artificial sweeteners–Saccharin-Cyclomate and Aspartate, Food flavours-esters, aldehydes and heterocyclic compounds–Food colours- Emulsifying agents–preservatives-leavening agents. Baking powder– yeast–taste makers–MSG-vinegar.	6
IV	**Beverages** Beverages-soft drinks-soda-fruit juices-alcoholic beverages-examples. Carbonation-addiction to alcohol–diseases of liver and social problems.	6
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	6

	values and their significance.	
	Total	**30**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Learn about Food adulteration-contamination of Wheat, Rice, Milk and Butter.	K1,K2,K3,K4
2	Get an awareness about food poisons like natural poisons(alkaloids nephrotoxin) pesticides, DDT, BHC, Malathion.	K1,K2,K3,K4, K5,K6
3	Get an exposure on food additives, artificial sweeteners, Saccharin, Cyclomate and Aspartate in the food industries.	K1,K2,K3,K4, K5,K6
4	Acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples.	K1,K2,K3,K4, K5,K6
5	Study about fats and oils-Sources of oils-production of refined vegetable oils-preservation. Saturated and unsaturated fats–MUFA and PUFA.	K1,K2,K3,K4, K5

Textbooks

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, Narosa publishning house, 2010.
4	***Food Chemistry***, Dr.L. Rakesh Sharma, Evince 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***, 4thEdition, 2009.
2.	M. Swaminathan, ***Food Science and Experimental Foods***, Ganesh and Company, 1979.
3.	Hasenhuettl, 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.

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Inst. Hours	Marks		
					CIAE	External	Total
23UCHFN11	Role of Chemistry in daily life	FC	2	2	25	75	100

Learning Objectives		
L1	Importance of Chemistry in everyday life.	
L2	Chemistry of building materials and food.	
L3	Chemistry of Drugs and pharmaceuticals.	
UNIT	**Contents**	**No. of Hours**
I	General survey of chemicals used in everyday life. Air- components and their importance; photosynthetic reaction, air pollution, green - house effect and the impact on our life style. Water- Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness-water pollution	6
II	Building materials - cement, ceramics, glass and refractories- definition, composition and application only. Plastics-polythene, PVC, bakelite, polyesters, melamine-formaldehyde resins- preparation and uses only.	6
III	Food and Nutrition- Carbohydrates, Proteins, Fats- definition and their importance as food constituents– balanced diet–Calories, minerals and vitamins (sources and their physiological importance). Cosmetics–toothpaste, face powder, soaps and detergents, shampoos, nail polish, perfumes –general formulation and preparations-possible hazards of cosmetic use.	6
IV	Chemicals in food production– fertilizers - need, natural sources; urea, NPK fertilizers and super phosphate. Fuel – classification - solid, liquid and gaseous; nuclear fuel examples and uses.	6
V	Pharmaceutical drugs-analgesics and antipyretics- paracetamol and aspirin. Colour chemicals - pigments and dyes - examples and applications. Explosives-classification and examples.	6
	Total	**30**

Course Outcomes		Knowledge Level
CO	**On completion of this course, students will**	
1	Earn about the chemicals used in everyday life as well as air pollution and water pollution.	K1,K2,K3,K4
2	Get knowledge on building materials cement, ceramics, glass and plastics, polythene, PVC bakelite, polyesters.	K1,K2,K3,K4, K5,K6
3	Acquire information about Food and Nutrition. Carbohydrates, Proteins, Fats. Also have awareness about Cosmetics, Toothpastes, face powder, soaps and detergents.	K1,K2,K3,K4, K5,K6
4	Discuss about the fertilizers like urea, NPK fertilizers and superphosphate. Fuel classification solid, liquid and gaseous; nuclear fuel- examples and uses.	K1,K2,K3,K4, K5,K6
5	Have an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications.	K1,K2,K3,K4, K5
Textbooks		
1	***Food chemistry***, H.K.Chopra, P.S.Panesar, Narosa publishing house, 2010.	
2	***A text book of pharmaceutical chemistry*** by Jayashree Ghosh, S Chand publishing, 2012.	
3	S.Vaithyanathan, ***Text book of Ancillary Chemistry***; Priya Publications, Karur, 2006.	
4	B.K, Sharma, ***Industrial Chemistry***; GOEL publishing house, Meerut, sixteenth edition, 2014.	
5	Jayashree Ghosh, ***Fundamental Concepts of Applied Chemistry***, S.Chand & Co.Publishers, second edition, 2006.	
6	***Introduction to forensic chemistry***, Kelly M. Elkins, CRC Press Taylor& Francis Group, 2019.	
Reference Books		
1	Randolph. Norris Shreve, ***Chemical Process Industries***, Mc Graw Hill, Texas, fourth edition, 1977.	
2	W.A. Poucher, Joseph A.Brink, Jr. ***Perfumes, Cosmetics and Soaps***, Springer, 2000.	
3	A.K.De, ***Environmental Chemistry***, New Age International Public Co., 1990.	

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Inst. Hours	Marks		
					CIAE	External	Total
23UCHCC21	**General Chemistry-II**	**Core**	**5**	**5**	**25**	**75**	**100**

Learning Objectives		
L1	Chemistry of acids, bases and ionic equilibrium.	
L2	Properties of s and p-block elements.	
L3	Chemistry of hydrocarbons.	
L4	Applications of acids and bases.	
L5	Compounds of main block elements and hydrocarbons.	
UNIT	**Contents**	**No. of Hours**
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 polybasic acids, ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation; acid base indicators, theory of acid base indicators–action of phenolphthalein and methyl orange, titration curves-use of acid base indicators; Buffer solutions-types, mechanism of buffer action in acid and basic buffer, Henderson- Hasselbalch equation; Salt hydrolysis-salts of weak acids and strong bases, weak bases and strong acids, weak acids and weak bases-hydrolysis constant, degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis; Solubility product-determination and applications; numerical problems involving the core concepts**.**	15
II	**Chemistry of s-Block Elements** Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, Na_2CO_3, KBr, $KClO_3$ alkaline earth metals. Anomalous behavior of Be. **Chemistry of p-Block Elements (Group13&14)**	15

	Preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al. comparison of carbon with silicon. Carbon-di-sulphide Preparation, properties, structure and uses. Percarbonates, permonocarbonates and perdicarbonates.	
III	**Chemistry of p-Block Elements(Group15-18)** General characteristics of elements of Group15; chemistry of H_2N-NH_2, NH_2OH, NH_3 and HNO_3. Chemistry of PH_3, PCl_3, PCl_5, $POCl_3$, P_2O_5 and oxyacids 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 and selenium– Oxyacids of sulphur (Caro's and Marshall's acids). Chemistry of Halogens: General characteristics of halogen with reference to electronegativity, 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 IF7), pseudohalogens [$(CN)_2$ 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.	15
IV	**Hydrocarbon Chemistry-I** **Petroproducts:** Fractional distillation of petroleum; cracking, isomerisation, alkylation, reforming and uses **Alkenes**-Nomenclature, general methods of preparation– Mechanism of β elimination reactions – E1 and E2 mechanism - factors influencing – stereochemistry– orientation–Hofmann and Saytzeff rules. Reactions of Alkenes –addition reactions–mechanisms– Markownikoff's rule, Kharasch effect, oxidation reactions–hydroxylation, oxidative degradation, epoxidation, ozonolysis; polymerization. **Alkadienes** Nomenclature-classification isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to Conjugated dienes 1, 2and1,4 additions; free radical addition to conjugated dienes–Diels–Alder reactions–polymerisation– polybutadiene, polyisoprene (natural rubber), vulcanisation, polychloroprene.	15

	Alkynes Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerization and isomerisation. **Cycloalkanes:** Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations. Conformational analysis of cyclohexane, mono and disubstituted cyclohexanes. Geometrical isomerism in cyclohexanes.	
V	**Hydro carbon 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. Monosubstituted and disubstituted benzene-Effect of substituent–orientation and reactivity. **Polynuclear Aromatic hydrocarbons**: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions–electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at-position –reduction, oxidation–uses. Anthracene – synthesis by Elbs reaction, Diels – Alder reaction and Haworth synthesis; physical properties; reactions-Diels-Alder reaction, preferential substitution at C-9 and C-10; uses.	15
	Total	**75**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Explain the concept of acids, bases and ionic equilibria; periodic properties of s and p block elements, preparation and properties of aliphatic and aromatic hydrocarbons.	K1,K2,K3,K4
2	Discuss the periodic properties of s and p-block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids.	K1,K2,K3,K4, K5,K6
3	Classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons.	K1,K2,K3,K4, K5,K6
4	Explain theories of acids, bases and indicators, buffer action and	K1,K2,K3,K4,

	important compounds of s-block elements.	K5,K6
5	Assess the application of hard and soft acids indicators, buffers, compounds of s and p-block elements and hydrocarbons.	K1,K2,K3,K4, K5

Textbooks	
1	Madan R D, Sathya Prakash, (2003), ***Modern Inorganic Chemistry***, 2nded, S. Chand and Company, New Delhi.
2	Sathya Prakash, Tuli G D, Basu S K and Madan R D, (2003), ***Advanced Inorganic Chemistry,***17thed., S.Chand and Company, New Delhi.
3	Bahl B S, Arul Bhal, (2003), ***Advanced Organic Chemistry***, 3rded., S. Chand and Company, New Delhi.
4	Tewari K S, Mehrothra S N and Vishnoi N K, (1998), ***Textbook of Organic Chemistry*** 2nded., Vikas Publishing House, New Delhi.
5	Puri B R, Sharma L R, (2002), ***Principles of Physical Chemistry***, 38thed., Vishal Publishing Company, Jalandhar.
Reference Books	
1.	Maron S H and Prutton C P,(1972), ***Principles of Physical Chemistry***, 4thed., The Mac millan Company, Newyork.
2.	Barrow G M, (1992), ***Physical Chemistry***, 5thed., Tata Mc Graw 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***, 4thed., Addison Wesley Publishing Company, India.
5	Gurudeep Raj,(2001), ***Advanced Inorganic Chemistry Vol–I***, 26th ed., Goel Publishing House, Meerut.
6	Agarwal O P, (1995), ***Reactions and Reagents in Organic Chemistry***, 8thed., Goel Publishing House, Meerut.
Web Resources	
1	https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/smblack/chem1010/lecture_notes/4B.htmlhttp://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/course/64 -atomic-structure-and-chemical-bonding
2	**MOOC components** http://nptel.ac.in/courses/104101090/
3	Lecture1:Classification of elements and periodic properties http://nptel.ac.in/courses/104101090/

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Inst. Hours	Marks		
					CIAE	External	Total
23UCHCC2P	Qualitative organic analysis and preparation of organic compounds	Core	3	3	40	60	100

Learning Objectives		
L1	Laboratory safety.	
L2	Handling glass wares.	
L3	Analysis of organic compounds.	
L4	Preparation of organic compounds.	
UNIT	**Contents**	**No. of Hours**
I	Safety rules, symbols and first-aid in chemistry laboratory. Basic ideas about Bunsen burner, its operation and parts of the flame. Chemistry laboratory glassware–basis information and uses.	15
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.	15
III	**Preparation of Organic Compounds** • Nitration-picric acid from Phenol • Halogenation-p-bromo acetanilide from acetanilide • Oxidation-benzoic acid from Benzaldehyde	15

	• Microwave assisted reactions in water: • Methyl benzoate to Benzoic acid • Salicylic acid from Methyl Salicylate • Rearrangement-Benzil to Benzilic Acid • Hydrolysis of benzamide to Benzoic Acid **Separation and Purification Techniques (Not for Examination)** • Purification of organic compounds by crystallization (from water/alcohol) and distillation • Determination of melting and boiling points of organic compounds. • **Steam distillation** - Extraction of essential oil from citrus fruits/eucalyptus leaves. **Chromatography(anyone)(Group experiment)** • Separation of amino acids by Paper Chromatography • Thin Layer Chromatography-mixture of sugars/plant pigments/permanganate dichromate. • Column Chromatography-extraction of carotene, chlorophyll and xanthophylls from leaves/separation of anthracene-anthracene picrate. • **Electrophoresis–**Separation of amino acids and proteins. **(Demonstration)** • Isolation of casein from milk/Determination of saponification value of oil or fat/Estimation of acetic acid from commercial vinegar.(Any one Group experiment)(4, 5 & 6–not for ESE)	
	Total	**45**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Observe the physical state, odour, colour and solubility of the given organic compound.	K1,K2,K3,K4
2	Identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.	K1,K2,K3,K4, K5,K6
3	Compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non-reducing sugars and explain the reactions behind it.	K1,K2,K3,K4, K5,K6

4	Exhibit a solid derivative with respect to the identified functional group.	K1,K2,K3,K4, K5,K6
5	Demonstrate the isolation of casein from milk**.**	K1,K2,K3,K4, K5

Reference Books	
1	Venkateswaran,V.; Veeraswamy,R.; Kulandaivelu, A.R. ***Basic Principles of Practical Chemistry***, 2nded.; 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 Text book of Practical Organic Chemistry***, 5thed.;Pearson: India, 1989
Web Resources	
1	https://www.vlab.co.in/broad-area-chemical-sciences

Mapping with Programme Outcomes:

CO /PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	3	3	3	3	3	3	2	2	2

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Inst. Hours	Marks		
					CIAE	External	Total
23UBYGE21	ALLIED BOTANY-II	Core	3	4	25	75	100

Learning Objectives		
L1	To be familiar with the basic concepts and principles of plant systematics.	
L2	Learn the importance of plant anatomy in plant production systems.	
L3	Understand the mechanism underling the shift from vegetative to reproductive phase.	
L4	To learn about the physiological processes that underlie plant metabolism.	
L5	To know the energy production and its utilization in plants.	
UNIT	**Contents**	**No. of Hours**
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.	12
II	**TAXONOMY:** Study of the range of characters and plants of economic importance in the following families: Rutaceae, Caesalpiniaceae, Asclepiadaceae, Euphorbiaceae and Cannaceae	12
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.	12
IV	**EMBRYOLOGY** Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination -double fertilization, structure of dicotyledonous and monocotyledonous seeds.	12
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.	12
	Total	**60**
		Knowledge Level

Course Outcomes		
CO	**On completion of this course, students will**	
1	Understand the fundamental concepts of plant anatomy and embryology.	K1,K2,K3,K4
2	Analyze and recognize the different organs of plants and secondary growth.	K1,K2,K3,K4,K5,K6
3	Understand water relation of plants with respect to various physiological processes.	K1,K2,K3,K4,K5,K6
4	Classify aerobic and anaerobic respiration.	K1,K2,K3,K4,K5,K6
5	Classify plant systematics and recognize the importance of herbarium and virtual herbarium.	K1,K2,K3,K4,K5

Textbooks	
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.	Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.
5.	Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand and Company Ltd., New Delhi
6.	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_esc=y
2.	https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFnUC&redir_esc=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

Mapping with Programme Outcomes

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	3	3	3	-	-	-
CO 2	3	3	3	3	3	-	-	-
CO 3	2	3	3	3	3	-	-	-
CO 4	3	3	2	3	3	-	-	-
CO 5	3	2	2	2	2	-	-	-

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	1	3	3	3	3
CO4	3	2	3	2	3
CO5	2	2	1	2	1

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Inst. Hours	Marks		
					CIAE	External	Total
23UZYGE21	Allied Zoology – II	Core	3	4	25	75	100

Learning Objectives		
L1	To enable students to learn basic concepts relating to aspects of respiratory, circulatory, excretory nervous and sensory physiology.	
L2	To enable students to comprehend the processes involved during development	
L3	To enable students to learn basic concepts of immunity and the working of immune organs and familiarize them with the recommended vaccinations schedule	
L4	To enable students to comprehend the basic concepts of human genetics and patterns of inheritance	
L5	To enable students to learn about aspects of animal behavior such as for aging, courtship, nest construction, parental care and learning	
UNIT	**Contents**	**No. of Hours**
I	Cell Biology:-Animal cell -Structure and functions of Cell membrane, Mitochondria and Endoplasmic reticulum. Microbiology: structure of aprokaryotic cell(E.Coli), T4 Phage Morphology of Bacteria –coccus,bacillus,spirochetes and comma shaped bacteria	12
II	Developmental biology:- Structure of sperm and ovum in Frog -- Fertilization, cleavage, Placentation in Mammals- Classification and functions - Test tube baby. Biotechnology Transgenic animals, DNA fingerprinting application	12
III	Genetics: Mendel's Laws–Mono and Di-hybrid crosses. Linkage and Crossing over-Sex Determination in Humans; Molecular Biology:-Structureand functions of DNA, tRNAs, DNA replication –Protein synthesis--.	12
IV	Biochemistry and Animal Physiology:-Classification- of Carbohydrates, Proteins and Lipids with examples-Mechanism of respiration and Transport of gases – Brief account on- Structure of Nephron and Neuron. Ecology: Ecosystem: Components – food chain and its types – food web; Ecological pyramids	12
V	Immunology: Types of Immunity(Innate and Acquired immunity).Lymphoid organs.(Primary and secondary)-	12

	Immunoglobulin– Types and structure-Antigen–antibody reactions. Evolution: Lamarckism and Darwin's theory-Human Evolution	
	Total	**60**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Recall the parts and working of body organs and Developmental stages, name the patterns off inheritance and list different types of animal behavior	K1,K2,K3,K4
2	Analyze the different developmental stages	K1,K2,K3,K4, K5,K6
3	Analyze the working of body and immune systems	K1,K2,K3,K4, K5,K6
4	Analyze the different patterns of inheritance	K1,K2,K3,K4, K5,K6
5	Relate the behavior of animals to physiology. Analyse the Different types of bio molecules.	K1,K2,K3,K4, K5

Textbooks	
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.(12thed.).New Jersey:Pearson Education
3.	Mathur,R.-Animal Behaviour.Meerut : Rastogi.
4.	Verma p. s. & Agrwal Developmental Biology.,Chordta embryology S.Chan&co.

Mapping with Programme Outcomes:

CO /PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	3	3	3	2	3	2	2	3
CO 2	2	3	3	2	3	3	2	1
CO 3	3	2	2	3	3	3	3	2
CO 4	3	3	2	3	3	2	2	3
CO 5	3	2	3	2	3	3	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Inst. Hours	Marks		
					CIAE	External	Total
23UBYGE2P	**ALLIED BOTANY PRACTICAL**	**Core**	**2**	**2**	**40**	**60**	**100**

Learning Objectives		
L1	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.	
L2	To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.	
L3	To be familiar with the basic concepts and principles of plant systematics.	
L4	Understanding of laws of inheritance, genetic basis of loci and alleles.	
L5	To learn about the physiological processes that underlie plant metabolism.	
UNIT	**Contents**	**No. of Hours**
I	Make suitable micro preparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.	9
II	Micro photographs of the cell organelles ultra structure.	9
III	Simple genetic problems.	9
IV	To describe in technical terms, plants belonging to any of the family prescribes and to identify the family.	9
V	To dissect a flower, construct floral diagram and write floral formula.	8
VI	Demonstration experiments 1.Ganong's Light screen 2.Ganong'srespiroscope	8
VII	Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperm anatomy, Embryology, Cell biology and Biotechnology.	8
	Total	**60**

Course Outcomes	**Knowledge Level**

CO	On completion of this course, students will	
1	To study the internal organization of algae and fungi.	K1,K2,K3,K4
2	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms..	K1,K2,K3,K4,K5, K6
3	To study the classical taxonomy with reference to different parameters.	K1,K2,K3,K4,K5, K6
4	Understand the fundamental concepts of plant anatomy and embryology	K1,K2,K3,K4,K5, K6
5	To study the effect of various physical factors on photosynthesis.	K1,K2,K3,K4,K5

Textbooks

1	Sharma,O.P.2017. Bryophyta,MacMillanIndia Ltd,NewDelhi.
2	Sharma,O.P.2012. Pteridophyta,Tata McGraw-Hills Ltd,NewDelhi
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 manualto algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3.	Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual forBryophytes and Pteridophytes. Lambert Academic Publishing.
4.	AlerGingauz.2001. MedicinalChemistry.OxfordUniversityPress&WileyPublications
5.	Steward, F.C. 2012. Plant Physiology Academic Press, US

Web Resources

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

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	3	3	3	-	-	-
CO 2	3	3	3	3	3	-	-	-
CO 3	2	3	3	3	3	-	-	-
CO 4	3	3	2	3	3	-	-	-
CO 5	3	2	2	2	2	-	-	-

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	1	3	3	1	3
CO4	3	3	2	3	3
CO5	2	2	1	2	2

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Inst. Hours	Marks		
					CIAE	External	Total
23UZYGE2P	**Allied Zoology Practical**	**Allied**	**2**	**2**	**40**	**60**	**100**

Learning Objectives	
L1	Visualize, analyze and observe the various types of organisms in invertebrate and chordate, their organ systems, adaptations, their basic developmental pattern

Unit	Content	No.of Hours
I	**DISSECTION CHART:-** Earthworm: Nervous System. Cockroach: Digestive System and Nervous System Pila: Digestive system. Frog: Arterial System and Venous System. ***Comment on mounting charts:*** Earthworm: Body Setae Honeybee: Mouth Parts Pila: Radula. Shark: Placoid Scales.	12
II	**Spotters** Protozoa: Paramecium, Entamoeba. Porifera: Simple Sponge, Sponge-Gemmule, Sponge–Spicules. Coelenterata: Obelia colony, Sea anemone. Helminthes: Liver fluke, Ascaris (Male and Female) Annelida: Earthworm, Leech. Arthropoda: Prawn, Peripatus, Mollusca: Pila, Sepia. Echinodermata: Starfish, Sea-cucumber. Prochordata: Amphioxus, Balanoglossus , Ascidian. Agnatha: Petromyzon. Pisces: Hippocampus, Tilapia. Amphibian: Bufo, Salamander. Reptilia: Poisonous Snakes: Cobra, Krait, and Viper. Non-Poisonous Snakes: Dryophis and Ptyas. Lizards- Chaemeleon and Draco. Aves: Pectoral and Pelvic girdle of Pigeon, Archaeopteryx. Mammals: Bat, Loris.	12
III	**Charts on:** Mitochondria, Golgibody, Endoplasmic reticulum, Mitotic stages identification.	12

	DNA– Model, tRNA –Model Following stages of Frog: i) Egg, ii) Sperm, iii) Blastula, iv) Gastrula. Sheep placenta.	
IV	**List of practical:** Simple staining of non-pathogenic bacteria and observe the morphological structure. Preparation of Onion root tip and observe the Mitotic stages. Mounting of squamous epithelial cell. Qualitative test for ammonia, urea, and uric acid.	12
V	Qualitative test for Carbohydrates, protein, and lipid. Antigen–antibody reaction (in blood grouping). Study the Mendelian traits in man. Human blood grouping	12
	Total	**60**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Explain invertebrate and chordates organ systems	K1,K2,K3,K4
2	Recall that provides basic understanding of principles of animal taxonomy	K1,K2,K3,K4,K5,K6
3	Acquire basic knowledge on cellular components and the developmental stages of organisms	K1,K2,K3,K4,K5,K6
4	Acquire skill on the handling of microbes and plant and animal cells.	K1,K2,K3,K4,K5,K6
5	Acquire the skill of testing the biological samples	K1,K2,K3,K4,K5

Textbooks

1	Kapoor, Practical Zoology, Silver Line Publications, Allahabad, Uttrapradesh , 2014.

Reference Books

1.	Barnes, R.D. Invertebrate Zoology, Cengage Learning, India. 2006, VII Edition.
2.	Pechenik, J. A. Biology of the Invertebrates. McGraw-Hill Education, 2015, VII Edition.
3.	Kotpal, R.L -Modern Text Book of Zoology, Invertebrates (Animal diversity – I), Rastogi Publications, Meerut, 2012.
4.	Vasantika Kashyap- Life of Invertebrates, Second Revised Edition, Vikas Pub. House Pvt. Ltd., New Delhi, 2013.

Web Resources

https://www.mlsu.ac.in/econtents/4190_practical-zoology-invertebrate.pdf

https://www.mlsu.ac.in/econtents/758_PRACTICAL%20ZOOLOGY%20%20VERTEBRATE%20(%20PDFDrive%20).pdf
https://www.uou.ac.in/sites/default/files/slm/BSCZO-104.pdf

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	3	2	3	3	2	2	2	3
CO2	3	3	2	2	3	3	2	1
CO3	3	2	1	3	2	3	1	2
CO4	2	2	2	2	3	3	2	2
CO5	3	2	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Inst. Hours	Marks		
					CIAE	External	Total
23UCHSE21	**Dairy Chemistry**	**NME**	**2**	**2**	**25**	**75**	**100**

Learning Objectives		
L1	chemistry of milk and milk products.	
L2	Processing of milk.	
L3	Preservation and formation of milk products.	
UNIT	**Contents**	**No. of Hours**
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.	6
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, Batchand HTST (High Temperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization.	6
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	6

	adulterants added to ghee and their detection-rancidity-definition-prevention-antioxidants and synergists-natural and synthetic.	
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.	6
V	**Fermented and other Milk Products** Fermented milk products – fermentation of milk-definition, conditions, cultured milk - definition of culture - example, conditions –cultured cream, butter milk - Bulgarious milk -acidophilous milk – Yoheer Indigeneous products- khoa and chhena definition - 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.	6
	Total	**30**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Understand about general composition of milk–constituents and its physical properties.	K1,K2,K3,K4
2	Acquire knowledge about pasteurization of Milk and various types of pasteurization -Bottle, Batchand HTST Ultra High Temperature Pasteurization.	K1,K2,K3,K4,K5,K6
3	Learn about Cream and Butter their composition and how to estimate fat in cream and Ghee	K1,K2,K3,K4,K5,K6
4	Explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk	K1,K2,K3,K4,K5,K6
5	Have an idea about how to make milk powder and its drying process-types of drying process	K1,K2,K3,K4,K5
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.DattaRoy, P.Dinakar, Indian Council of Agricultural Research,1st edition,2008.
4	***A Text book of dairy chemistry***, Saurav Singh, Daya Publishing house,1st 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. Mc sweeney, ***Dairy Chemistry and Biochemistry***, Springer, Second edition, 2016.
5	Dairy chemistry and biochemistry, P.F.Fox, T. Uniacke-Lowe, P.L.H.Mc Sweeney, J.A.O Mahony, Springer, Second edition, 2015.

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Inst. Hours	Marks		
					CIAE	External	Total
23UCHSE22	Cosmetics and Personal Care products	SEC	2	2	25	75	100

Learning Objectives		
L1	Formulations of various types of cosmetics and their significance.	
L2	Hair, skin and dental care.	
L3	Makeup preparations and personal grooming.	
UNIT	**Contents**	**No. of Hours**
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.	6
II	**Hair care** Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner types–ingredients. **Dental care** Toothpastes–ingredients–mouthwash.	6
III	**Makeup** Base–foundation–types–ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouge.	6
IV	**Perfumes** Classification – Natural –plant origin–parts of the plant used chief constituents; animal origin– ambergris from whale, civetone from civet cat, musk from musk deer; synthetic–classification emphasizing characteristics–esters–alcohols–aldehydes–ketones.	6
V	**Beauty treatments** Facials - types – advantages – disadvantages; face masks–types; bleach-types–advantages–disadvantages; shaping the brows; eye lash tinting; perming types; hair colouring and dyeing ; permanent waving – hair straightening; wax types –waxing; pedicure, manicure-	6

	advantages –disadvantages.	
	Total	**30**
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Know about the composition of various cosmetic products.	K1,K2,K3,K4
2	Understand chemical aspects and applications of hair care and dental care and skin care products.	K1,K2,K3,K4, K5,K6
3	Understand chemical aspects and applications of perfumes and skin care products.	K1,K2,K3,K4, K5,K6
4	To understand the methods of beauty treatments their advantages and disadvantage.	K1,K2,K3,K4, K5,K6
5	Understand the hazards of cosmetic products.	K1,K2,K3,K4, K5
Textbooks		
1	Thankamma Jacob,(1997)***Foods, drugs and cosmetics*** –A consumer guide, Macmillan publication, London.	
Reference Books		
1	Wilkinson JBE and Moore R J, (1997) ***Harry's cosmeticology***, 7thed., Chemical Publishers, London.	
2	George Howard, (1987) ***Principles and practice of perfumes and cosmetics***, Stanley Therones, Chettenham.	
Web Resources		
1	http://www.khake.com/page75.html	
2	Net.foxsm/list/284	

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Strong-3 Medium-2 Low-1