K.M.G. COLLEGE OF ARTS AND SCIENCE

(AUTONOMOUS)

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

P.G. AND RESEARCH DEPARTMENT OF BIOCHEMISTRY

B.Sc., BIOCHEMISTRY

SYLLABUS

(CHOICE BASED CREDIT SYSTEM)

Under

LEARNING OUTCOMES-BASED CURRICULUM

FRAMEWORK (LOCF)

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

PREFACE

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

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

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

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

(i)Cognitive Domain

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

(ii) Affective Domain

(iii) Psychomotor Domain

ABOUT THE COLLEGE

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

VISION OF THE COLLEGE

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

MISSION OF THE COLLEGE

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

QUALITY POLICY OF THE COLLEGE

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

ABOUT THE DEPARTMENT

The knowledge of basic science is essential for the sustainable development of the society. To get the basic knowledge in Biochemistry to young students the Department of Bio chemistry initiated in the academic year 2000-2003. The objective of our department is to motivate students to excel in Biochemistry at the global level, which is necessary for Biochemists getting placement as well as becoming an entrepreneur in future. The department was uplifted as the post graduate department in the year 2004-2006. The department has been recognized as a research department since 2008 to offer M.Phil., Followed that the Thiruvalluvar University accorded recognition to the Department as a centre for Doctoral research in Biochemistry from 2019-2020. The focus of the department is the holistic development of the students and involves them in curricular and co-curricular activities. The Bio Chemistry Department pledges itself to serve in the broadest, innovative and most liberal manner towards the advancement of Biochemistry in all of its branches through academics, research and service missions upholding the values and entrepreneurial skills. The job potential to the biochemist is very high now and opportunities to provoke research in biochemistry are ample. Needless to say that for a developing country likes ours, “BIOCHEMISTRY IS OUR LIFE AND FUTURE”.

VISION OF THE DEPARTMENT

- Produce World class academicians, Scientist, Industrialist and entrepreneurs in the field of Biochemistry.

MISSION OF THE DEPARTMENT

- To educate and inspire the young minds from the basics to the latest innovations in science.
- Inculcate strong theoretical, practical, research and analytical skills in the subject domains and thereby prepare the students for both employability and entrepreneurship.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

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

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

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

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

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

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

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

PROGRAM OUTCOMES (POs)

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

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

PSOs	Statements
PSO1	Comprehend the knowledge in the biochemical, analytical, biostatistical and computational areas.
PSO2	Ability to understand the technical aspects of existing technologies that help inaddressing the biological and medical challenges faced by human kind.
PSO3	Acquiring analytical and hands on skills to perform research in multidisciplinaryenvironments.

Correlation Rubrics:

High	Moderate	Low	No Correlation
3	2	1	-

Mapping of PSOs with POs:

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

K.M.G. COLLEGE OF ARTS AND SCIENCE

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Subject and Credit System- B.Sc., Biochemistry

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

Semester	Part	Category	Course Code	Course Title	Ins.Hrs / Week	Credit	Maximum Marks		
							Internal	External	Total
SEMESTER - I	I	Language	AULT10 / AULU 10	General Tamil – I / Urdu - I	6	3	25	75	100
	II	English	AULE10	English – I	6	3	25	75	100
	III	Core – 1	AUCBC11	Nutritional Biochemistry	6	5	25	75	100
	III	Core – 2	AUCPBC 12	Practical I - Nutritional Biochemistry	3	3	25	75	100
	III	Elective-I	AUECH13	Chemistry I	3	3	25	75	100
	III	Elective Practical	AUEPCH23	Practical - Chemistry	2	-	-	-	-
	IV	Skill Enhancement	AUSBC14	Health and Nutrition	2	2	25	75	100
	IV	Skill Enhancement	AUFBC15	Foundation Course (Basics of Biochemistry	2	2	25	75	100
				Semester Total	**30**	**21**			
SEMESTER - II	I	Language	AULT20 / AULU20	General Tamil – II / Urdu - II	6	3	25	75	100
	II	English	AULE20	English – II	6	3	25	75	100
	III	Core - 3	AUCBC21	Cell Biology	5	5	25	75	100
	III	Core – 4	AUCPBC22	Practical II - Cell Biology	3	3	25	75	100
	III	Elective-II	AUECH23	Chemistry II	3	3	25	75	100
	III	Elective Practical	AUEPCH23	Practical - Chemistry	3	3	25	75	100
	IV	Skill Enhancement	AUSBC24	Medicinal Diet	2	2	25	75	100
	IV	Skill Enhancement	AUSBC25	First Aid	2	2	25	75	100
				Semester Total	**30**	**24**			

Semester	Part	Category	Course Code	Course Title	Ins.Hrs / Week	Credit	Maximum Marks		
							Internal	External	Total
SEMESTER - III	I	Language	AULT30 / AULU 30	General Tamil – III / Urdu - III	6	3	25	75	100
	II	English	AULE30	English – III	6	3	25	75	100
	III	Core - 5	AUCBC31	Biomolecules	4	4	25	75	100
	III	Core – 6	AUCPBC32	Practical III- Biomolecules	3	3	25	75	100
	III	Elective-III	AUAEMB33	Microbiology-I	3	3	25	75	100
	III	Elective Practical	AUAEPMB43	Practical - Microbiology	2	--	-	-	-
	IV	Skill Enhancement	AUSBC34	Tissue Culture	2	2	25	75	100
	IV	Skill Enhancement	AUSBC35	Plant Biochemistry &Plant therapeutics	2	2	25	75	100
	IV	Compulsory	AUES30	Environmental Science	2	2	25	75	100
				Semester Total	**30**	**22**			
SEMESTER - IV	I	Language	AULT40 / AULU 40	General Tamil – IV / Urdu - IV	6	3	25	75	100
	II	English	AULE40	English – IV	6	3	25	75	100
	III	Core - 7	AUCBC41	Biochemical Techniques	5	5	25	75	100
	III	Core-8	AUCPBC42	Practical IV - Biochemical Techniques	3	3	25	75	100
	III	Elective-IV	AUAEMB43	Microbiology - II	3	3	25	75	100
	III	Elective Practical	AUAEPMB43	Practical - Microbiology	3	3	25	75	100
	IV	Skill Enhancement Course	AUSBC44	Bioinformatics	2	2	25	75	100
	IV	Skill Enhancement	AUSBC45	Biochemical Pharmacology	2	2	25	75	100
				Semester Total	**30**	**24**			

Semester	Part	Category	Course Code	Course Title	Ins.Hrs / Week	Credit	Maximum Marks		
							Internal	External	Total
SEMESTER - V	III	Core – 9	AUCBC51	Enzymes	6	4	25	75	100
	III	Core – 10	AUCBC52	Intermediary Metabolism	5	4	25	75	100
	III	Core – 11	AUCBC53	Medical Lab Technology	5	4	25	75	100
	III	Core – 12	AUPBC56	Project with Viva-voce	5	4	25	75	100
	III	Elective-V (Choose any one)	AUEBC 54A	Physiology	4	3	25	75	100
			AUEBC54B	Research Methodology					
			AUEBC54C	Bioentrepreneurship					
	III	Elective Practical	AUEPBC55	Practical V- Medical Lab Technology	3	3	25	75	100
	IV	Compulsory	AUVE50	Value Education	2	2	25	75	100
	IV	Compulsory	AUIBC57	Internship/Industrial Training (Carried out in II-Year Summer vacation) (30hours)	.	2	100	-	100
				Semester Total	**30**	**26**			
SEMESTER - VI	III	Core – 13	AUCBC61	Molecular Biology	6	4	25	75	100
	III	Core – 14	AUCBC62	Biotechnology	5	4	25	75	100
	III	Core – 15	AUCBC63	Clinical Biochemistry	4	3	25	75	100
	III	Core–16	AUCPBC64	Practical-VI-Clinical Biochemistry	3	3	25	75	100
	III	Elective-VII	AUEBC65	Medical coding	5	3	25	75	100
	III	Elective-VIII (Choose any one)	AUEBC66A	Immunology	5	3	25	75	100
			AUEBC66B	Basics of Forensic Science					
	IV	Compulsory	AUEA60	Extension Activity	-	1	100	-	100
	V	Compulsory	AUPCBC67	Professional Competency Skill	2	2	25	75	100
				Semester Total	**30**	**23**			

Consolidated Semester wise and Component wise Credit distribution

Parts	Semester-I	Semester-II	Semester-III	Semester-IV	Semester-V	Semester-VI	Total Credits
Part-I	03	03	03	03	-	-	12
Part-II	03	03	03	03	-	-	12
Part-III	11	14	10	14	22	20	91
Part-IV	04	04	06	04	04	01	23
Part-V	-	-	-	-	-	02	02
Total	21	24	22	24	26	23	**140**

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

COURSE DESCRIPTORS

Title of the Course	Nutritional Biochemistry	**Hours/Week**	06
Course Code	AUCBC11	**Credits**	05
Category	Core-1	**Year & Semester**	I & I
Prerequisites	Higher secondary Chemistry/Biology/Mathematics/Botany/ Zoology/Physics	**Regulation**	2024

Objectives of the course:

The objectives of this course are to

- Create awareness about the role of nutrients in maintaining proper health.
- Understand the nutritional significance of carbohydrates, lipids and proteins.
- Understand the importance of a balanced diet.
- Study the effect of additives, emulsifiers, and flavor enhancing substances in food.
- Study the significance of nutraceuticals.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Concepts of food and nutrition. Basic food groups-energy yielding, bodybuilding 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.	CO1 CO3	K1 K2 K3
UNIT-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 –Kwashiorkor and Marasmus, Obesity-Types and preventive measures.	CO1 CO2 CO3	K1 K2 K3 K4

UNIT-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.	CO3 CO4	K1 K2 K3
UNIT-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, flavours, anti-caking agent, antioxidants. Safety assessment of food additives.	CO2 CO3 CO4 CO5	K1 K2 K3
UNIT-V	Nutraceuticals and Functional Foods: Definition, properties and function of Nutraceuticals, food Supplements, dietary supplements prebiotics, probiotics, and functional Foods. Food as medicine. Natural pigments from plants– carotenoids, anthocyanins and its benefits.	CO2 CO3 CO4 CO5	K1 K2 K3

Recommended Text Books

1. Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bred benner. 2013. Wardlaw's Perspectives in Nutrition: A Functional Approach. McGraw-Hill, Inc., NY, USA.
2. M.Swaminadhan (1995) Principles of Nutrition and Dietetics. Bappco.
3. Tom Brody (1998). Nutritional Biochemistry (2nded), Academic press, USA.
4. Garrow, JS.James WPT and Ralph A (2000). Human nutrition and dietetics (10thed) Churchill Livingstone.
5. Andreas M.Papas (1998). Antioxidant Status, Diet, Nutrition, and Health (1st ed) CRC.

Reference Books

1. Branen, A.L., Davidson PM & Salminen S. 2001. Food Additives. 2nd Ed. Marcel Dekker.
2. George, A.B. 1996. Encyclopedia of Food and Colour Additives. Vol. III. CRC Press.
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. Geoffrey Campbell-Platt. 2009. Food Science and Technology. Wiley-Blackwell, UK.

Website and e-learning source

1. http://old.noise.ac.in/SecHmscicour/english/LESSON O3.pdf
2. https://study.com/academy/lesson/energy-yielding-nutrients-carbohydratesfat-
3. protein.html.https://www.nhsinform.scot/healthy-living/food-and-nutrition/eatingwell/vitamins-and-minerals

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Cognizance of basic food groups viz. Carbohydrates, proteins and lipids and their nutritional aspects as well as calorific value.	K1,K2,k3
CO2	Identify and explain nutrients in foods and the specific functions in maintaining health.	K1,K2,K3
CO3	Classify the food groups and its significance	K1,K2,K3
CO4	Understand the effect of food additives	K1,K2,K3
CO5	Describe the importance of nutraceuticals and pigments	K1,K2,K3

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

COURSE DESCRIPTORS

Title of the Course	Practical I-Nutritional Biochemistry	**Hours/Week**	03
Course Code	AUCPBC12	**Credits**	03
Category	Core-II	**Year & Semester**	I & I
Prerequisites	Higher secondary chemistry/Biology/Mathematics/Botany/Zoology/Physics	**Regulation**	2024

Objectives of the course:

The objectives of this course are to

- Impart hands-on training in the estimation of various constituents by titrimetric method
- Prepare Biochemical preparations.
- Determine the ash content and extraction of lipid.

UNITS	Contents	COs	Cognitive Levels
UNIT-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)	CO1,CO3	K5,K4,K3
UNIT-II	**BIOCHEMICAL PREPARATIONS** 1. Preparation of the following substances and its qualitative tests. 2. Lecithin from egg yolk.	CO1, CO2, CO3	K1,K2, K3,K5
UNIT-III	1. Starch from potato. 2. Casein and Lactalbumin from milk.	CO3 CO4	K1,K2 K5
UNIT-IV	**GROUP EXPERIMENT** 1. Determination of ash content and moisture content in food sample	CO1,CO2 CO3	K1,K2 K5
UNIT-V	1. Extraction of lipid by Soxhlet's method.	CO1,CO2 CO4	K1,K2 K5

Recommended Text Books

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 & II, M.S. Swami Nathan.
3. Bowman and Robert M. 2006. Present Knowledge in Nutrition. 9th edition, International Life Sciences Publishers.
4. Indrani TK. 2003. Nursing Manual of Nutrition and Therapeutic Diet, 1st edition Jaypee Brothersmedical publishers.
5. Martha H. and Marie A. 2012. Biochemical, Physiological, and Molecular Aspects of HumanNutrition. 3rd edition. Chand Publishers

Website and e-learning source

1.https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-for-authors

2.http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf

3.https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf? sequence=1&isAllowed=y

4.https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistry pdf.p

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Estimate the important biochemical constituents in the food samples.	K1,K2
CO2	Prepare the macronutrients from the rich sources.	K1,K2,K4
CO3	Determine the ash and moisture content of the food samples	K1,K2,K3
CO4	Extract oil from its sources	K1,K2,K3
CO5	Determine Prophase, Anaphase, Metaphase, Telophase of the Cell	K1,K2,K3

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

COURSE DESCRIPTORS

Title of the Course	Health and Nutrition	**Hours/Week**	02
Course Code	AUSBC14	**Credits**	02
Category	Skill enhancement Course –SEC-1	**Year & Semester**	I & I
Prerequisites	Higher secondary chemistry/Biology/Mathematics/Botany/Zoology/Physics	**Regulation**	2024

Objectives of the course:

The objectives of this course are to

- Gain basic knowledge about health.
- Understand about vitamins.
- Learn about functions of fat on health.
- Understand the types of minerals and its functions
- Know about the importance of carbohydrates and proteins on health

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Health – definition, Factors affecting human health. Importance of health care of children, adults and elderly people. Balanced diet and calorific value.	CO1 CO3	K1 K2 K3
UNIT-II	Vitamins-definition, classification, sources, properties, Functions and deficiency symptoms. Recommended daily allowances.	CO1 CO2 CO3	K1 K2 K3 K4
UNIT-III	Sources and functions of dietary fats Role of fats in health and diseases (LDL, HDL, VLDL and Cholesterol).	CO3 CO4	K1 K2 K3
UNIT-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.	CO2 CO3 CO4	K1 K2 K3
UNIT-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.	CO2 CO3 CO4 CO5	K1 K2 K3

Recommended Text Books

1. Davidson and J.R.Passmore (1986) Human Nutrition and Dietetics, (8th ed), Churchill Livingstone.
2. J. S. Garrow, W. Philip T. James, A. Ralph (2000), Human Nutrition and Dietetics (10th ed), Churchill Livingstone.
3. M.Swaminathan (1995) Principles of Nutrition and Dietetics, Bappco.

Reference Books

1. Margaret Mc Williams (2012). Food Fundamentals (10th ed), Prentice Hall

Website and e-learning source

1. https://www.universalclass.com/articles/health/nutrition/nutritional-needs-for-differentages.
2. nhp.gov.in/healthy living/healthy diet
3. www.anme.com.mx/libros/PrinciplesofNutrition.pdf

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Understand about the importance of health and diet.	K1,K2
CO2	Discuss about the classification, properties and deficiencies of vitamins.	K1,K2,K4
CO3	Understand about sources and functions of fats and lipids onhealth.	K1,K2,K3
CO4	Detail about the different typed of minerals and its role in health.	K1,K2,K3
CO5	Relate the role of proteins and carbohydrates on health.	K1,K2,K3

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

COURSE DESCRIPTORS

Title of the Course	Basics of Biochemistry	**Hours/Week**	02
Course Code	AUFBC15	**Credits**	02
Category	Foundation course (Bridge course)	**Year & Semester**	I & I
Prerequisites	Higher secondary Chemistry/Biology/Mathematics/Botany/Zoology/Physics	**Regulation**	2024

Objectives of the course:

The objectives of this course are to

- Create awareness about the role of nutrients in maintaining proper health.
- Understand the nutritional significance of carbohydrates, lipids and proteins.
- Understand the importance of a balanced diet.
- Study the effect of additives, emulsifiers, and flavor enhancing substances in food.
- Study the significance of nutraceuticals.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Definition, Important Functional & structural features of biomolecules in biological system Outline the classification of carbohydrates-Mono, Di, and Polysaccharide Proteins classification-Simple. Conjugated Proteins- Keratin, Collagen, Silk fibroin, Hemoglobin. Lipids Classification - simple, complex, and derived lipids. Role of lipids-DNA is genetic material.	CO1 CO3	K1 K2 K3
UNIT-II	Nucleic acids- Central dogma, Watson Crick model of DNA, Mode of Replication, RNA - Structure and type's m-RNA, t-RNA, r-RNA with function – Genetic code.	CO1 CO2 CO3	K1 K2 K3 K4
UNIT-III	Enzymes-structure, and function in a biological system Vitamins classification and its deficiency symptoms.	CO3 CO4	K1 K2 K3
UNIT-IV	Classification of microbes .Role of Microbes in fermentation and infections. Immune system- Definition of Immunity, Role of immune cells in infections.	CO2 CO3 CO4	K1 K2 K3

UNIT-V	Role of Medical lab in the diagnosis of Clinical disorder Applications of Medical Coding.	CO2 CO3 CO4 CO5	K1 K2 K3

Recommended Text Books

1. David L. Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th Edition) W.H.Freeman.
2. Voet.D & Voet.J.G (2010) Biochemistry, (4th Edition), John Wiley &Sons, Inc.
3. Metzler D.E (2003).The chemical reactions of living cells (2nd Edition), Academic Press.
4. Zubay G.L (1999) Biochemistry, (4th Edition), McGrew-Hill.
5. Lubert Stryer (2010) Biochemistry, (7th Edition), W.H.Freeman
6. Satyanarayan.U (2014) Biochemistry (4th Edition), Arunabha Sen Books & Allied (P) Ltd, Kolkata.

Reference Books

1. Voet.D. etal., 2012. Fundamentals of Biochemistry: Life at the Molecular level, 4th Edition John Wiley and Sons.
2. Zubay,G.L. 1998. Biochemistry, Wm. C. Brown Publishers.
3. Sinden, S.R.DNA structure and function, First Edition, Academic Press, 1994.
4. Carl Branden and John Tooze, Introduction to Protein Structure, Second Edition, Garland Publishing, 1999.
5. Garrett, R. and Grisham C, 2010 .Biochemistry, 4th Edition, Saunders.
6. Chemistry of Biomolecules by RJ Simond.
7. Biomolecules: Chemistry of Living System by VK Ahluwalia.
8. Cell Biology (Cytology, Biomolecules and Molecular Biology) by Verma PS and Agarwal V
9. Textbook of Biochemistry with clinical correlations by Thomas. M. Devlin, John Wiley liss Hobokhen NJ Publishers 2006.
10. Biochemistry and Molecular Biology of Antimicrobial Drug Action, 6th Edition Paperback– 2005. by franklint.j. et.al (Author).

Website and e-learning source

1. http://old.noise.ac.in/SecHmscicour/english/LESSON O3.pdf
2. https://study.com/academy/lesson/energy-yielding-nutrients-carbohydratesfat-
3. https://www.nhsinform.scot/healthy-living/food-and-nutrition/eatingwell/vitamins-and-minerals

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Students will be introduced to the structure of biomolecules.	K1,K2
CO2	The significance of carbohydrates in biological processes will be understood.	K1,K2,K4
CO3	The structure, properties and biological significance of lipids in the biological system will be studied	K1,K2,K3
CO4	Students will learn about the concepts of protein structure and their significance in biological processes and creatively comprehend the role of membrane components with their biological Significance.	K1,K2,K3
CO5	Students will gain knowledge about the structures and functional roles of nucleic acids in the Biological system	K1,K2,K3

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

COURSE DESCRIPTORS

Title of the Course	BIOCHEMISTRY I	**Hours/Week**	04
Course Code	AUEBC15	**Credits**	03
Category	Elective subject	**Year & Semester**	I & I
Prerequisites	Higher secondary chemistry/Biology/Mathematics/Botany/Zoology/Physics	**Regulation**	2024

Learning objectives

The objectives of this course are to

- Introduce the structure and classification of carbohydrates
- Comprehend the metabolism of carbohydrates
- Study the classification and properties of amino acids
- Elucidate the various levels of organization of Proteins
- Study functions and deficiency diseases of vitamins

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Definition and classification of carbohydrates** Linear and cyclic forms (Haworth projection) for glucose fructose and mannose and disaccharides (Maltose, Lactose sucrose).General properties of monosaccharide and disaccharides. Occurrence and significance of polysaccharides.	CO1 CO3	K1 K2 K3
UNIT-II	**Metabolism- Catabolism and Anabolism.** Carbohydrate metabolism – Glycolysis, TCA cycle, HMP shunt and glycogen metabolism andenergetics.	CO1 CO2 CO3	K1 K2 K3 K4
UNIT-III	**Amino acids** Classifications, Physical properties - amphoteric nature, Isoelectric point and chemical reactions of carboxyl, Amino and both groups. Amino acid metabolism- transamination, deamination and decarboxylation.	CO3 CO4	K1 K2 K3
UNIT-IV	**Proteins** Classification-Biological functions physical properties - ampholytes, Isoelectric point, salting in and salting out, Denaturation, nature of peptide bond. Secondary structure α-helix β-pleated sheet Tertiary structure of various forces involved- quaternary structure.	CO2 CO3 CO4	K1 K2 K3

UNIT-V	**Vitamins** Classification - Fat Soluble vitamins (A, D, E and K) and water Soluble Vitamins and Vitamin C – sources, RDA, biological functions and deficiency diseases.	CO2 CO3 CO4 CO5	K1 K2 K3

Recommended Text Books

1 Satyanarayan.U (2014) Biochemistry (4th ed), Arunabha sen Books & Allied (P) Ltd, Kolkata.2.Jain J.L.(2007) Fundamentals of Biochemistry, S.Chand publishers 311

Reference Books

1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed) W.H.Freeman.

2. Voet.D & Voet. J.G (2010) Biochemistry, (4th ed), John Wiley & Sons, Inc.

3. Lubert Stryer (2010) Biochemistry, (7th ed), W.H.Freeman.

4. Satyanarayan, U (2014) Biochemistry (4th ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.

5. Jain J.L. (2007) Fundamentals of Biochemistry, S.Chand publishers 31.

Website and e-learning source

1.onlinecourses.swayam2.ac.in/cec20_bt12

Course Outcome

COs	CO Description	Cognitive Level
CO1	Classify the structure of carbohydrates and its properties.	K1,K2,K3
CO2	Explain the metabolism of carbohydrates and its significance.	K1,K2,K3
CO3	Classify amino acids and its properties.	K1,K2,K3,K4
CO4	Explain the classification and elucidate the different levels of structural organization of proteins.	K1,K2,K3
CO5	Identify the disease caused by the deficiency of vitamins.	K1,K2,K4

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

COURSE DESCRIPTORS

Title of the Course	PRACTICAL - BIOCHEMISTRY	**Hours/Week**	03
Course Code	AUEPBC15	**Credits**	03
Category	Elective Practical	**Year & Semester**	I & I
Prerequisites	Higher secondary chemistry/Biology/Mathematics/Physics	**Regulation**	2024

Learning objectives

- Identify carbohydrates by qualitative test
- Estimate biomolecules volumetrically
- Estimate protein quantitatively

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**I Qualitative analysis of carbohydrates**- 25 Hrs a. Monosaccharide -Glucose, Fructose b. Disaccharides- Lactose, Maltose	CO1 CO3	K1 K2 K3
UNIT-II	c. Disaccharides – Sucrose (Non reducing) d. Polysaccharides-Starch	CO1,CO2, CO3	K1,K2 K3,K4
UNIT-III	**II Volumetric analysis 15 Hrs** 1. Estimation of ascorbic acid using 2,6 dichlorophenol-indophenol as a link solution. 2. Estimation of Glucose by Benedict's method.	CO3 CO4	K1 K2 K3
UNIT-IV	1. Estimation of Glycine by Sorenson Formal titration.	CO2,CO3, CO4	K1,K2,K3
UNIT-V	**III Quantitative analysis** (Demonstration Expt) 1. Colorimetric estimation of protein by Biuret method	CO2,CO3 CO4,CO5	K1,K2,K3

Recommended Text Books

1. Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, New Age International Publishers, 2011,
2. An Introduction to Practical Biochemistry, David T. Plummer, 3 rd 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

Website and e-learning source

1. onlinecourses.swayam2.ac.in/cec20_bt12

Course Outcome

COs	CO Description	Cognitive Level
CO1	Qualitatively analyze and report the type of carbohydrate based on specific tests	K1.K2,K3
CO2	Quantitatively estimate the carbohydrates, amino acids and ascorbic acid.	K1,K2,K4
CO3	Estimate protein by colorimetric method.	K1,K2,K3
CO4	Estimation of ascorbic acid using 2,6dichlorophenol - indophenol as link solution.	K1,K2,K4
CO5	Colorimetric estimation of protein by Biuret method.	K1,K2,K4

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

COURSE DESCRIPTORS

Title of the Course	**CELL BIOLOGY**	**Hours/Week**	5
Course Code	**AUCBC 21**	**Credits**	5
Category	**CORE -III**	**Year & Semester**	I & II
Prerequisites	Higher secondary chemistry/Biology/Mathematics/Botany/ Zoology/Physics	**Regulation**	2024

Objectives of the course:

- Provide basic understanding of architecture of cells and its organelles.
- Understand the organization of prokaryotic and eukaryotic genome.
- Educate on the structural organization of bio membrane and transport mechanism.
- Impart knowledge on cell cycle, cell division and basics of cells
- Familiarize the concept of mechanism of cell-cell interactions.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Architecture of cells- Structural organization of prokaryotic and eukaryotic cells, microbial, plant and animal cells. The Ultra structure of nucleus, mitochondria, RER, SER, Golgi apparatus,lysosome, peroxisome and their functions.	CO1	K2, K3
UNIT-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.	CO2	K1,K2,K3

UNIT-III	Biomembranes - Structural organization of bilipid layer model and basic functions - transport across cell membranes- Uniport, Symport and Antiport. Passive and active transport.	CO3	K1,K3
UNIT-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.	CO4	K2,K3
UNIT-V	Extracellular matrix – Collagen, Laminin, Fibronectin and Proteoglycans- structure and biological role. Structure and role of cadherin, selectins, Integrin, Cell - cell interactions- Types- gapjunctions, tight junctions and Desmosomes.	CO5	K1,K2,K3

Recommended Text Books

1. Arumugam. N, Cell biology. Sara's publication(10ed, paperback), 2019
2. Devasena.T. Cell Biology. Oxford University Press India-ISBN: 9780198075516, 0198075510, 2012
3. Bruce Albert's and Dennis Bray. 2018, Essential Cell Biology. (5th Ed). Garland Science.
4. Karp's Cell Biology, Global Edition By Gerald Karp, Janet Iwasa, Wallace Marshall · 2018

Reference Books

1. Arumugam.N. (2019). Cell biology. Saras publication (10ed, paperback)
2. Devasena.T. (2012). Cell Biology. Oxford University Press India – ISBN: 9780198075516**, 0198075510**
3. Cooper, G.A.The Cell: A Molecular Approach. Sinauer Associates, Inc ISBN10: 0878931066 / ISBN 13: 9780878931064, 2013
4. E.M.F., D.R,Cell and Molecular Biology. Lippincott Williams &Wilkins Philadelphia – ISBN: 0781734932 9780781734936,
5 .Lodish H.A, Berk C.A, Kaiser M, Krieger M.P, Scott A, Bretscher H, Plough and Matsudaira. 2007. Molecular Cell Biology, 6th Edition, WH. Freeman Publishers, NewYork, USA.
6. Mechanics of the cell by David boal, Cambridge publishers. 2nd edition, 2012

Website and e-learning source

1. Cell biology: https://nicholls.edu/biol-ds/bio1155/Lectures/Cell%20Biology.pdf
2. The Cell: https://www.medicalnewstoday.com/article/320878.php
3. Cell structure: https://biologydictionary.net/cell

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Explain the structure and functions of basic components of Prokaryotic and Eukaryotic cells, especially the organelles.	K2, K3
CO2	Familiarize the Cytoskeleton and Chromatin	K1,K2,K3
CO3	Illustrate the structure, composition and functions of cell membrane related to membrane transport	K1,K3
CO4	Elaborate the phases of Cell cycle and Cell division, Mitosis and Meiosis and characteristics of cancer cells.	K2,K3
CO5	Relate the structure and biological role of extracellular matrix in cellular interactions	K1,K2,K3

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

COURSE DESCRIPTORS

Title of the Course	**PRACTICAL II -CELL BIOLOGY**	**Hours/Week**	3
Course Code	**AUCPBC22**	**Credits**	3
Category	**CORE-IV**	**Year & Semester**	I & II
Prerequisites	Higher secondary Chemistry/Biology/Mathematics/Botany/ Zoology/Physics	**Regulation**	2024

Objectives of the course

- Learn the parts of Microscope.
- Investigate the Cells under microscope.
- Image the Cells using different stains.
- Identify the Cells, Organelles and stages of cell division
- Identify the spotters.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**MICROSCOPY** 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.	CO1	K1,K2,K3
UNIT-II	**STAINING TECHNIQUES** 5. Visualization of Nuclear fraction by acetocarmine stain. 6. Staining and Visualization of Mitochondria by Janus Green stain.	CO2	K2
UNIT-III	**GROUP EXPERIMENT** 7. Identification of different stages of Mitosis in onion root tip. 8. Identification of different stages of Meiosis in onion bulb.	CO3	K2,K3
UNIT-IV	**SPOTTERS** 9. a) **Cells**: Nerve, Plant and Animal cell b)**Organelles:** Mitochondria, Chloroplast, Endoplasmic reticulum,	CO4	K1,K2
UNIT-V	**SPOTTERS** c) Mitosis stages–Prophase, Anaphase, Metaphase, Telophase	CO5	K1,K2

Website and e learning source

1. Cell organelle: https://www.microscopemaster.com/organelles.html
2. Biochemistry books: https://www.pdfdrive.com/biochemistry-books.htm
3. Histology studies : http://medcell.med.yale.edu/histology/cell_lab.php#:~:text=
4. Mitosis: http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Identify the parts of Microscope.	K1,K2,K3
CO2	Understand the Preparation of Slides and staining techniques.	K2
CO3	Identify the stages of Mitosis & Meiosis	K2,K3
CO4	Visualize Nucleus and Mitochondria by staining methods	K1,K2
CO5	Identify the spotters of cells, organelles and stages of Cell division	K1,K2

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

COURSE DESCRIPTORS

Title of the Course	**MEDICINAL DIET**	**Hours/Week**	2
Course Code	**AUSBC24**	**Credits**	2
Category	**SKILL ENHANCEMENT COURSE-III**	**Year & Semester**	I & II
Prerequisites	**Higher secondary chemistry/Biology/Mathematics/Botany/ Zoology/Physics**	**Regulation**	2024

Objectives of the course:

- Provide basic knowledge about diet.
- Understand of diet modification for GI diseases.
- Plan a diet for liver diseases.
- Prepare diet chart for Infectious diseases.
- Plan a diet for Diabetes, Renal and Cardio-vascular diseases.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Principles of Therapeutic Diet: Definitions of Normal diet, Therapeutic diet, Soft Diet and Liquid diet. Objectives of Diet Therapy. Advantages of using normal diet as the basis for Therapeutic diet.	CO1	K1,K2,K3
UNIT-II	Diet modification in Gastrointestinal diseases: Peptic ulcer, Diarrhea, Lactose intolerance, Constipation and Malabsorption syndrome	CO2	K1,K2,K3
UNIT-III	Diet Modification in liver and gall bladder in diseases: Etiology, symptoms and dietary treatment in jaundice, hepatitis, Cirrhosis of liver and hepatic coma.	CO3	K2,K3
UNIT-IV	Diet Modification in Infectious Diseases: Fevers, Typhoid, Tuberculosis and Viral Hepatitis. Dietary modifications in Tuberculosis.	CO4	K2,K3

UNIT-V	Diet Modification in Diabetes, Renal and Cardio-vascular diseases-Diabetes Acute & Chronic glomerulonephritis, nephrosis, renal failure, kidney stone and Hypertension.	CO5	K1,K2,K3

Recommended Text Books

1. M. Raheena Begum, A Text Book of Foods, Nutrition and Dietetics, Sterling PublishersPvt. Ltd. 3 rd edition,2014
2. M.V.Raja Gopal, Sumati. R., Mudambi, Fundamentals of foods and Nutrition, WileyEastern Limited, Year-1990.
3. William S.R Nutrition and Diet Therapy, 1985, 5th edition, Mosly Co. St.Louis.
4. Modern Nutrition by Catharineross, Woiters Kiuwe publishers.
5. Complete food and Nutrition Guide By Robert Larson day off, John and Willy Publishers.
6.Food as Medicine :A Handbook of Natural nutrition by Kirsten Hartvig,2023.ISBN 1801521174

Reference Books

1. Nutritional Biochemistry by Patricla Trueman, 2019 ISBN 10:81-8094-031-4.
2. Food as Medicine: A Handbook of Natural Nutrition Paperback, 28 November 2023 by Kirsten Hartvig (Author)
3. Food As Medicine By Guru Dharma Singh Khalsa · 2010
4. William's Essentials of Nutrition and Diet Therapy by Eleanor D .Schlenkar & Joyce Gilbert – 2015,11th Edition
5. Food and Nutrients in Disease Management, Ingrid Kohlstadt · 2016.

Website and e-learning source

1. Medicinal diet: https://www.rickysinghmd.com/a-guide-to-the-medicinal-diet/
2. Healthy diet: https://www.who.int/news-room/fact-sheets/detail/healthy-diet
3. Food and nutrition: https://www.healthline.com/nutrition/food-as-medicine
4. Food as medicine**:** https://nutrition.org/food-as-medicine/

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Possess basic knowledge about diet.	K1,K2,K3
CO2	Acquire knowledge on diet plan for GI diseases.	K1,K2,K3
CO3	Sketch diet modifications for liver diseases.	K2,K3
CO4	Understand diet plan for Infectious diseases.	K2,K3
CO5	Prepare diet chart for Diabetes Renal and Cardio-vascular diseases.	K1,K2,K3

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

COURSE DESCRIPTORS

Title of the Course	**FIRST AID**	**Hours/Week**	2
Course Code	**AUSBC 25**	**Credits**	2
Category	**SKILL ENHANCEMENT COURSE-IV**	**Year & Semester**	I & II
Prerequisites	**Higher secondary chemistry/Biology/Mathematics/Botany/ Zoology/Physics**	**Regulation**	2024

Objectives of the course:

- Provide knowledge on the basics of first aid.
- Perform first aid during various respiratory issues.
- Demonstrate the first aid to treat injuries.
- Learn the first aid techniques to be given during emergency.
- Familiarize the first aid during poisoning

UNITS	Contents	COs	Cognitive Levels
UNIT-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.	CO1	K1,K2,K3,K4
UNIT-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.	CO2	K1,K2,K3
UNIT-III	Common medical aid- first aid for wounds, cuts, head, chest, abdominal injuries, shocks, burns, amputations, fractures, dislocation of bones.	CO3	K1,K2,K3,K4
UNIT-IV	First aid related to unconsciousness, stroke, fits, convulsions - seizures, epilepsy	CO4	K1,K2,K3,K4
UNIT-V	First aid in poisonous bites (Insects and snakes), honey bee stings, animal bites, disinfectant, acid and alkali poisoning	CO5	K1,K2

Recommended Text Books

1. First aid and health Dr. Gauri Goel, Dr. Kumkum Rajput, Dr.Manjul Mungali 1SBN-978-93-92208-19-5
2. The Complete First Aid Pocket Guide Published:13 November 2018 Author: John Furst ISBN:9781507208892
3. ACEP First Aid Manual 5th Edition September 2014 Author: American College

Reference Books

1. A Comprehensive First Aid Manual and Reference Guide By Nigel Barraclough · 2017
2. First Aid and Emergency Care, Jain publication, 1st Edition, January 2024.
3. First Aid for the Basic sciences by kendall Krause.
4. First Aid made easy by Nigelbarraclough-2017 ISBN 09552294

Website and e-learning source

1. First aid training: https://www.redcross.org/take-a-class/first-aid/first-aid-training/first-aid-online
2. First aid: https://www.first aid for free.com/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Discuss on the rules of first aid, dealing during emergency and first aid techniques	K1,K2,K3,K4
CO2	Understand the first aid techniques to be given during different types of respiratory problems	K1,K2,K3,K4
CO3	Provide first aid for injuries, shocks and bone injury	K1,K2,K3,K4
CO4	Detail on the first aid to be given for unconsciousness, stroke, fits and convulsions	K1,K2,K3,K4
CO 5	Gain expertise in giving first aid for insect bites and chemical poisoning	K1,K2

	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	-	3	3	3	1	1	3	3	3	-
CO2	2	2	3	1	3	3	3	2	1	3	3	3	-
CO3	2	2	3	2	3	3	2	1	1	3	3	2	1
CO4	2	3	3	1	3	3	3	1	1	3	3	2	-
CO5	2	3	3	1	3	3	2	1	1	3	3	3	1

COURSE DESCRIPTORS

Title of the Course	**BIOMOLECULES**	**Hours/Week**	04
Course Code	**AUCBC 31**	**Credits**	04
Category	**Core - V**	**Year & Semester**	II & III
Prerequisites	Higher secondary Chemistry/Biology/Mathematics/Botany/ Zoology/Physics	**Regulation**	2024-25

Objectives of the course:

1. Introduce the structure, properties and biological significance of carbohydrates
2. Comprehend the classification, functions and acid base properties of amino acids
3. Elucidate the various levels of organization of Proteins.
4. Impart knowledge on the classification, Properties and characterization of Lipids.
5. Acquaint with the classification, structure, properties and functions of nucleic acids.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Carbohydrates-Classification and biological significance, physical properties - stereo isomerism, optical isomerism, annoyers, epimers and mutarotation. Monosaccharides: Occurrence, linear and cyclic structure, Reactions of monosaccharide's due to the presence of hydroxyl, aldehyde and keto groups. Disaccharides: Structure and properties of reducing disaccharides (lactose and mannose), non-reducing disaccharide (sucrose). Polysaccharides: Homopolysaccharides - Occurrence, structure and biological significance of starch, glycogen and cellulose. Heteropolysaccharides - Structure and biological significance of Mucopolysaccharides-Hyaluronic acid, Chondroitin sulphate and Heparin.	CO1	K1, K2, K3, K4
UNIT-II	Amino acids -Classification based on composition of side chain and nutritional significance. General structure of amino acids. 3 - and 1-letter abbreviations. Modified amino acids in protein and non - protein amino acids. Physical properties of amino acids, isoelectric point, Zwitter ion, titration curve, optical activity. Chemical reactions due to carboxyl group, amino group and side chains. Colour reactions of amino acids.	CO2	K1, K2, K3

UNIT-III	Proteins- Classification based on shape, composition, solubility and functions. Properties of proteins - Ampholytes, Isoelectric point, salting in and salting out, denaturation and renaturation, UV absorption. Levels of Organization of protein structure- Primary structure, Formation and characteristics of peptide bond, phi and psi angle, Ramachandran plot, Secondary structure-α helix, β- pleated sheath, triple helix. Tertiary structure – with reference to myoglobin. Quaternary structure with reference to hemoglobin.	CO3	K1, K2, K3, K4
UNIT-IV	Lipids -Lipids: Bloor's classification, chemical nature and biological functions. Fatty acids: classification, nomenclature, structure and properties of fatty acids. Simple and mixed triglycerides: structure and general properties, Characterization of fats- iodine value, saponification value, acid number, acetyl number, Polanski number, Reichert–Meissl number along with their significance. Compound lipids – Structure and functions of phospholipids and glycolipids. Derived lipids-Structure and functions of cholesterol, Bile Acids and bile salts.	CO4	K1,K3, K4, K5
UNIT-V	Nucleic acids- Structure of purine and pyrimidine bases, nucleosides and nucleotides and their biological importance. Watson and Crick double helical model of DNA, Types of DNA: A, B, Z DNA, structure and biological significance. Types of RNA: mRNA, t-RNA, r-RNA, hn-RNA, Sn-RN, Secondary and tertiary structure of t-RNA. Properties of DNA- Hypo chromic and hyper chromic effect, melting temperature. Denaturation and Renaturation of DNA.	CO5	K1,K3, K4, K5

Recommended Text Books

1. Biochemistry, U.Sathyanarayana & U.Chakrapani, 6th edition Elsevier India Pvt. Ltd., Books & Allied Pvt.Ltd. 2023.

2. Fundamentals of Biochemistry, J.L.Jain, SunjayJain, Nitin Jain, 7th edition S.Chand & Company Ltd. 2013.

3. Text book of Medical Biochemistry, MN Chatterjee, Rana Shinde, 8th edition, Jaypee Brothers, 2012.

Reference Books

1.David L.Nelson, Michael M.Cox, Principles of Biochemistry, 4th edition W.H.Freeman and Company. 2013

2.Voet.D, Voet.J.G.and Pratt, C.W, Principles of Biochemistry, 4th edition John Wiley& Sons, Inc. , 2010

3. Zubay G.L, et.al. Principles of Biochemistry, 1st edition, WMC. Brown Publishers. 1998

Website and e-learning source

1. https://www.britannica.com/science/biomolecule
2. https://en.wikipedia.org/wiki/Biomolecule
3. https://www.khanacademy.org/science/biology/macromolecules

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Illustrate the structure, the physical and Chemical properties of carbohydrates.	K1, K2, K3, K4
CO2	Indicate the classification, structure, properties and biological Functions of amino acids.	K1, K2, K3
CO3	Explain the classification and elucidate the different levels of structural organization of proteins.	K1, K2, K3,K4
CO4	Understand the classification, structure, properties, functions and characterization of lipids	K1,K3,K4,K5
CO5	Describe the structure, properties and functions of different types of nucleic acids	K1,K3,K4,K5

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

COURSE DESCRIPTORS

Title of the Course	PRACTICAL -III BIOMOLECULES	Hours/Week	03
Course Code	AUCPBC 32	Credits	03
Category	Core – VI	Year & Semester	II & III
Prerequisites	Higher secondary Chemistry/Biology/Mathematics/Botany/ Zoology/Physics	Regulation	2024-25

Objectives of the course:

1. Identify the biomolecules Carbohydrates and Amino acids by Qualitative test
2. Determine the quality of Lipids by titrimetric methods
3. Isolate nucleic acids from plant and animal source**.**

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Qualitative test for Carbohydrates** a) Glucose b) Fructose c) Arabinose	CO1	K1, K2, K3, K4
UNIT-II	**Qualitative test for Carbohydrates** a) Maltose b) Sucrose c) Lactose d) Starch.	CO2	K1, K2, K3
UNIT-III	**Qualitative test for Amino acids** a) Arginine b) Cysteine c) Histidine d) Proline e) Tryptophan f) Tyrosine g) Methionine	CO3	K1, K2, K3, K4
UNIT-IV	**Titrimetric methods** 1) Determination of Saponification value of edible oil. 2) Determination of Iodine number of edible oil. 3) Determination of Acid number of edible oil. 4) Estimation of Glycine.	CO4	K1,K3, K4, K5
UNIT-V	**Group Experiments** 1) Isolation of DNA from plant/animal source. 2) Isolation of RNA from rich source.(Yeast)	CO5	K1,K3, K4, K5

Recommended Text Books

1. David T Plummer, An Introduction to Practical Biochemistry, 3 rd edition Tata Mc Graw- Hill Edition 2017.

2. J.Jayaraman Laboratory Manual in Biochemistry, New Age International (P) Limited second edition 2020.

3. S.SadasivamA. Manickam Biochemical Methods, Newage International Pvt Ltd publisher's third edition 2018.

Reference Books

1. Rageeb, KiranPatil, M.Bakshi Rahman, Sufiyan Ahmad Raees house,1st Edition, A Practical book on Biochemistry Everest publishing 2019.

2. Introductory practical Biochemistry–S.K.Sawhney,Randhir Singh,2nd Ed,2005.

3. Biochemical Tests–Principles and Protocols .AnilKumar, Sarika Gargand Neha Garg.Vinod Vasishtha Viva Books Pvt Ltd, 2015.

4. Harold Varley,Practical Clinical Biochemistry,CBS.6edition,2006.

5. Keith Wilson and John Walker. Principles and Techniques of Practical Biochemistry, 4th edition, Cambridge University press, Britain.1995

Website and e-learning source

1.https://www.pdfdrive.com/instant-notes-analytical-chemistry-e912659.html14

2.https://www.pdfdrive.com/analytical-biochemistry-e46164604.html

3.https://www.pdfdrive.com/biochemistry-books.html

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Qualitatively analyze the carbohydrates –Monosaccharides and report the type of carbohydrate based on specific tests	K1, K2, K3, K4
CO2	Qualitatively analyze the carbohydrates –Di, Polysaccharides and report the type of carbohydrate based on specific tests	K1, K2, K3
CO3	Qualitatively analyze amino acids and report the type of Amino acids based on specific tests	K1, K2, K3,K4
CO4	Determine the Saponification, Iodine and acid number of Edible oil and Estimation of Glycine	K1,K3,K4,K5
CO5	Isolate the DNA and RNA from biological sources	K1,K3,K4,K5

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

COURSE DESCRIPTORS

Title of the Course	**TISSUE CULTURE**	**Hours/Week**	02
Course Code	**AUSBC34**	**Credits**	02
Category	**Skill Enhancement**	**Year & Semester**	II & III
Prerequisites	Higher secondary Chemistry/Biology/Mathematics/Botany/ Zoology/Physics	**Regulation**	2024-25

Objectives of the course:

1. Introduce the tools and techniques used in tissue culture technique.
2. Acquire knowledge on preparation of growth medium for culture techniques.
3. Impart knowledge on procedures involved gene transfer.
4. Acquaint with the process of tissue culture technique.
5. Understand the importance of plant and animal tissue culture for the production and evaluation of bioactive compounds

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Introduction to Tissue culture, Types-seed, embryo, Callus, Organ, Protoplast culture, Advantages and importance of tissue culture, Tools and techniques.	CO1	K1, K2, K3, K4
UNIT-II	Media and Culture Preparation-pH, temperature, solidifying agents. Role of Micro and macronutrients. Maintenance of cultures.	CO2	K1, K2, K3
UNIT III	Methods of gene transfer in plants and animals-direct and indirect Gene transfer methods, Cell culture applications.	CO3	K1, K2, K3, K4
UNIT-IV	Cell culture technique - Explants selection, sterilization and Inoculation. Tissue culture labs.	CO4	K1,K3, K4, K5
UNIT- V	Transgenic plants for crop improvement. Transgenic plants for molecular farming. Animal Cloning- an overview- Applications of animal cell culture.	CO5	K1,K3, K4, K5

Recommended Text Books

1. Trivedi,P.C. Applied Biotechnology: Recent Advances, panima Publishing corporation,2016
2. Ignacimuthu Applied Plant Biotechnology. Tata McGraw – Hill,2012.
3. Lycett,G.W and Grierson,D.(ed). Genetic Engineering of crop plants, 2013.
4. Chawla, H.S.,"Introduction to Plant Biotechnology", 3rd Edition, Science Publishers, 2009.

Reference Books

1. Stewart Jr.,C.N.,"Plant Biotechnology and Genetics: Principles, Techniques and Applications" Wiley- Interscience, 2008.
2. Freshney, R.I Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. Wiley-Blackwell, 6th Edition. 2010.
3. Davis, J.M. Basic Cell Culture. Oxford University Press. New Delhi. 2008
4. Davis, J. M. Animal Cell Culture. John Willy and Sons Ltd. USA, 2011
5. Butler, M. Animal Cell Culture and Technology. Taylor and Francis. Key work USA. (2004).

Website and e-learning source

1. https://www.britannica.com/science/tissue-culture
2.https://en.wikipedia.org/wiki/Plant_tissue_culture
3. https://microbeonline.com/animal-cell-culture-introduction-types-methods-applications/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Tools and techniques of plant tissue culture.	K1, K2, K3, K4
CO2	Acquire knowledge on preparation of tissue culture media	K1, K2, K3
CO3	Understanding on different methods of gene transfer	K1, K2, K3,K4
CO4	Preparation of plant and animal cell culture techniques	K1,K3,K4,K5
CO5	Study of applications of genetically modified plants and animals.	K1,K3,K4,K5

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

COURSE DESCRIPTORS

Title of the Course	**PLANT BIOCHEMISTRY AND PLANT THERAPEUTICS**	**Hours/Week**	02
Course Code	**AUSBC 35**	**Credits**	02
Category	Skill Enhancement	**Year & Semester**	II & III
Prerequisites	Higher secondary Chemistry/Biology/Mathematics/Botany/ Zoology/Physics	**Regulation**	2024-25

Objectives of the course:

1. Convey the knowledge of photosynthesis.
2. Detail the structure and types of secondary metabolites.
3. Impart the idea on various plant hormones.
4. Emphasize the effects of free radicals and the importance of antioxidants
5. Understand the role of medicinal plants in treating diseases.

UNITS	Contents	COs	Cognitive Levels
UNIT- I	Photosynthesis- Photosynthesis apparatus, pigments of photosynthesis, photo chemical reaction, photosynthetic electron transport chain, path of carbon in photosynthesis- Calvin cycle, Hatch–lack pathway (4ways) CAM pathway, Significance of photosynthesis.	CO1	K1, K2, K3, K4
UNIT- II	Secondary metabolites: Structure, Types, Sources, Biosynthesis and function of phenolics, tannins, lignins, terpenes and Alkaloids. Medicinal properties of secondary metabolite**s.**	CO2	K1, K2, K3
UNIT-III	Plant hormones Structure and function of plant hormones such as ethylene, cytokinins, auxins, Absicicacid, Florigin and Gibberlins.	CO3	K1, K2, K3, K4
UNIT- IV	Free radicals, types, production, free radical induced damages, lipid peroxidation, reactive oxygen species, antioxidant defense system, enzymatic and non-enzymatic antioxidants, role of antioxidants in prevention of disease, Phytochemical as antioxidants.	CO4	K1,K3, K4, K5

UNIT-V	Plant therapeutics: Bioactive principles in herbs, plants with anti Diabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties	CO5	K1,K3, K4, K5

Recommended Text Books

1. Singh M.Pand Panda. H.Medicinal Herbs with their formulations, Day a publishing house, Delhi, 2006

2. Plant Physiology-Devlin N.Robert and Francis H. Witham, CBS Publications, 2017.

3. Text Book of Plant Biochemistry and Molecular Biology Publisher: Kalyani, 2024.

Reference Books

1. Khan, I.A and Khanum. A. Role of biotechnology in medicinal and aromatic plants, Vol.1and Vol.10, Ukka2 publications, Hyderabad. 2004

2.Plant Biochemistry and Molecular Biology–Hans Walter Heldt, Oxford University, 4th Edition, 2010

3. Plant biochemistry Caroline bowsher, Martinsteer, Alyson Tobin, garland science. (2008),

4. Plant physiology and development (sixth edition) by Lincoln Taiz, Eduardo Zeiger, IanMax Moller and Angus Murphy publisher; Oxford university press, 2015.

Website and e-learning source

1. https://www.intechopen.com/books/secondarymetabolies-sources-and- applications/ an introductory-chapter-secondary-metabolites
2. https:// www.toppr.com/guides/biology/plant-growth-and development/plant growth

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Briefly on photosynthetic apparatus, pigments present, pathways, and significance of photosynthesis	K1, K2, K3, K4
CO2	Discuss about the structure, types, sources, biosynthesis and functions secondary metabolites.	K1, K2, K3
CO3	Understand the structure and functions of plant hormones.	K1, K2, K3,K4
CO4	Discuss about free radicals, types and its harmful effects. Role of Enzymatic and non-enzymatic antioxidant in defence mechanism, prevention in disease.	K1,K3,K4,K5
CO5	Identify the plants with anti diabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties.	K1,K3,K4,K5

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

COURSE DESCRIPTORS

Title of the Course	Biochemical Techniques	Hours/Week	05
Course Code	AUCBC41	Credits	05
Category	Core-VII	Year & Semester	II & IV
Pre requisites	Higher secondary Chemistry/Biology/Mathematics/Botany/ Zoology/Physics	Regulation	2024

Objectives of the course:

- To introduce the basic principles, types and applications of various sedimentation techniques.
- To provide an understanding of the underlying principles of chromatographic techniques
- To demonstrate experimental skills in various electrophoretic techniques.
- To appraise the use of colorimetric and spectroscopic techniques in Biology.
- To impart knowledge about the measurement of radioactivity and safety aspects of radioactive isotopes.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Centrifugation and Electrochemical techniques** Measurement of pH, Standard Hydrogen electrode, Henderson Hesselbalch equation, pH, pOH, types of Buffer, role of buffers in biological system. Centrifugation-Basic principles, RCF, Sedimentation coefficient, Svedberg constant. Types of rotors. Preparative centrifugation- differential and density gradient centrifugation, Rate zonal and Isopycnic techniques, construction, working and applications of analytical ultra centrifuge–Determination of molecular weight (Derivation excluded).	CO1	K1, K2, K3, K4
UNIT-II	**Chromatography** Chromatography-adsorption, partition. Principle, instrumentation and applications of paper chromatography, thin layer chromatography, ion-exchange chromatography, gel permeation chromatography, gas chromatography and affinity chromatography.	CO2	K1, K2, K3

UNIT-III	**Electrophoresis** Electrophoresis –General principles, factors affecting electrophoretic mobility. Tiselius moving boundary electrophoresis. Electrophoresis with paper and starch. Principle, instrumentation and applications of agarose gel electrophoresis and SDS-PAGE	CO3	K1, K2, K3
UNIT-IV	**Electromagnetic chemistry** Basics of Electromagnetic radiations-Energy, wave length, wave number and frequency. Absorption and emission spectra, Lambert – Beer Law, Light absorption and transmittance. Colorimetry-Principle, instrumentation and applications. Visible and UV spectrophotometry – Principle, instrumentation and applications– enzyme assay, structural Studies of proteins and nucleic acids.	CO4	K2, K3
UNIT-V	**Radioactivity** Radioactivity - Types of Radioactive decay, half-life, units of radioactivity, Detection and measurement of radioactivity - Methods based upon ionization - Geiger Muller Counter. Methods based upon excitation-Solid & Liquid scintillation counters. Autoradiography. Biological applications and safety aspects of radioisotopes.	CO5	K3, K4, K5

Recommended Text Books

1. Avinash Upadhyay, Kakoli Upadhyay & Nirmalendu Nath 2020, Biophysical Chemistry, Principles and Techniques, 3rd edition, Himalaya Publishing House.
2. L. Veerakumari, 2009, Bioinstrumentation, 1st edition, MJP Publishers.
3. Keith Wilson & John Walker, 2018, Practical Biochemistry-Principles and techniques, Cambridge University Press, 8th edition.

Reference Books

1. Terrance G. Cooper the tools of Biochemistry, 2011, John Wiley & Sons, Singapore.
2. Guru Mani, Research Methodology for Biological Sciences, 2021, 5th edition, MJP Publishers.
3. Saroj Dua, Neera Garg, Biochemical Methods of Analysis, 2019, 5th edition, Narosa Publishing house.

Website and e-learning source

1.https://www.britannica.com/science/chromatography
2.https://www.youtube.com/watch?v=xgxFQZYXlE
3.https://www.youtube.com/watch?v=7onjVBsQwQ8

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Describe the types of rotors and centrifugation technique.	K1, K2, K3, K4
CO2	Demonstrate the principles, operational procedure, applications of planar and column chromatography.	K1, K2, K3
CO3	Explain the separation of DNA and protein using electrophoretic technique.	K1, K2, K3
CO4	Illustrates the instrumentation and uses of colorimeter and spectrophotometer.	K2, K3
CO5	Measurement and Safety aspects of radioactive isotopes.	K3, K4, K5

Mapping with Programme Outcomes:

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

COURSE DESCRIPTORS

Title of the Course	**Practical IV- Biochemical Techniques**	**Hours/Week**	03
Course Code	AUCPBC42	**Credits**	03
Category	Core-VIII	**Year & Semester**	II & IV
Prerequisites	Higher secondary Chemistry/Biology/Mathematics/Botany/ Zoology/Physics	**Regulation**	2024

Objectives of the course:

- To acquaint the students with colorimetric estimations of biomolecules.
- To impart Knowledge on the estimation of DNA and RNA.
- To acquire Knowledge on Estimation of Minerals.
- To equip skills on Chromatography separation techniques.
- To impart knowledge about the Separation of Serum Proteins.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Colorimetry – Estimation of Protein** 1. Estimation of amino acid by Ninhydrin method. 2. Estimation of protein by Biuret method.	CO1	K3, K4, K5
UNIT-II	**Colorimetry – Estimation of Nucleic Acids** 1. Estimation of DNA by Diphenylamine method. 2. Estimation of RNA by Orcinol method.	CO2	K3, K4, K5

UNIT-III	**Colorimetry- Estimation of Mineral** Estimation of Phosphorus by Fiske and Subbarow method.	CO3	K3, K4, K5
UNIT-IV	**Chromatography** 1. Separation and identification of sugars and amino acids by paper chromatography. 2. Separation and identification of amino acids and lipids by Thin layer chromatography.	CO4	K1, K2, K3, K4
UNIT-V	**Demonstration** 1. Separation of Serum and Plasma from blood by centrifugation. 2. Separation of Serum proteins by SDS-PAGE.	CO5	K1, K2, K3, K4

Recommended Text Books

1. J. Jayaraman, Laboratory Manual in Biochemistry New Age International (P) Limited,8 th edition 2019.
2. S.Sadasivam, A.Manickam Biochemical Methods New age International Pvt Ltd publishers' third edition, 2018.
3. Keith Wilson and John Walker Principles and techniques of Practical Biochemistry Cambridge University Press, 8 th edition. 2018.

Reference Books

1. S.K.Sawhney Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd, 5 th edition, 2018.
2. David T.Plummer, 2020, An Introduction to Practical Biochemistry, 12th edition, Tata McGraw- Hill publishing company limited.
3. Varley's Practical Clinical Biochemistry by Alan H Gowenlock, published by CBS Publishers and distributors, India, 6th Edition,2006.

Website and e-learning source

https://www.pdfdrive.com/biochemistry-books.html

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Estimate the amount of Biomolecules by Colorimetric method.	K3, K4, K5
CO2	Quantify the amount of DNA and RNA by Colorimetric method.	K3, K4, K5
CO3	Estimate the amount of Minerals by Colorimetric method.	K3, K4, K5
CO4	Separate and identify Sugars, lipids and amino acids by chromatography	K1, K2, K3, K4
CO5	Demonstrate the separation of proteins Electrophoretically and Operate centrifuge for the separation of serum and plasma.	K2, K3, K4

Mapping with Programme Outcomes:

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

COURSE DESCRIPTORS

Title of the Course	**Bioinformatics**	**Hours/Week**	02
Course Code	AUSBC44	**Credits**	02
Category	Skill Enhancement Course	**Year & Semester**	II & IV
Pre requisites	Higher secondary Chemistry/Biology/Mathematics/Botany/ Zoology/Physics	**Regulation**	2024

Objectives of the course:

- To impart knowledge on bioinformatics and applications.
- To learn about biological databases.
- To understand the local and global sequence alignment.
- To provide insights on BLAST and Microarray.
- To familiarize about structural genomics and visualization tools.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Introduction to Bioinformatics** Bioinformatics and its applications.–Genome,Metabolome Definition and its applications. Metabolome -Metabolome database, E.coli metabolome database, Human Metabolome database. Transcriptome, Definition and applications.	CO1	K1, K2, K3
UNIT-II	**Biological Databases** Definition, types and examples –, Nucleotide sequence database (NCBI, EMBL, Gene bank, DDBJ) Protein sequence database Swiss Prot, TrEMBL, Structural Database, PDB,Metabolic database KEGG	CO2	K1, K2, K3

UNIT-III	**Sequence Alignment** Local and Global alignment Dot-matrix analysis, PAM, BLOSUM. Dynamic Programming concept - Needleman Wunch algorithm, Smith waterman algorithm. Heuristic methods of sequence alignment	CO3	K1, K2, K4, K5
UNIT-IV	**BLAST** Features, types (BLASTP, BLASTN, BLASTX), PSI BLAST, result format. DNA Microarray Procedure and applications.	CO4	K2, K3
UNIT-V	**Structural genomics** Whole genome sequencing (Shotgun approach), Comparative genomics tools for genome comparison, VISTA servers and pre computed tools. Molecular visualization tools. RASMOL, Swiss PDB viewer. Nutrigenomics- Definition and applications.	CO5	K1, K2, K3

Recommended Text Books

1. Basic of Bioinformatics by Rui Jiang Xuegong Zhang and Michael Q. Zhang, 6th Editors, 2019.
2. Bioinformatics for Beginners Genes, Genomes, Molecular Evolution, Databases and Analytical Tools By: Supratim Choudhuri (Author),2016.
3. Bioinformatics by Sara's publication, by V. Kumaresan, R. Sundaralingam, ISBN 9788194931362, 2021.
4. Introduction to Bioinformatics by Arthur Lesk ISBN 9780198794141, Publised by Oxford University Press, 2019.

Reference Books

1.Computation in Bioinformatics Multidisciplinary Applications S.Balamurugan, and T. Krishnan, Dinesh Goyal, Balakumar Chandrasekaran, ISBN-978-1119654766 Published by Wiley-Scrivener,2021

2. Chemo informatics and Bioinformatics in the Pharmaceutical Sciences, Navneet Sharma Ph.D., Pharmaceutics, Himanshu Ojha, Pawan Raghav,RameshK.Goyal,2021.

Website and e-learning source

1. https://nptel.ac.in/courses/102/106/102106065/
2 http://www.digimat.in/nptel/courses/video/102106065/L65.html
3 https://www.slideshare.net/sardar1109/bioinformatics-lecture-notes

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Introduce the fundamentals of Bioinformatics and its applications.	K1, K2, K3
CO2	Classify biological database and to correlate the different file formats.	K1, K2, K3
CO3	Develop algorithms for interpreting biological data.	K1, K2, K4, K5
CO4	Discuss the concepts of sequence alignment and its types.	K2, K3
CO5	Apply the various tools employed in genomic study and Protein visualization.	K1, K2, K3

Mapping with Programme Outcomes:

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

COURSE DESCRIPTORS

Title of the Course	**Biochemical Pharmacology**	**Hours/Week**	02
Course Code	AUSBC45	**Credits**	02
Category	Skill Enhancement Course	**Year& Semester**	II & IV
Prerequisites	Higher secondary Chemistry/Biology/Mathematics/Botany/ Zoology/Physics	**Regulation**	2024

Objectives of the course:

- To introduce the basic concepts of pharmacology.
- To explain the metabolism of drugs and factors responsible for metabolism.
- To acquaint the adverse response and side effects of drugs.
- To familiarize important drugs used for common metabolic disorders.
- To provide an understanding about the action of antibiotics.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Drugs–classification** Drugs– classification based on sources, routes of drug administration -Oral/Enteral, Parenteral and Local application. Absorption of drugs, factors influencing drug absorption, distribution and excretion of drugs.	CO1	K1, K2, K3, K4
UNIT-II	**Drug metabolism** Drug metabolism- Phase I and Phase II reactions, role of cytochrome P_{450}, non- microsomal reactions of drug metabolism. Factors influencing drug metabolism. Therapeutic index.	CO2	K1, K2, K3

UNIT-III	**Drug allergy, Drug tolerance** Drug allergy, Drug tolerance-IC50,LD50 of a drug,Drug intolerance, Drug addiction, Drug abuses and their biological effects. Drug resistance-biochemical mechanism	CO3	K1, K2, K3
UNIT-IV	**Therapeutic Drugs** Therapeutic Drugs - Analgesics and Non-steroidal anti-inflammatory drugs(NSAIDs)–Aspirin and Acetaminophen. Insulin, Oral anti diabetic drugs- Sulfonyl ureas, Biguanides. Antihypertensive drugs-ACE inhibitors, Calcium channel blockers. Anti-cancer agents–Anti metabolites.	CO4	K1, K2, K3
UNIT-V	**Antibiotics** Antibiotics-Definition, Examples and Biochemical mode of action of penicillin, streptomycin, tetracycline and chloramphenicol.	CO5	K1, K2, K3, K4

Recommended Text Books

1. N.Murugesh, A concise textbook of Pharmacology–Sathya Publishers,2021
2. Jayashree Ghosh, A Textbook of Pharmaceutical chemistry–S. Chand & Company Ltd,2017
3. SC Mehta,Ashutosh Kar, Pharmaceutical Pharmacology–NewAge International (P)Limited, Publishers,2025

Reference Books

1.Lippincott's illustrated Reviews-Pharmacology by Mary J.Mycek, Richard A.Harvey, Pamela C.Champe, Lippincott–Raven publishers, New Delhi, Second South Asian Edition 6th June 2024.
2. David.E.Golan, Principles of Pharmacology, Wolters Kluwer (India)Pvt.Ltd,2016
3. R.S.Satoskar, S.B.Elsevier Pharmacology and pharmacotherapy.-ISBN-10: 9788131248867 / ISBN-13: 978-8131248867, 2017.
4. Tripathi,K.Essentials of Medical Pharmacology. Jaypee Publishers-ISBN-10: 9350259370 / ISBN-13: 978-9350259375.2018.

Website and e-learning source

https://slideplayer.com/slide/3728296/64/video/What+is+bioremediation%3F.mp4

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Classify the different routes of drug administration, metabolism and excretion.	K1, K2, K3, K4
CO2	Explain the role of cytochromes in drug metabolism.	K1, K2, K3
CO3	List out the various adverse response and side effects of drugs.	K1, K2, K3
CO4	Justify the use of synthetic drugs and its pharmacological actions.	K1, K2, K3
CO5	Demonstrate the importance and mode of action of antibiotics.	K1, K2, K3, K4

Mapping with Programme Outcomes:

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