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 BIOCHEMISTRY

BACHELOR OF SCIENCE – BIOCHEMISTRY

SYLLABUS (I Year)

Choice Based Credit System – CBCS

(As per TANSCHE/MKU Guidelines)

with

Outcome Based Education (OBE)

(With effect from 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 otherdeprived, under privileged sections of the society, inculcating the sense of social responsibility in them. Our college is committed to produce talented, duty-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 continues forever.

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Department Vision and Mission

Vision

The department of biochemistry discerns to provide quality students trained in the contemporary biochemical tools and technology and to achieve academic excellence in biochemistry. Imparting in depth knowledge to the students, facilitating research activities and cater the ever changing industrial demand and societal needs.

Mission

Strive and achieve a quality education that help the students to enhance problem solving skills to be successful in their professionalizes and to prepare students a lifelong learner offering solid theoretical and practical foundation in various discipline of the biochemistry. Also educate them about their professional and ethical responsibilities that benefit the society at large.

THE REGULATIONS ON LEARNING OUTCOMES BASED CURRICULUM FRAME WORK FOR UNDERGRADUATE EDUCATION

1. Preamble

Biochemistry is the cross over scientific discipline that integrates the living world and chemistry. It involves the study of the structure of biomolecules and explores the biological processes at molecular level in the living organisms. It is the laboratory science that has several domains like cell biology, molecular biology, clinical biology, enzymology, immunology, physiology, pharmacology etc., It has enlightened many aspects of health and diseases and paved the way for many interdisciplinary technological innovations like metabolomics, genomics and proteomics. There is a continuous demand for biochemists in public and private health care sectors, agriculture, medical and forensic departments. Almost all food, pharmaceuticals, health and beauty care etc required quality control and safety checks for which experts in the field of Biochemistry are always in need. The syllabi for the three year B.Sc., degree programme in Biochemistry was framed in such a way that at the end of the course they could apply the knowledge and expertise in industries, diagnostic laboratories and various research fields

The programme endeavours to provide students a broad based training in biochemistry with a solid background of basic concepts as well as exposing them to the exciting advancements in the field. In addition to theoretical knowledge, significant emphasis has been given to provide hands on experience to the students in the forefront areas of experimental biochemistry. A multidisciplinary approach has been employed to provide the best leverage to students to enable them to move into frontier areas of biological research in the future.

The course defines clearly the objectives and the learning outcomes, enabling students to choose the elective subjects for broadening their skills. The course also offers skills to pursue research in the field of Biological Chemistry and thus would produce best minds to meet the demands of society.

Biochemistry, today is considered as an application oriented integrated basic science. It's an interdisciplinary science that has emerged by the confluence of principles of Chemistry, Physics and Mathematics to Biology. Advances in Biochemistry have immense positive implications on the understanding of biochemical interactions, cellular communications, hormonal mechanisms and the cross talks between them. The research in Biochemistry has been translational and there is a shift from hypothesis driven research to data dependent research that promises translational, product oriented research. Much of the advancement in Biochemistry is in the advancement of Biotechnology, as a basic science discipline Biochemistry lead to Biotechnological advancement. Considering its pivotal role in biological sciences, it is imperative to strengthen the fundamental concepts of Biochemistry.

TANSCHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR UNDERGRADUATE EDUCATION	
Programme:	**B.Sc Biochemistry**
Programme Code:	
Duration:	**3 years [UG]**
Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

	PO 11 Self-directed learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability toembrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
Programme Specific Outcomes:	**PSO1 – Placement:** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions. **PSO 2 - Entrepreneur:** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations **PSO3 – Research and Development:** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development. **PSO4 – Contribution to Business World:** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO 5 – Contribution to the Society:** To contribute to the development of the society by collaborating with stakeholders for mutual benefit

PROGRAM OUTCOMES

PO1	Acquire knowledge in Biochemistry and apply the knowledge in their day to day life for betterment of self and society
PO2	Develop critical ,analytical thinking and problem solving skills
PO3	Develop research related skills in defining the problem, formulate and test the hypothesis, analyse, interpret and draw conclusion from data
PO4	Address and develop solutions for societal and environmental needs of local, regional and national development
PO5	Work independently and engage in lifelong learning and enduring proficient progress
PO6	Provoke employability and entrepreneurship among students along with ethics and communication skills

PROGRAM SPECIFIC OUTCOMES

PSO1	Comprehend the knowledge in the biochemical, analytical, biostatistical and computational areas
PSO2	Ability to understand the technical aspects of existing technologies that help in addressing the biological and medical challenges faced by human kind
PSO3	Acquiring analytical and hands on skills to perform research in multidisciplinary environments
PSO4	Use library search tools and online databases and sources to locate and retrieve scientific information about a topic and techniques related to biochemistry

Highlights of the Revamped Curriculum

- The curriculum is created to improve the relationship between business and academia
- Every semester, practicals based on the course taken that semester will aid students in applying what they have learned
- Students will benefit from the introduction of skill based elective courses including Bioinformatics, Nano biotechnology, Therapeutic nutrition, and Medical Laboratory technology as they keep up with technological advancements in their fields of study
- The fourth semester internship will give students a chance to apply what they have learned in class to a real world working experiment
- Skill enhancement courses help students venture new platforms in career.
- Equip students with employability skills, generate self-employment and small scale entrepreneurs.

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	**Foundation Course** It depicts the overview of entry education and makes the students assimilate with the biochemistry course. This course will inculcate knowledge of the academic skills, laboratory skills and research	It gives a strong determination to undergo the course. Be committed and interested in learning the subject
I, II, III, IV	**Skill Enhancement papers (Discipline centric / Generic / Entrepreneurial)**	Improve employability Develop the skill as Laboratory Analyst To make students compete with industrial expectations.
		Incorporating the interest on health, diet, lifestyle diseases will enable the students gain knowledge to get exposed themselves in medical field
		Biomedical Instrumentation skills will aid the students gain knowledge on the various instruments used in the field of medical laboratory and research.
		Entrepreneurial skill training will increase the chance to build their career independently.Learning this skills will encourage the students to enhance creativity, innovation and collaboration
		Discipline /subject specific skill will serve as a route for employability
V & VI	**Elective papers-** An open choice of topics categorized under Generic and Discipline Centric	It reinforces additional knowledge inputs along with core course.Students are familiarized with multi-disciplinary,crossdisciplinary and inter disciplinary subjects. It broadens the knowledge on immunological aspects, pharmacology and research. Additional Employability skills are facilitated through computational biology and Bioentrepreneurship.
V semester Vacation activity	**Internship/ Industrial visit/Field visit**	Hand on training in Medical Labs/ Industry/ Research centres enable the students to explore the practical aspects in career path. They gain confident to fix their career.
VI Semester	**Project with Viva – voce**	Self-learning is enhanced·It serves as a platform to express their innovative ideas in a practical way, which serves as a pathway to enter in the field of research.

VI Semester	**Introduction of Professional Competency skill**	The revamped curriculum caters the education to all category of learners; Learning multidisciplinary papers, updated in the curriculum will help the students to fix their career in the fields of Medical, pharmaceutical, forensic, nutritional, diagnostic coding, etc ·Students are trained in the field of research to bring out the progress in the field of Medical, Agriculture ,Nutrition ,etc which will be a back bone for health and wealth creation and improve the quality of life
Extra Credits: **For Advanced Learners / Honours degree**		ETo cater to the needs of peer learners / research aspirants
Skills acquired from the Courses		Analytical, Laboratory operating, Predicting, Experimenting, Critical thinking, Problem solving, Communication, Interpersonal, Time management and Multi-tasking Skills

Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
ExternalEvaluation	EndSemesterExamination	75 Marks
	Total	100 Marks
Methods of Assessment		
Recall(K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/Comprehend(K2)	MCQ, True/ False, Shortessays, Concept explanations, Short summary or overview	
Application (K3)	Suggest idea/ concept twith examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze(K4)	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate	
	Between various sideas, Map knowledge	
Evaluate(K5)	Longer essay/Evaluation essay, Critiqueorjustify with pros and cons	
Create(K6)	Checkknowledgeinspecificoroffbeatsituations,Discussion,Debatingor Presentations	

Programme SchemeEligibility

A Pass in +2 examination conducted by Board of Higher Secondary Education, Government of Tamilnadu or equivalent with Biology/ Botany and Zoology as one of the subjects.

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
Assignment	-	05 Marks
Total	**-**	**25 Marks**

Pattern of Term End Examinations(Max. Marks: 75 / Time: 3 Hours)

External Examinations Question Paper Pattern for Part I & III and Part IV (Elective & Skill Enhancement Course Subject)

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	6	25	75	100	3
	23UMMLL11	Prose, Composition and Translation	6	25	75	100	3
Part II	23UENLL11	General English - I	6	25	75	100	3
Part – III	23UBCCC11	Nutritional Biochemistry	5	25	75	100	5
	23UBCCC1P	Practical I- Nutritional Biochemistry	3	40	60	100	3
	23UCHGE11	Chemistry For Biological Sciences - I	4	25	75	100	3
	23UCHGE1P	Chemistry Practical For Physical And Biological Sciences - I	2	40	60	100	2
Part IV	23UBCSE11	NME I - Health and Nutrition	2	25	75	100	2
	23UBCFN11	Foundation Course - Basic Concepts in Biochemistry.	2	25	75	100	2
Total			**30**				**23**

Semester-II

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part I	23UTALL21	பொதுத்தமிழ் - 2 தமிழ் இலக்கிய வரலாறு - 2	6	25	75	100	3
	23UARLL21	Paper II : Grammar	6	25	75	100	3
	23UMMLL21	Office Communication Malayalam	6	25	75	100	3
Part II	23UENLL21	General English- II	6	25	75	100	3
Part – III	23UBCCC21	Cell Biology	5	25	75	100	5
	23UBCCC2P	Cell Biology Practical	3	40	60	100	3
	23UCHGE21	Chemistry For Biological Sciences -II	4	25	75	100	3
	23UCHGE2P	Chemistry Practical For Physical And Biological Sciences - II	2	40	60	100	2
Part IV	23UBCSE21	NME II – LIFE STYLE DISEASES	2	25	75	100	2
	23UBCSE22	First Aid	2	25	75	100	2
Total			**30**				**23**

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UBCCC11	Nutritional Biochemistry	Core	5	5	25	75	100

Learning Objectives		
L1	Create awareness about the role of nutrients in maintaining proper health	
L2	Understand the nutritional significance of carbohydrates, lipids and proteins.	
L3	Understand the importance of a balanced diet.	
L4	Study the effect of additives, emulsifiers, flavour enhancing substances in food	
L5	Study the significance of nutraceuticals.	
UNIT	**Contents**	**No. of Hours**
I	Concepts of food and nutrition. Basic food groups-energy yielding, body building and functional foods. Modules of energy. Calorific and nutritive value of foods. Measurement of Calories by bomb calorimeter. Basal metabolic rate (BMR)- definition, determination of BMR and factors affecting BMR. Respiratory quotient (RQ) of nutrients and factors affecting the RQ. SDA-definition and determination- Anthropometric measurement and indices – Height, Weight, chest and waist circumference BMI.	15
II	Physiological role and nutritional significance of carbohydrates, lipids and protein. Evaluation of proteins by nitrogen balance method- Biological value of proteins- Digestibility coefficient, Protein Energy Ratio and Net Protein Utilization. Protein energy malnutrition – Kwashiorkar and Marasmus, Obesity-Types and preventive measures.	15
III	Balanced diet, example of low and high cost balanced diet- for infants, children, adolescents, adults and elderly people. ICMR classification of five food groups and its significance food pyramid. Junk foods- definition and its adverse effects.	15
IV	Food additives: Structure, chemistry, function and application of preservatives, emulsifying agents, buffering agents, stabilizing agents, natural and artificial sweeteners, bleaching, starch modifiers, antimicrobials, food emulsions, fat replacers, viscosity agents, gelling agents and maturing agents. Food colors, flavors, anti-caking agent, antioxidants. Safety assessment of food additives.	15
V	Nutraceuticals and Functional Foods: Definition, properties and function of Nutraceuticals, food Supplements, dietary supplements prebiotics and probiotics, and functional Foods. Food as medicine. Natural pigments from plants– carotenoids, anthocyanins and its benefits.	15
	Total	**75**

Course Outcomes		Knowledge Level
CO	**On completion of this course, students will**	
1	Cognizance of basic food groups viz. Carbohydrates, proteins and lipids and their nutritional aspects as well as calorific value	K1,K2,K3,K4
2	Identify and explain nutrients in foods and the specific functions in maintaining health.	K1,K2,K3,K4,K5,K6
3	Classify the food groups and its significance	K1,K2,K3,K4,K5,K6

4	Understand the effect of food additives	K1,K2,K3,K4,K5,K6
5	Describe the importance of nutraceuticals and pigments	K1,K2,K3,K4,K5
Textbooks		
1	Wardlaw's Perspectives in Nutrition: A Functional Approach, Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bredbenner, McGraw-Hill, Inc., NY, USA, 2013.	
2	Principles of Nutrition and Dietetics, M. Swaminathan, Bappco, 1995.	
3	Nutritional Biochemistry, Tom Brody, 2nd edition, Academic press, USA, 1998.	
4	Human nutrition and dietetics, Garrow JS, James WPT and Ralph A, 10th edition, Churchill Livingstone, 2000.	
5	Antioxidant Status, Diet, Nutrition, and Health, Andreas M. Papas, 1st edition CRC Press, 1998.	
Reference Books		
1.	Food Additives, Branen, A.L., Davidson PM & Salminen S, 2nd edition, Marcel Dekker, 2001.	
2.	Encyclopaedia of Food and Color Additives, Gerorge, A.B, Vol. III. CRC Press, 1996.	
3.	Advances in food biochemistry, Fatih Yildiz (Editor), CRC Press, Boca Raton, USA, 2010.	
4.	Food biochemistry & food processing, Y.H. Hui (Editor), Blackwell Publishing, Oxford, UK, 2006.	
5.	Food Science and Technology, Geoffrey Campbell-Platt, 2nd edition, Wiley-Blackwell, UK, 2017.	
Web Resources		
1.	Energy-Yielding Nutrients | Overview & Types - Lesson | Study.com	
2.	Food and nutrition - Healthy living | NHS inform	
3.	FINAL-231-250.pdf	

Mapping with Program Outcomes

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	3	2	-
CO 2	3	3	3	3	3	-
CO 3	3	2	3	3	3	-
CO 4	3	2	3	3	3	-
CO5	3	3	3	3	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	1	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
23UBCCC1P	Nutritional Biochemistry	Core	3	3	40	60	100

Learning Objectives		
L1	Impart hands-on training in the estimation of various constituents in food by titrimetric method.	
L2	Extraction of Biochemicals from food stuff.	
L3	Determine the ash content and extraction of food stuff.	
UNIT	**Contents**	**No. of Hours**
I	**TITRIMETRY** 1. Estimation of ascorbic acid in a citrus fruit. 2. Estimation of calcium in milk. 3. Estimation of glucose by Benedict's method in honey. 4. Estimation of phosphorous (Plant source)	**24**
	BIOCHEMICAL PREPARATIONS 5. Lecithin from egg yolk. 6. Starch from potato. 7. Casein and Lactalbumin from milk.	**12**
	GROUP EXPERIMENT 8.Determination of ash content and moisture content in food sample 9.Extraction of lipid by Soxhlet's method.	**9**
	Total	**45**

Course Outcomes		Knowledge Level
CO	**On completion of this course, students will**	
1	Estimate the important biochemical constituents in the food samples.	K1,K2,K3,K4
2	Prepare the macronutrients from the rich sources.	K1,K2,K3,K4,K5,K6
3	Determine the ash and moisture content of the food samples	K1,K2,K3,K4,K5,K6
4	Extract oil from its sources	K1,K2,K3,K4,K5,K6
5	Describe the importance of nutraceuticals and pigments	K1,K2,K3,K4,K5

Textbooks	
1	Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, New Age International Publishers, 2011.
2	An Introduction to Practical Biochemistry, David T. Plummer, 3rd edition, Tata McGraw-Hill Publishing Company Limited, 2001.

Reference Books

1.	Biochemical Methods, Sadasivam S and Manickam A, 4h edition, New Age International Publishers, 2016.
2.	Essentials of Food and Nutrition, Vol. I & amp; II, M.S. Swaminathan, 1974.
3.	Present Knowledge in Nutrition, Bowman and Robert M, 9th edition, International Life Sciences Publishers, 2006.
4.	Nursing Manual of Nutrition and Therapeutic Diet, Indrani TK, 1st edition Jaypee Brothers medical publishers, 2003.
5.	Biochemical, Physiological, and Molecular Aspects of Human Nutrition, Martha H. and Marie A, 3rd edition, Chand Publishers, 2012.
Web Resources	
1.	Word Pro - Titrimetric Analysis - Methods.lwp
2.	https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y

Mapping with Program Outcomes

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	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
23UCHGE11	Chemistry for Biological Sciences I	Generic Elective	3	4	25	75	100

Learning Objectives		
L1	Basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry.	
L2	Nuclear chemistry and industrial chemistry.	
L3	Importance of speciality drugs and	
L4	Separation and purification techniques.	
UNIT	**Contents**	**No. of Hours**
I	**Chemical Bonding and Nuclear Chemistry** Chemical Bonding**:** Molecular Orbital Theory- bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. **Nuclear Chemistry:** Fundamental particles - Isotopes, Isobars, Isotones and Isomers- Differences between chemical reactions and nuclear reactions-group displacement law. Nuclear binding energy- mass defect-calculations. Nuclear fission and nuclear fusion- differences–Stellar energy. Applications of radioisotopes–carbon dating, rock dating and medicinal applications.	12
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.	12
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 Kb of organic acids and bases, electromeric, mesomeric, Hyperconjugation and steric-examples and explanation. Reaction mechanisms: Types of reactions–aromaticity (Huckel's rule) – aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation.	12

	Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.	
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.	12
V	**Analytical Chemistry** Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques–extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.	12
	Total	**60**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	State the theories of chemical bonding, nuclear reactions and its applications.	K1,K2,K3,K4
2	Evaluate the efficiencies and uses of various fuels and fertilizers.	K1,K2,K3,K4,K5,K6
3	Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.	K1,K2,K3,K4,K5,K6
4	**Demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.**	K1,K2,K3,K4,K5,K6
5	Analyse various methods to identify an appropriate method for the separation of chemical components.	K1,K2,K3,K4,K5

Textbooks

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

Reference Books

1.	P.L.Soni, Mohan Katyal, ***Text book of Inorganic chemistry***; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
2.	B.K,Sharma, ***Industrial Chemistry***; GOEL publishing house, Meerut, sixteenth edition,2014.

3.	Jayashree Gosh, ***Fundamental Concepts of Applied Chemistry***; Sultan & Chand, Edition 2006.

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	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
23UCHGE1P	**Chemistry Practical for Physical and Biological Sciences-I**	**Generic Elective**	**2**	**2**	**40**	**60**	**100**

Learning Objectives	
L1	Basics of preparation of solutions.
L2	Principles and practical experience of volumetric analysis.

VOLUMETRIC ANALYSIS

- Estimation of sodium hydroxide using standard sodium carbonate.
- Estimation of hydrochloric acid using standard oxalic acid.
- Estimation of ferrous sulphate using standard Mohr's salt.
- Estimation of oxalic acid using standard ferrous sulphate.
- Estimation of potassium permanganate using standard sodium hydroxide.
- Estimation of magnesium using EDTA.
- Estimation of ferrous ion using diphenylamine as indicator.

Total Hours: 30

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Gain an understanding of the use of standard flask and volumetric pipettes, burette.	K1,K2,K3,K4
2	Design, carryout, record and interpret the results of volumetric titration.	K1,K2,K3,K4,K5,K6
3	Apply their skill in the analysis of water/hardness.	K1,K2,K3,K4,K5,K6
4	Analyze the chemical constituents in allied chemical products.	K1,K2,K3,K4,K5,K6
5	Estimate the weight of magnesium using EDTA.	K1,K2,K3,K4,K5
Reference Books		
1	V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, ***Basic Principles of Practical Chemistry***; Sultan Chand & sons, Second edition, 1997.	

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	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	Hours	Marks		
					CIAE	TEE	Total
23UBCSE11	HEALTH AND NUTRITION	NME	2	2	25	75	100

Learning Objectives		
L1	Gain basic knowledge about health	
L2	Understand about vitamins.	
L3	Learn about functions of fat on health.	
L4	Understand the types of minerals and its functions	
L5	Know about the importance of carbohydrates and proteins on health	
UNIT	Contents	No. of Hours
I	Health – definition, Factors affecting human health. Importance of health care of children, adults and elderly people. Balanced diet and calorific value.	6
II	Vitamins-definition, classification, sources, properties, functions and deficiency symptoms. Recommended daily allowances.	6
III	Sources and functions of dietary fats, role of fats in health and diseases.	6
IV	Minerals- Role of minerals on human health, sources, biological functions, deficiency disorders with special reference to Calcium, Phosphorus, Potassium, Copper, Iron, Zinc and Selenium. Minerals in biological systems and their importance –Iron, Calcium, Phosphorus, Iodine, Copper, Zinc.	6
V	Role of proteins and carbohydrates in health. Functions of protein and carbohydrate and their calorific value. Dietary sources and deficiency disorders – Kwashiorkor and Marasmus – supplementation programs in India and their implications.	6
	Total	30

Course Outcomes		Knowledge Level
CO	On completion of this course, students will	
1	Understand about the importance of health and diet	K1,K2,K3,K4
2	Discuss about the classification properties and deficiencies of vitamins	K1,K2,K3,K4,K5,K6
3	Understand about sources and functions of fats and lipids on health	K1,K2,K3,K4,K5,K6
4	Detail about the different typed of minerals and its role in health	K1,K2,K3,K4,K5,K6
5	Relate the role of proteins and carbohydrates on health	K1,K2,K3,K4,K5

Textbooks	
1	Principles of Nutrition and Dietetics, M. Swaminathan, Bappco, 1995.
2	Nutritional Biochemistry, Tom Brody, 2nd edition, Academic press, USA, 1998.
3	Human nutrition and dietetics, Garrow JS, James WPT and Ralph A, 10th edition, Churchill Livingstone, 2000.

Reference Books	
1.	Food Fundamentals, Margaret Mc Williams, 10th edition, Prentice Hall, 2012.

2.	Nursing Manual of Nutrition and Therapeutic Diet, Indrani TK, 1st edition Jaypee Brothers medical publishers, 2003.
3.	Biochemical, Physiological, and Molecular Aspects of Human Nutrition, Martha H. and Marie A, 3rd edition, Chand Publishers, 2012.
4.	Nursing Manual of Nutrition and Therapeutic Diet, Indrani TK, 1st edition Jaypee Brothers medical publishers, 2003.
Web Resources	
1.	Energy-Yielding Nutrients | Overview & Types - Lesson | Study.com
2.	Food and nutrition - Healthy living | NHS inform
3.	FINAL-231-250.pdf

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	3	2	3	3
CO 4	3	3	3	2	3	3
CO 5	3	3	3	2	3	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
23UBCFN11	Basic Concepts in Biochemistry	FC	2	2	25	75	100

Learning Objectives		
L1	Basic knowledge on solution and its preparation.	
L2	Understand the importance of pH and buffer in Biochemistry.	
L3	Understand the foundation of evolution of living organism.	
L4	Study the plant system and its organisation.	
L5	Study the human system and its organisation.	
UNIT	**Contents**	**No. of Hours**
I	**Solutions:** Definition of solution – Types of solutions – Concentration of the solution – Mass percentage – Volume percentage – Mass by volume percentage – Part per million- Mole fraction – Normality – Molarity – Molality. (problem included).	6
II	**Basics of Experimental Biochemistry:** Accuracy and precision - Acids & Bases – pH and its measurement – Buffers – Preparation and characteristics of Buffer.	6
III	**Evolution:** Origin of life – Evidence for evolution – Evolution of organism – Human evolution - Darwin's theory.	6
IV	**Plant system:** Plants- types of plants – Plant organ system – Plant tissue and its types – Introduction to Photosynthesis.	6
V	**Human system**: Human body organisation – over view of human organ system – Tissues and its types – Different types of cell in human body – Introduction to metabolism.	6
	Total	**30**

Course Outcomes		Knowledge Level
CO	**On completion of this course, students will**	
1	Aquaria knowledge to prepare and calculate the strength of solutions with different concentration.	K1,K2,K3,K4
2	Understand the importance of pH and Buffer solution in chemical and biological reactions	K1,K2,K3,K4,K5,K6
3	Discuss scientifical hypothesis in origin and evolution of life on earth.	K1,K2,K3,K4,K5,K6
4	Differentiate the organ system of plant and it autotropic character	K1,K2,K3,K4,K5,K6
5	Enumerate the different human organ system and their role in metabolism	K1,K2,K3,K4,K5

Textbooks	
1	Chemistry, grade 11 NCERT text book, 2022, New Delhi.
2	Biology, grade 11 NCERT text book, 2022, New Delhi.

3	Biochemistry, U. Sathyanarayana & U. Chakrapani, 4th edition, Elsevier India Pvt. Ltd., 2015.
4	Text Book of Medical Biochemistry M.N. Chatterjee and Rana Shinde, 8th edition, JAYPEE, New Delhi, 2012.
Web Resources	
1.	https://ncert.nic.in/textbook.php?kech1=0-6
2.	https://ncert.nic.in/textbook.php?kebo1=0-19

Mapping with Program Outcomes

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	2	2	2	2	2
CO 2	2	2	2	2	2	2
CO 3	2	2	2	2	2	2
CO 4	2	2	2	2	2	2
CO 5	2	2	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	3	3	3	3	3
CO4	3	3	3	3	3
CO5					

Strong-3 Medium-2 Low-1

SEMESTER II

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UBCCC21	Cell Biology	Core	5	5	25	75	100

Learning Objectives		
L1	Provide basic understanding of architecture of cells and its organelles.	
L2	Understand the organization of prokaryotic and eukaryotic genome.	
L3	Educate on the structural organization of bio membrane and transport mechanism.	
L4	Impart knowledge on cell cycle, cell division and basics of cells	
L5	Familiarize the concept of mechanism of cell-cell interactions.	
UNIT	**Contents**	**No. of Hours**
I	Architecture of cells- Structural organization of prokaryotic and eukaryotic cells microbial, plant and animal cells. The ultrastructure of nucleus, mitochondria, RER, SER, Golgi apparatus, lysosome, peroxisome and their functions.	15
II	Cytoskeleton- microfilament, microtubules and intermediary filament- structure, composition and functions. Organization of Genome -prokaryotic, and eukaryotic genome. Organization of chromatin – histones, nucleosome concept, formation of chromatin structure. Special types of chromosomes – lamp brush chromosomes, polytene chromosomes.	15
III	Bio membranes-structural organization of bilipid layer model and basic functions- transport across cell membranes- uniport, symport and antiport. Passive and active transport.	15
IV	Cell cycle-Definition and Phases of Cell cycle – Cell division –Mitosis and Meiosis and its significance, Cancer cells- definition, types and characteristics of cancer cells.	15
V	Extracellular matrix – Collagen, laminin, fibronectin and proteoglycans- structure and biological role. Structure and role of cadherin, selectins, integrins, Cell -cell interactions- Types-gap junctions, tight junctions and Desmosomes	15
	Total	75

Course Outcomes		Knowledge Level
CO	**On completion of this course, students will**	
1	Explain the structure and functions of basic components of prokaryotic and eukaryotic cells, especially the organelles.	K1,K2,K3,K4
2	Familiarize the cytoskeleton and chromatin	K1,K2,K3,K4,K5,K6
3	Illustrate the structure, composition and functions of cell membrane related to membrane transport	K1,K2,K3,K4,K5,K6
4	Elaborate the phases of cell cycle and cell division-mitosis and meiosis and characteristics of cancer cells.	K1,K2,K3,K4,K5,K6
5	Relate the structure and biological role of extra cellular matrix in cellular interactions	K1,K2,K3,K4,K5

Textbooks

1	Cell biology, Arumugam. N, 10th edition, Saras publication, 2019.
2	Cell Biology, Devasena. T, Oxford University Press India-ISBN:9780198075516, 0198075510, 2012.
3	Essential Cell Biology, Bruce Alberts and Dennis Bray, 4th edition, Garland Science, 2013.
Reference Books	
1.	The Cell: A Molecular Approach, Cooper G. A, Sinauer Associates, Inc -ISBN10: 0878931066 / ISBN 13: 9780878931064, 2013.
2.	Cell and Molecular Biology, Nalini Chadar & Susan Viselli, Lippincott Williams & Wilkins Philadelphia, USA, 2010.
3.	Molecular Cell Biology, Lodish H.A, Berk C.A, Kaiser M, Krieger M.P, Scott A, Bretscher H, Ploegh and Matsudaira, 6th edition, WH. Freeman Publishers, New York, USA, 2007.
Web Resources	
1.	10 Cell Biology Books for Free! [PDF] | InfoBooks.org
2.	NPTEL :: Biotechnology - Cell Biology
3.	Cell - Definition, Functions, Types and Examples | Biology Dictionary

Mapping with Programme Outcomes

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO5	3	3	3	3	3	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	Hours	Marks		
					CIAE	TEE	Total
23UBCCC2P	Cell Biology Practical	Core	3	3	40	60	100

Learning Objectives		
L1	Learn the parts of microscope	
L2	Learn the parts of microscope	
L3	Investigate the cell sunder microscope.	
L4	Identify the cells, organelles and stages of cell division	
L5	Identify the spotters	
UNIT	**Contents**	**No. of Hours**
I	**MICROSCOPY AND STAINING TECHNIQUES** 1. Study the parts of light and compound microscope 2. Preparation of Slides and Micrometry 3. Examination of prokaryotic and eukaryotic cell 4. Visualization of animal and plant cell by methylene blue 5. Visualization of nuclear fraction by acetocarmine stain 6. Staining and visualization of mitochondria by Janus green stain	15
II	**GROUP EXPERIMENT** 7.Identification of different stages of mitosis noni on root tip 8.Identification of different stages of meiosis in onion bulb	10
III	**SPOTTERS** 9. a) **Cells**: Nerve, plant and Animal cell b) **Organelles**: Mitochondria, Chloroplast, Endoplasmic reticulum, c) **Mitosis stages**– Prophase, Anaphase, Metaphase, Telophase	10
	Total	**45**

Course Outcomes		Knowledge Level
CO	On completion of this course, students will	
1	Identify the parts of microscope.	K1,K2,K3,K4
2	Preparation of Slides	K1,K2,K3,K4,K5,K6
3	Identify the stages of mitosis & meiosis	K1,K2,K3,K4,K5,K6
4	Visualize nucleus and mitochondria by staining methods	K1,K2,K3,K4,K5,K6
5	Identify the spotters of cells, organelles and stages of cell division	K1,K2,K3,K4,K5

Textbooks	
1	Cell Biology: Essential Techniques, Rick wood, D and J. R. Harris, Johnwikey,1996.
2	Basic Cell culture: A practical approach, Davis, J.M., IRL 1994.
3	Laboratory Manual for Practical Biochemistry, Ganesh M.K. and Shivashankara A.R. 2nd edition, Jaypee publications, 2012.

Reference Books	
1.	Essential practical handbook of Cell biology, Genetics and Microbiology -A Practical manual- Debarati Das, 1st Edition, Academic publishers, ISBN, 9789383420599, 2017.
2.	Cell biology Practical, Dr. Venugupta ISBN8193651219, Prestige publisher, 1st Jan

	2018.
3.	Cell and Molecular biology, DeRobertis, 8th edition, 1st June, 1987
Web Resources	
1.	olabs.edu.in//?sub=79&brch=18&sim=237&cnt=1
2.	Different Cell Organelles and their Functions
3.	Meiosis | Cell division | Biology (article) | Khan Academy

Mapping with Program Outcomes

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

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
23UCHGE21	**Chemistry for Biological Sciences II**	**Generic Elective**	**3**	**4**	**25**	**75**	**100**

Learning Objectives		
L1	Nomenclature of coordination compounds and carbohydrates.	
L2	Amino Acids and Essential elements of biosystem.	
L3	Understand the concepts of kinetics and catalysis.	
L4	Provide fundamentals of electrochemistry and photochemistry.	
UNIT	**Contents**	**No. of Hours**
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)-Applications in qualitative and quantitative analysis. Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques –BOD and COD.	12
II	**Carbohydrates and Amino acids** Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose–fructose interconversion. Properties of starch and cellulose. Amino acids: Classification-preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).	12
III	**Electrochemistry** Galvanic cells-Standard hydrogen electrode-calomel electrode-standard electrode potentials - electrochemical series. Strong and weak electrolytes-ionic product of water-pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications-	12

	electroplating-Nickel and chrome plating–Types of cells-fuel cells-corrosion and its prevention.	
IV	**Kinetics and Catalysis** Order and molecularity, Integrated rate expression for I and II (2AProducts) order reactions. Pseudo first order reaction, methods of determining order of a reaction – Half-life period – Catalysis –homogeneous and heterogeneous, catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.	12
V	**Photochemistry** Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield-Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).	12
	Total	**60**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology.	K1,K2,K3,K4
2	Explain the preparation and property of carbohydrate, amino acids and nucleic acids.	K1,K2,K3,K4,K5,K6
3	Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.	K1,K2,K3,K4,K5,K6
4	Identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst.	K1,K2,K3,K4,K5,K6
5	Outline the various type of photochemical process.	K1,K2,K3,K4,K5

Textbooks

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

Reference Books

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

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

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	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
23UCHGE2P	**Chemistry practical for Physical and biological sciences - II**	**Generic Elective**	**2**	**2**	**40**	**60**	**100**

Learning Objectives	
L1	Identification of organic functional groups.
L2	Different types of organic compounds with respect to their properties.
L3	Determination of elements in organic compounds.

The analysis must be carried out as follows:

- Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].
- Detection of elements (N, S, Halogens).
- To distinguish between aliphatic and aromatic compounds.
- To distinguish–Saturated and unsaturated compounds.

Total Hours: 30

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Identify different types of organic functional groups.	K1,K2,K3,K4
2	Analyze the nature of different types of organic compounds with respect to their properties.	K1,K2,K3,K4, K5,K6
3	Determine different elements present in organic compounds.	K1,K2,K3,K4, K5,K6
4	Distinguish between aliphatic and aromatic compounds.	K1,K2,K3,K4, K5,K6
5	Classify between saturated and unsaturated compounds.	K1,K2,K3,K4, K5

Reference Books

1 V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, ***Basic Principles of Practical Chemistry;*** Sultan Chand & sons,Second edition,1997.

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	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	Hours	Marks		
					CIAE	TEE	Total
23UBCSE21	LIFE STYLE DISEASES	NME	2	2	25	75	100

Learning Objectives		
L1	Create awareness on lifestyle diseases among adolescents.	
L2	List out the lifestyle diseases.	
L3	Explain the common lifestyle diseases and their prevention.	
L4	Acquaint the disorders associated with women's health.	
L5	Impart life skills so as to prevent life style diseases.	
UNIT	**Contents**	**No. of Hours**
I	Lifestyle diseases: Definition, Factors contributing to lifestyle diseases – Physical inactivity, Poor food habits, disturbed biological clock, sleep deprivation.	6
II	Top lifestyle diseases, Impact of Lifestyle diseases on family, society and economy of country.	6
III	Causes, symptoms, types, preventive measures and treatment of Obesity, cardiovascular diseases, diabetes and cancer.	6
IV	Women's lifestyle diseases: Polycystic Ovarian Disease, Infertility, Breast and cervical cancer and Osteoporosis.	6
V	Prevention of lifestyle diseases: Balanced diet, sufficient intake of water, physical activity, sleep-wake cycle, stress management and meditation.	6
	Total	**30**

Course Outcomes		Knowledge Level
CO	**On completion of this course, students will**	
1	Define Lifestyle diseases and describe the contributing factors	K1,K2,K3,K4
2	Enumerate the top life style diseases and its impact on life.	K1,K2,K3,K4,K5,K6
3	Elaborate the treatment and prevention measures of common lifestyle diseases.	K1,K2,K3,K4,K5,K6
4	Highlight the life style diseases that affects the women's health	K1,K2,K3,K4,K5,K6
5	Illustrate the various measures for prevention of life style diseases	K1,K2,K3,K4,K5

Textbooks	
1	Lifestyle Medicine, JamesM R, 2nd edition, CRC Press, 2013.
2	New Frontiers in Lifestyle-Related Disease, Akira Miyazaki, Springer,2008
Reference Books	
1.	Disease Control Priorities in Developing Countries. 2nd edition. Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2006.

2.	Guide to prevention of lifestyle diseases, Kumar M & R. Kumar, Deep & Deep publications, 2003.
Web Resources	
1.	Immunotherapy: How the Immune System Fights Cancer
2.	LIFESTYLE DISEASES: Keeping fit for a better tomorrow - PMC
3.	Home Science (Eng) Ch-8.pdf

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	3	3	3	3	3
CO 2	2	3	3	2	3	3
CO 3	2	3	3	2	3	3
CO 4	2	3	3	2	3	3
CO 5	2	3	3	2	3	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
23UBCSE22	First Aid	SEC (Discipline)	2	2	25	75	100

Learning Objectives		
L1	Provide knowledge on the basics of first aid.	
L2	Perform first aid during various respiratory issues.	
L3	Demonstrate the first aid to treat injuries.	
L4	Learn the first aid techniques to be given during emergency.	
L5	Familiarize the first aid during poisoning.	
UNIT	**Contents**	**No. of Hours**
I	Aims and important rules of first aid, dealing with emergency, types and content of a first aid kit. First aid technique – Dressing and Bandages, fast evacuation technique, transport techniques.	6
II	Basics of Respiration – CPR, first aid during difficult breathing, drowning, choking, strangulation and hanging, swelling within the throat, suffocation by smoke or gases and asthma.	6
III	Common medical aid- first aid for wounds, cuts, head, chest, abdominal injuries, shocks, burns, amputations, fractures, dislocation of bones.	6
IV	First aid related to unconsciousness, stroke, fits, convulsions-seizures, epilepsy.	6
V	First aid in poisonous bites (Insects and snakes), honey bee stings, animal bites, disinfectant, acid and alkali poisoning.	6
	Total	**30**

Course Outcomes		Knowledge Level
CO	**On completion of this course, students will**	
1	Discuss on the rules of first aid, dealing during emergency and first aid techniques	K1,K2,K3,K4
2	Understand the first aid techniques to be given during differe types of respiratory problems	K1,K2,K3,K4,K5,K6
3	Provide first aid for injuries, shocks and bone injury	K1,K2,K3,K4,K5,K6
4	Detail on the first aid to be given for unconsciousness, stroke, fits and convulsions	K1,K2,K3,K4,K5,K6
5	Gain expertise in giving first aid for insect bites and chemical poisoning	K1,K2,K3,K4,K5

Textbooks	
1	First aid and health, Dr. Gauri Goel, Dr. Kumkum Rajput, Dr. Manjul Mungali 1SBN-978-93-92208-19-5
2	Indian First Aid Mannual-https://www.indianredcross.org/publications/FA-manual.pdf
3	Red Cross First Aid/CPR/AED Instructor Manual

Web Resources	
1.	https://www.redcross.org/take-a-class/first-aid/first-aid-training/first-aid-online
2.	https://www.firstaidforfree.com/

Mapping with Programme Outcomes

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	3	3	3	3	3
CO 2	2	3	3	3	3	3
CO 3	2	3	3	3	3	3
CO 4	2	3	3	3	3	3
CO5	2	3	3	3	3	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