D.K.M. COLLEGE FOR WOMEN (AUTONOMOUS)

VELLORE -1

DEPARMENT OF BIOCHEMISTRY

B. Sc., Biochemistry

Syllabus

With effect from 2024 - 2025

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.

B.SC. BIOCHEMISTRY

Programme Educational Objectives (PEOs)

PEO1: Attain Academic and Professional Excellence

Build a strong academic foundation and skill set that will enable success in higher education, competitive examinations, teaching, research, industry, and entrepreneurial ventures.

PEO2: Emerge as Empowered Individuals

Develop into confident, self-reliant, and economically independent women capable of applying scientific knowledge to enhance personal growth, family welfare, and community development.

PEO3: Advance Research and Innovation

Demonstrate the ability to investigate real-world challenges and contribute contextually relevant, research-driven, and innovative solutions across scientific disciplines.

PEO4: Uphold Ethical and Cultural Values

Adhere to high ethical standards, respect cultural diversity, and engage responsibly in scientific practices that contribute to a just and inclusive society.

PEO5: Respond to Societal and National Needs

Utilize scientific understanding to support public health, environmental conservation, and technological advancement, fostering inclusive regional and national progress.

PEO6: Exhibit Leadership and Social Responsibility

Lead scientific and community initiatives with integrity, inspire collaborative action, and actively contribute to positive social transformation at local and global levels.

PEO7: Engage in Lifelong and Global Learning

Pursue continuous personal and professional development while staying abreast of global trends, innovations, and interdisciplinary scientific advancements.

Programme Outcomes (POs)

PO1: Comprehend and Apply Scientific Knowledge

Acquire and apply core knowledge from scientific disciplines to understand natural phenomena, solve complex problems, and support innovation across various domains of life and industry.

PO2: Demonstrate Analytical and Critical Thinking

Develop the ability to think critically and analytically by formulating hypotheses, interpreting experimental results, evaluating scientific literature, and drawing evidence-based conclusions.

PO3: Exhibit Technical and Laboratory Competency

Gain proficiency in laboratory techniques, handling of scientific instruments, and use of software tools, while adhering to safety protocols, accuracy, and reproducibility in experimental work.

PO4: Communicate Effectively

Present scientific concepts and findings clearly and coherently through oral presentations, technical writing, and the use of digital tools, adapting to both academic and professional contexts.

PO5: Uphold Ethical Values and Environmental Consciousness

Integrate ethical principles and environmental awareness into scientific practices, promoting sustainable solutions and a sense of accountability towards society and nature.

PO6: Engage in Lifelong Learning

Cultivate an inquisitive mindset and adaptability to emerging scientific advancements, technologies, and interdisciplinary approaches, thereby remaining relevant and competent throughout life.

PO7: Collaborate and Lead in Scientific and Social Contexts

Participate effectively in collaborative scientific projects and community-based activities, demonstrating leadership, decision-making, and commitment to women’s empowerment and societal progress.

Programme Specific Outcomes (PSOs) – B.Sc. Biochemistry (UG)

PSO1: Grasp Core Concepts of Biochemistry

Understand the structure and function of biomolecules, enzyme kinetics, metabolic pathways, and molecular mechanisms of cellular processes.

PSO2: Apply Biochemistry to Human Health

Demonstrate knowledge of nutrition, metabolism, and clinical biochemistry to understand disease mechanisms and diagnostic principles.

PSO3: Develop Basic Laboratory Competency

Acquire practical skills in standard biochemical techniques such as titration, colorimetry, chromatography, and basic molecular biology tools.

PSO4: Integrate Allied Scientific Knowledge

Connect principles from microbiology, physiology, and genetics to understand interdisciplinary aspects of life sciences.

PSO5: Promote Ethical and Environmental Awareness

Exhibit responsibility in lab practices and understand the social and ecological impact of biochemical processes and products.

PSO6: Prepare for Higher Education and Entry-Level Careers

Build a foundation for pursuing postgraduate studies or employment in diagnostic labs, pharma/biotech industries, or healthcare sectors.

PSO7: Cultivate Scientific Curiosity and Self-Learning

Develop an attitude of inquiry and lifelong learning to adapt to emerging scientific developments.

TANSCHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAME WORK FOR UNDERGRADUATE EDUCATION	
Programme:	**B. Sc Biochemistry**
Programme Code:	
Duration:	**3years[UG]**
Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and undertanding of one or more disciplines that forma 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, synthesizing 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. **PO11: Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.

	PO12: 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 to embrace 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 demonstrating the ability to identify ethical issues related to one's work, avoid unethical behavior 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 workplace through knowledge/skill development/reskilling.

PROGRAM OUTCOMES

PO1	Acquire knowledge in Biochemistry and apply the knowledge in their day today 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	Comprehendtheknowledgeinthebiochemical,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 humankind
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

Eligibility for admission

Candidate for admission to the first year of B.Sc. Degree Course in Bio-Chemistry shall be required to have passed the Higher Secondary Examination with Chemistry and Biology or Chemistry, Botany and Zoology or Biochemistry and Chemistry.

3. 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, Nanobiotechnology, 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.

4. 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 male 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, cross disciplinary 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 multi disciplinary 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 backbone for health and wealth creation and improve the quality of life.

Extra Credits: **For Advanced Learners / Honours degree**	Extra credits to 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.

Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System for all UG courses including Lab Hours.

First Year
Semester I

Part	List of Courses	Credit	Hours Per week (L/T/P)
Part-I	Language–Tamil	3	6
Part-II	English	3	6
Part-III	Nutritional Biochemistry	5	5
	Generic Elective–I: Chemistry for Biological Science-I	3	3
	Core Practical I – Nutritional Biochemistry	3	3
	Generic Elective: Practical Chemistry–I	-	3
Part-IV	Skill Enhancement Course – Health and Nutrition	2	2
	Foundation Course FC– Basics in Biochemistry	2	2
		21	**30**

Semester-II

Part	List of Courses	Credit	Hours Per week (L/T/P)
Part-I	Language–Tamil	3	6
Part-II	English	3	6
Part-III	Cell Biology	5	5
	Generic Elective–II: Chemistry for Biological Science-II	3	3
	Core Practical II-Cell Biology	3	3
	Generic Elective: Practical Chemistry–I	2	3
Part-IV	Skill Enhancement Course -3(Entrepreneurial Based)– First Aid	2	2
	Skill Enhancement Course(Discipline/Subject Specific)– Tissue culture	2	2
		23	**30**

Second Year
Semester-III

Part	List of Courses	Credit	Hours Per week (L/T/P)
Part-I	Language–Tamil	3	6
Part-II	English	3	6
Part-III	Biomolecules	5	5
	Generic Elective–III-Microbiology I	3	3
	Core Practical III Biomolecules	3	3
	Generic Elective: Practical- Microbiology	-	3
Part-IV	Skill Enhancement Course - 4(Entrepreneurial Based) – Medical Laboratory Technology Practical	2	2
	Skill Enhancement Course- SEC-5 – Life Style Diseases	1	1
	Environmental Studies	-	1
		20	**30**

Semester-IV

Part	List of Courses	Credit	Hours Per week (L/T/P)
Part-I	Language–Tamil	3	6
Part-II	English	3	6
Part-III	Biochemical techniques	5	5
	Generic Elective IV- Microbiology II	3	3
	Core Practical IV- Biochemical Techniques	3	3
	Generic Elective: Practical- Microbiology	2	2
Part-IV	Skill Enhancement Course-6 – Basics of Forensic Science	2	2
	Skill Enhancement Course–7 – Bioinformatics Practical	2	2
	Environmental Studies	2	1
		25	**30**

Third Year
Semester-V

Part	List of Courses	Credit	Hours Per week (L/T/P)
Part-III	Enzymes	5	6
	Intermediary Metabolism	5	6
	Clinical Biochemistry	5	6
	*Elective Paper 1	4	5
	Core Practical V- Clinical Biochemistry	4	5
Part-IV	Value Education	2	2
	Internship/Industrial Training (Summer vacation at the end of IV semester activity)	2	-
		27	**30**

Semester-VI

Part	List of Courses	Credit	Hours Per week (L/T/P)
Part-III	Molecular Biology	5	5
	Human Physiology	4	5
	Plant Biochemistry & Plant therapeutics	4	5
	*Elective paper 2	4	5
	Core Project	4	8
Part-IV	Professional Competency Skill	2	2
Part-V	Extension Activity	1	-
		24	**30**

Total Credits: 140

Remarks: English Soft Skill Two Hours will be handled by English Teachers (4+2 = 6 hours for English).

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	11	13	11	13	23	21	92
Part IV	4	4	3	6	4	2	23
Part V	-	-	-	-	-	1	1
Total	21	23	20	25	27	24	**140**

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

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

I YEAR: SEMESTER I

NUTRITIONAL BIOCHEMISTRY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24CBC1A	Nutritional Biochemistry	Core	3	2	-	-	5	5	25	75	100

Learning Objectives

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.

Module 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. **15 Hrs**

Module 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 Hrs**

Module III: Balanced diet, diet during a normal life cycle, Nutrition from infancy to adolescence, ways of measuring growth, relationship of nutrients to the growth process, nutritional requirements of different age groups. ICMR classification of five food groups. Junk foods- definition and its adverse effects .**15 Hrs**

Module IV : Food additives: Intentional additives, Incidental additives, Contamination of food, Classification of toxic chemicals in food, lathyrism, Food – Borne diseases and their prevention, Safe food preparation practices, Detection of food adulteration, Effects of food adulteration, Nutritional labeling. **15 Hrs**

Module 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 Hrs**

Course Outcomes

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Cognizance of basic food groups viz. Carbohydrates, proteins and lipids and their nutritional aspects as well as calorific value	PO1,PO5
CO2	Identify and explain nutrients in foods and the specific functions in maintaining health.	PO1
CO3	Classify the food groups and its significance	PO1,PO2
CO4	Understand the effect of food additives	PO1,PO2
CO5	Describe the importance of nutraceuticals and pigments	PO1,PO5,PO6

Text books

1. Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bredbenner. 2013. Wardlaw's Perspectives in Nutrition: A Functional Approach. McGraw-Hill, Inc., NY, USA.
2. M.Swaminadhan (1995) Principles of Nutrition and Dietics. 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 (1sted) CRC

Reference Books

1. Branen, A.L., Davidson PM &Salminen S. 2001. Food Additives.2nd Ed. Marcel Dekker.
2. Gerorge, A.B. 1996. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.
3. Advances in food biochemistry, FatihYildiz (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.

Web resources

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

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3				2		3	3	3	3
CO 2	3						3	3		3
CO 3	3	2					3	1		3
CO 4	3	2					3	3		3
CO5	3				2	2	3	3		3

S-Strong (3) M-Medium (2) L-Low (1)

I YEAR: SEMESTER I

PRACTICAL I -NUTRITIONAL BIOCHEMISTRY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24CBC11	**Core paper 2Practical 1-Nutritional Biochemistry**	Core	-	-	3	-	3	3	25	75	100

Learning objectives

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.

TITRIMETRY 20hrs

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)

BIOCHEMICAL PREPARATIONS 15 Hrs

Preparation of the following substances and its qualitative tests

5. Lecithin from egg yolk.
6. Starch from potato.
7. Casein and Lactalbumin from milk.

GROUP EXPERIMENT 10Hrs

8. Determination of ash content and moisture content in food sample
9. Extraction of lipid by Soxhlet's method.

Course Outcomes

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Estimate the important biochemical constituents in the food samples.	PO1,PO3
CO2	Prepare the macronutrients from the rich sources.	PO1,PO3
CO3	Determine the ash and moisture content of the food samples	PO1,PO3
CO4	Extract oil from its sources	PO1,PO3,PO6

Text books

1. Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, NewAge InternationalPublishers, 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, NewAge InternationalPublishers, 2016.
2. Essentials of Food and Nutrition, Vol. I & amp; II, M.S. Swaminathan.
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 Brothers medical publishers.
5. Martha H. and Marie A. 2012. Biochemical, Physiological, and Molecular Aspects ofHuman Nutrition.3rd edition. Chand Publishers.

Web resources

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

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
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	3

S-Strong (3) M-Medium (2) L-Low (1)

I YEAR: SEMESTER I

HEALTH AND NUTRITION

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24SBC1A	Health and Nutrition	SEC 1	1	1	-	-	2	2	25	75	100

Learning Objectives

The main 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

Module I: Health – definition, Factors affecting human health. Importance of health care of children, adults and elderly people. Balanced diet and calorific value. **6 Hrs**

Module II: Vitamins-definition, classification, sources, properties, functions and deficiency symptoms. Recommended daily allowances. **6 Hrs**

Module III: Sources and functions of dietary fats, role of fats in health and diseases. **6 Hrs**

Module 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 Hrs**

Module 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 Hrs**

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Understand about the importance of health and diet	PO1
CO2	Discuss about the classification properties and deficiencies of Vitamins	PO1
CO3	Understand about sources and functions of fats and lipids on health	PO1.PO4
CO4	Detail about the different types of minerals and its role in health	PO1,PO4
CO5	Relate the role of proteins and carbohydrates on health	PO1,PO4

Text books

1. S. Davidson and J.R. Passmore (1986) Human Nutrition and Dietetics, (8^{th} ed), Churchill Livingstone.
2. J. S. Garrow, W. Philip T. James, A. Ralph (2000), Human Nutrition and Dietetics (10thed), 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

Web Resources

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

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3	3		3
CO 2	3						3	3		3
CO 3	3			2			3	3		3
CO 4	3			2			3	3		3
CO5	3			2			3	3		3

S-Strong (3) M-Medium (2) L-Low (1)

I YEAR: SEMESTER I

BRIDGECOURSE

BASICS IN BIOCHEMISTRY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24SBC1B	Basics in Biochemistry	Foundation Course	2	-	-	-	2	2	25	75	100

Learning objectives

- The students can understand biomolecules and its function
- Able to differentiate DNA and RNA and its types
- Understand the significance of Enzymes and coenzymes Vitamins
- Importance of Immunity against infectious microbe
- Diagnosis of diseases and medical coding

I. Biomolecules

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. **6 hrs**

II. Genetics & Biotechnology

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. Role of recombinant DNA technology. **6 hrs**

III. Enzymes & Coenzymes

Enzymes- structure and function in biological system. Vitamins classification and its deficiency symptoms. **6 hrs**

IV. Microbiology & Immunology

Classification of microbes. Role of microbes in fermentation and infections. Immune system – Definition of Immunity. Role of immune cells in infections. **6 hrs**

V. Medicinal Techniques

Role of medical lab in diagnosis of clinical disorder. Applications of medical coding. **6 hrs**

FIRST YEAR: SEMESTER II

CELL BIOLOGY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24CBC2A	Cell Biology	Core	5	-	-	-	5	5	25	75	100

Learning Objectives

The main objectives of this course are to

- Provide basic understanding of architecture of cells and its organelles.
- Understand the organization of Cell organelles and its function.
- 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 and mechanism of Microscopy.

Module I: Introduction about cell and cell biology, cell theory, functions, types, size, shape of cells, Number of cells. Architecture of cells- Structural organization of prokaryotic and eukaryotic cells, plant and animal cells. Elemental Composition of cells, scope of cell Biology. **15 Hrs**

Module II: Cell organelles – protoplasm, plasma membrane, cell walls, the ultrastructure of nucleus, mitochondria, RER, SER, chromosomes, ribosomes, golgi apparatus, lysosome, peroxisome and their functions. **15 Hrs**

Module III: Bio membranes-Structural organization of lipid layer model and basic functions-transport across cell membranes- uniport, symport and antiport. Passive and active transport. **15 Hrs**

Module 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. Stem cells and its types. **15 Hrs**

Module V: Introduction about Microscopy, magnification, resolving power, types of Microscopy, Cytological techniques – teasing, smear preparation squash preparation, Microtome. Fixation- aims of fixation, types, staining, types, cytochemical staining methods, Processing of tissues for light microscope. **15 Hrs**

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Explain the structure and functions of basic components of prokaryotic and eukaryotic cells, especially the organelles.	PO1
CO2	Familiarize the Cell organelles and its function	PO1,PO2
CO3	Illustrate the structure, composition and functions of cell membrane related to membrane transport	PO1,PO2
CO4	Elaborate the phases of cell cycle and cell division-mitosis and meiosis and characteristics of cancer cells and stem cells	PO1, PO2
CO5	Explain basics of microscopy, Cytological techniques and fixation.	PO1,PO2

Text books

1. Arumugam.N, Cell biology. Saras publication(10ed, paperback), 2019
2. Devasena.T.CellBiology.OxfordUniversityPressIndia-ISBN:9780198075516, 0198075510,2012
3. Bruce Alberts and Dennis Bray. 2013, Essential Cell Biology. (4"ed). Garland Science.

Reference books

1. S.C,R.Cell Biology. Newage Publishers -ISBN-10: 8122416888/ISBN-13: 978-8122416886, 2008
2. Cooper,G.A.The Cell:A Molecular Approach. Sinauer Associates,Inc -ISBN10: 0878931066 /ISBN 13: 9780878931064, 2013
3. E.M.F.,D.R,Cell and Molecular Biology. Lippincott Williams &Wilkins Philadelphia - ISBN:0781734932 9780781734936, 2006
4. LodishH.A ,Berk C.A, Kaiser M, Krieger M.P, Scott A, Bretscher H, Ploegh and Matsudaira. 2007. Molecular Cell Biology, 6th Edition, WH. Freeman Publishers, New York,USA.

Web resources

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

Mapping with Program Outcome

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3			3
CO 2	3	3					3			3
CO 3	3	3					3			3
CO 4	3	3					3	3		3
CO5	3	3					3			3

S-Strong (3) **M-Medium (2)** **L-Low (1)**

FIRST YEAR: SEMESTER II

PRACTICAL II CELL BIOLOGY

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24CBC21	Cell Biology	Core practical	-	-	3	-	3	3	25	75	100

Learning Objectives

The main objectives of this course are to

- 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

I. MICROSCOPY AND STAINING TECHNIQUES 20 Hrs

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

II. GROUP EXPERIMENT 10 Hrs

1. Identification of different stages of mitosis in onion root tip.
2. Identification of different stages of meiosis in onion bulb

III. SPOTTERS 15 Hrs

a) **Cells**: Nerve, Plant and Animal cell

b) **Organelles**: Mitochondria, Chloroplast, Endoplasmic reticulum,

c) **Mitosis stages**– Prophase, Anaphase, Metaphase, Telophase

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Identify the parts of microscope.	PO1,PO2
CO2	Preparation of Slides	PO1,PO2
CO3	Identify the stages of mitosis & meiosis	PO1,PO2
CO4	Visualize nucleus and mitochondria by staining methods	PO1,PO2
CO5	Identify the spotters of cells, organelles and stages of cell division	PO1,PO2

Text books

1. Rickwood, D and J.R. Harris cell Biology: Essential Techniques, Johnwikey1996.
2. Davis, J.M. Basic Cell culture: A practical approach, IRL 1994.
3. Ganesh M.K. and Shivashankara A.R. 2012. Laboratory Manual for Practical Biochemistry Jaypee publications, 2nd Edn.

Reference books

1. Essential practical handbook of Cell biology ,Genetics and Microbiology -A Practical manual- Debarati Das Academic publishers, ISBN, 9789383420599, 1st Edition 2017
2. Cellbiology Practical, Dr.Venugupta ISBN 8193651219, Prestige publisher,1st Jan2018.
3. Cell and Molecular biology, DeRobertis, 8th edition, 1st June, 1987

Web resources

1. http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1
2. https://www.microscopemaster.com/organelles.html
3. https://www.pdfdrive.com/biochemistry-books.htm
4. http://medcell.med.yale.edu/histology/cell_lab.php#:~:text=The%20electron%0 microscope%20is%20necessary,and%20small%20granules%20and%20vesicles.
5. http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1
6. https://www.khanacademy.org/science/ap-biology/heredity/meiosis-and- genetic diversity/a/phases-of-meiosis
7. https://www.microscopemaster.com/organelles.html
8. https://www.pdfdrive.com/biochemistry-books.html

Mapping with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
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

S-Strong (3) M-Medium (2) L-Low (1)

FIRST YEAR: SEMESTER II

FIRSTAID

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24SBC2A	First Aid	SEC (Entrepreneurial Based)	1	1	-	-	2	2	25	75	100

Learning Objectives

The main objectives of this course are to:

- 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.

Module I: Aim 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 Hrs**

Module 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 Hrs**

Module III: Common medical aid-first aid for wounds, cuts, head, chest, abdominal injuries, shocks, burns, amputations, fractures, dislocation of bones. **6Hrs**

Module IV: First aid related to unconsciousness, stroke, fits, convulsions-seizures, epilepsy. **6Hrs**

Module V: First aid in poisonous bites (Insects and snakes), honey bee stings, animal bites, disinfectant, acid and alkali poisoning.**6Hrs**

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Discuss on the rules of first aid, dealing during emergency and First aid techniques	PO1.PO4,PO5
CO2	Understand the first aid techniques to be given during different types of respiratory problems	PO1.PO4,PO5
CO3	Provide first aid for injuries, shocks and bone injury	PO1.PO4,PO5
CO4	Detail on the first aid to be given for unconsciousness, stroke, Fits and convulsions	PO1.PO4,PO5
CO5	Gain expertise in giving first aid for insect bites and chemical poisoning	PO1.PO4,PO5

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.indian red cross.org/publications/FA-manual.pdf
3. Red Cross First Aid/CPR/AED Instruct or Manual

Web resources

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

Mapping with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2						3	3	3	3
CO2	2			3	3		3	3	3	3
CO3	2			3	3		3	3	3	3
CO4	2			3	3		3	3	3	3
CO5	2			3	3		3	3	3	3

S –Strong (3) M-Medium (2) L-Low (1)

FIRST YEAR: SEMESTER II

TISSUE CULTURE

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24SBC2B	Tissue Culture	SEC (Discipline)	1	1	-	-	2	2	25	75	100

Learning Objectives

The objectives of this course are to

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

Module l: Introduction to Tissue culture, Types- seed, embryo, Callus, Organ, Protoplast culture, Advantages and importance of tissue culture, Tools and techniques **6 Hrs**

Module II: Media and Culture Preparation-pH, temperature, solidifying agents. Role of Micro and macro nutrients. Maintenance of cultures. **6 Hrs**

Module III: Methods of gene transfer in plants and animals- direct and indirect gene transfer methods. **6Hrs**

Module IV: Cell culture technique-Explants selection, sterilization and inoculation. **6Hrs**

Module V: Transgenic plants for crop improvement. Transgenic plants for molecular farming. Animal Cloning - an overview-Applications of animal cell culture **6Hrs**

Course outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Introduction to plant tissue culture	PO1,PO2.PO3
CO2	Brief knowledge on preparation of tissue culture media	PO1,PO2
CO3	Understanding on different methods of gene transfer	PO1,PO2.PO3
CO4	Gain knowledge on plant and animal cell culture techniques	PO1,PO2,PO3
CO5	Study of applications of genetically modified plants and animals.	PO1,PO2,PO3

Textbooks

1. Trivedi, P.C. 2000 .Applied Biotechnology: Recent Advances. PANIMA Publishing corporation.
2. Ignaci muthu. 1996. Applied Plant Biotechnology. Tata McGraw – Hill.
3. Lycett,G.W. and Grierson,D.(ed).1990.Genetic Engineering of crop plants.
4. Grierson and Covey,S.N.1988. Plant Molecular biology. Blackie.
5. Chawla, H.S.,"Introduction to Plant Biotechnology",3rdEdition, Science Publishers, 2009.

Reference books

1. Gamburg OL, Philips GC, Plant Tissue & Organ Culture fundamental Methods, arias Publications. 1995.
2. Stewart Jr., C. N. ,"Plant Biotechnology and Genetics: Principles, Techniques and Applications" Wiley- Inter science, 2008.
3. Freshney, R. I. (2010).Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. Wiley-Blackwell, 2010. 6th Edition.
4. Davis, J.M. (2008).Basic Cell Culture. Oxford University Press. New Delhi.
5. Davis, J. M. (2011). Animal Cell Culture. John Willy and Sons Ltd. USA.6Freshmen R. I. (2005). Culture of Animal Cells. John Willy and Sons Ltd. USA.
6. Butler, M.(2004).Animal Cell Culture and Technology. Taylor and Francis. Keywork USA.
7. Verma, A. S. and Singh, A.(2014).Animal Biotechnology. Academic Press, ELSEVIER,USA

Web Resources

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

Mapping with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3				3	3	3	3
CO2	2	3					3	3	3	3
CO3	2	3	3				3	3	3	3
CO4	2	3	3				3	3	3	3
CO5	2	3	3				3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

ALLIED COURSE OFFERED BY BIOCHEMISTRY

FIRSTYEAR: SEMESTER I

GENERIC ELECTIVE: BIOCHEMISTRY I

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24CEBC1A	Generic Elective: Biochemistry I	Generic Elective: Theory I	2	1	-	-	3	3	25	75	100

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.

Module 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 monosaccharides and disaccharides. Occurrence and significance of polysaccharides. **12Hrs**

Module II: Metabolism- Catabolism and Anabolism. Carbohydrate metabolism- Glycolysis, TCA cycle, HMP shunt and glycogen metabolism and energetics **12Hrs**

Module 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.**12Hrs**

Module IV : Proteins- classification - biological functions ,physical properties- ampholytes, iso electric point, salting in and salting out, denaturation, nature of peptide bond. Secondary structure, α-helix and β-pleated sheet, tertiary structure, various forces involved- quaternary structure. **12Hrs**

Module V: Vitamins- Fat (A, D, E and K) and water soluble vitamins (B complex and C) - sources, RDA, biological functions and deficiency diseases.**12 Hrs**

Course Outcome

CO	On completion of this course, students will be able to	Programme Outcome
CO1	Classify the structure of carbohydrates and its properties	PO1
CO2	Explain the metabolism of carbohydrates and its significance	PO1
CO3	Classify amino acids and its properties	PO1
CO4	Explain the classification and elucidate the different levels of Structural organization of proteins	PO1
CO5	Identify the disease caused by the deficiency of vitamins	PO1

Text Books

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

Reference books

1. David L. Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6thed) W.H. Freeman.
2. Voet.D & Voet .J. G (2010)Biochemistry,(4thed),JohnWiley & Sons, Inc.
3. Lubert Stryer(2010)Biochemistry,(7thed),W.H.Freeman

Web sources

1. onlinecourses.swayam2.ac.in/cec20_bt12
2. onlinecourses.swayam2.ac.in/cec20_bt19

Mapping with Program Outcome

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3						3			3
CO2	3						3			3
CO3	3						3			3
CO4	3						3			3
CO5	3						3	3		3

S-Strong (3) M –Medium (2) L –Low (1)

FIRST YEAR: SEMESTER II

GENERIC ELECTIVE: BIOCHEMISTRY II

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24CEBC2A	Generic Elective: Biochemistry II	Generic Elective Theory II	2	1	-	-	3	3	25	75	100

Learning objectives

The objectives of this course are to

- Impart knowledge on the classification, properties and characterization of lipids.
- Comprehend the metabolism of Lipids.
- Acquaint with the structure, properties and functions of nucleic acids.
- Learn about the enzyme kinetics and inhibition.
- Study the importance of Hormones.

Module I: Lipids–Bloor's classification of lipids- simple lipids, fatty acids (saturated and unsaturated), compound lipids, derived lipids. Properties of lipids- reduction, oxidation, halogenation, saponification and rancidity. Classification and functions of phospholipids, Cholesterol – structure and biological importance.**12 Hrs**

Module II: Lipid metabolism- Oxidation of fatty acids (Palmitic acid) – Beta oxidation-Role of carnitine, energetics , alpha oxidation and omega oxidation. Biosynthesis of saturated fatty acids.**12 Hrs**

Module III: Purine and pyrimidine bases, nucleosides, nucleotides, polynucleotides, DNA structure, various types, properties- absorbance, effect of temperature. Different types of RNA, structure and function, Genetic code. **12 Hrs**

Module IV : Enzymes - Nomenclature, IUB system of enzyme classification, active site, specificity, isoenzymes, units of enzyme activity, factors affecting enzyme activity- substrate concentration, pH, temperature. Enzyme Kinetics-Michaelis and Menten equation. Lineweaver- Burk plot. Enzyme inhibition, competitive, uncompetitive and non competitive inhibition **12Hrs**

Module V: Hormones -classification, Biological functions of Insulin, Thyroid and Reproductive hormones. **12Hrs**

Course Outcome

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Elaborate on classification, structure, properties, functions and characterization of lipids	PO1
CO2	Discuss the metabolism of lipids and its importance	PO1
CO3	Explain about structure, properties and functions of nucleic acids	PO1
CO4	Derive Michaelis Menten equation and concepts of enzyme inhibition	PO1,PO3
CO5	Classify the Hormones and its biological functions	PO1,PO4

Text books

1. Satyanarayana,U (2014)Biochemistry(4^{th} ed), Arunabha Sen Books &Allied (P) Ltd, Kolkata.
2. Jain J.L. (2007) Fundamentals of Biochemistry, S. Chand publishers

Reference books

1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6thed) W.H.Freeman.
2. Voet.D & Voet.J.G (2010)Biochemistry,(4thed), JohnWiley & Sons,Inc.
3. Lubert Stryer (2010) Biochemistry, (7thed), W.H.Freeman

Web sources

1. onlinecourses.swayam2.ac.in/cec20_bt12
2. onlinecourses.swayam2.ac.in/cec20_bt19

Mapping with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3						3			3
CO2	3						3			3
CO3	3		3				3			3
CO4	3			3			3			3
CO5	3						3	3		3

S-Strong (3) M –Medium (2) L –Low (1)

FIRST YEAR: SEMESTER II

GENERIC ELECTIVE PRACTICAL: BIOCHEMISTRY I

Course Code	CourseName	Category	L	T	P	S	Credits	Inst.Hours	Marks		
									CIA	External	Total
24CEBC21	Generic Elective Practical: Biochemistry I	Generic Elective Practical	-	-	3	-	2	3	25	75	100

Learning objectives

- Identify carbohydrates by qualitative test
- Estimate bio-molecules volumetrically
- Estimate protein quantitatively

I. Qualitative analysis of carbohydrates 25Hrs

a) Monosaccharides-Glucose, Fructose

b) Disaccharides-Lactose, Maltose, Sucrose

c) Polysaccharides-Starch

II. Qualitative analysis of Amino acids 25Hrs

a) Arginine b) Cysteine c) Tryptophan d) Tyrosine e) Histidine

III. Volumetric analysis 15Hrs

a).Estimation of ascorbic acid using 2,6 dichlorophenol indo phenol as link solution

b) Estimation of Glucose by Benedicts method

c).Estimation of Glycine by Sorenson Formal titration

IV. Quantitative analysis (Demonstration Expt.) **5 hrs**

a) Colorimetric estimation of protein by Biuret method .

Course Outcome

CO	On completion of this course, students will be able To	Program Outcomes
CO1	Qualitatively analyze and report the type of Carbohydrate based on specific tests	PO1,PO2.PO3
CO2	Qualitatively analyze and report the type of Amino acids based on specific tests	PO1,PO2,PO3
CO3	Quantitatively estimate the carbohydrates, amino Acids and ascorbic acid	PO1,PO2,PO3
CO4	Estimate the protein by colorimetric method	PO1,PO2,PO3

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.
3. Biochemical Methods, Sadasivam. Sand Manickam A, 4th edition, New Age International Publishers, 2016

Mapping with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3				3	3	3	3
CO2	2	3	3				3	3	3	3
CO3	2	3	3				3	3	3	3

S-Strong (3) M– Medium (2) L-Low (1)

SECONDYEAR: SEMESTER III
BIOMOLECULES

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24CBC3A	Biomolecules	Core	5	-	-	-	5	5	25	75	100

Learning objectives

The main objectives of this course are to:

- Introduce the structure, properties and biological significance of carbohydrates.
- Comprehend the classification, functions and acid base properties of amino acids.
- Elucidate the various levels of organization of Proteins.
- Impart knowledge on the classification, Properties and characterization of lipids.
- Acquaint with the classification, structure, properties and functions of nucleic acids.

Module I	**Carbohydrates**	
	Classification and biological significance, physical properties - stereo isomerism, optical isomerism, anomers, epimers and mutarotation. Monosaccharides: Occurrence, linear and cyclic structure, Reactions of monosaccharides due to the presence of hydroxyl, aldehyde and keto groups. Disaccharides: Structure and properties of reducing disaccharides (lactose and maltose), non-reducing disaccharide (sucrose). Polysaccharides: Homopolysaccharides - Occurrence, structure and biological significance of starch, glycogen and cellulose. Heteropolysaccharides - Structure and biological significance of Mucopolysaccharides- Hyaluronicacid, Chondroitin sulphate and Heparin. (Structural elucidation not needed).	**15hrs.**
Module 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, titration curve (alanine, lysine, glutamic acid), optical activity. Chemical reactions due to carboxyl group, amino group and side chains. Colour reactions of amino acids.	**15Hrs**
Module 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 f Organization of protein structure- Primary structure, Formation and characteristics of peptide	**15Hrs**

	bond, phi and psi angle, Secondary structure-α helix (egg albumin), β-pleated sheath (keratin), triple helix (collagen). Tertiary structure – with reference to Myoglobin. Quaternary structure with reference to Haemoglobin	
Module 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.	**15Hrs**
Module V	**Nucleic acids**	
	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-Hypochromic and hyperchromic effect, melting temperature. Denaturation and renaturation of DNA.	**15Hrs**

Course Outcomes

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Classify, illustrate the structure and explain the Physical and Chemical properties of carbohydrates.	PO1
CO2	Indicate the classification, structure, properties and biological functions of amino acids.	PO1
CO3	Explain the classification and elucidate the different levels of structural organization of proteins.	PO1
CO4	Elaborate on classification, structure, properties, functions and characterization of lipids	PO1,PO4
CO5	Describe the structure, properties and functions of different types of nucleic acids	PO1

Textbooks

1. Biochemistry, U. Sathyanarayana &U.Chakrapani,2013, 5th edition Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd.
2. Fundamentals of Biochemistry, J. L. Jain, Sunjay Jain, NitinJain, 2013, 7th edition S. Chand & Company Ltd.
3. Textbook of Medical Biochemistry, MN Chatterjee, Rana Shinde, 2002, 8th edition, Jaypee Brothers.

Reference books

1. David L. Nelson, Michael M. Cox, 2005, Principles of Biochemistry,4thedition W. H. Freeman and Company.
2. Voet. D, Voet .J.G.and Pratt,C. W, 2004, Principles of Biochemistry, 4th edition John Wiley & Sons, Inc.
3. Zubay G.L, *et.al*.1995, Principles of Biochemistry,1st edition, Wm C. Brown Publishers.

Web resources

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

Mapping with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3						3			3
CO2	3						3			3
CO3	3						3			3
CO4	3			2			3	2		3
CO5	3						3			3

S-Strong (3) M-Medium (2) L-Low

SECOND YEAR: SEMESTER III

PRACTICAL III: BIOMOLECULES

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24CBC31	Practical III: Biomolecules	Core Practical	-	-	3	-	3	3	25	75	100

Learning Objectives

The main objectives of this course are to

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

I. Qualitative test for Carbohydrates and Amino acids 15 Hrs

Carbohydrates

a) Glucose b) Fructose c) Arabinose d) Maltose e) Sucrose f) Lactose g) Starch

Amino acids

a) Arginine b) Cysteine c) Histidine d) Proline e) Tryptophan f) Tyrosine g) Methionine

II. Titrimetric methods 15 Hrs

1. Determination of Saponification value of edible oil.
2. Determination of Iodine number of edible oil.
3. Determination of Acid number of edible oil.

III. Group Experiments 15Hrs

1. Isolation of DNA from plant/animal source.
2. Isolation of RNA from rich source.

Course Outcomes

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Qualitatively analyse the carbohydrates and report the type of carbohydrate based on specific tests	PO1,PO2,PO3
CO2	Qualitatively analyze amino acids and report the type of Amino acids based on specific tests	PO1,PO2,PO3
CO3	Determine the Saponification, Iodine and acid number of Edible oil	PO1,PO3,PO4
CO4	Isolate the nucleic acid from biological sources	PO1,PO3

Textbooks

1. David T Plummer, An Introduction to Practical Biochemistry, 3rd edition, Tata Mc Graw- Hill Edition
2. J. Jayaraman Laboratory Manual in Biochemistry New Age International (P) Limited Fifth edition 2015
3. S. Sadasivam A. Manickam Biochemical Methods New age International Pvt Ltd publisher's third edition 2018

Reference books

1. Rageeb, Kiran Patil, M. Bakshi Rahman, Sufiyan Ahmad Raees A Practical book on Biochemistry Everest publishing house1st Edition, 2019
2. Introductory practical Biochemistry–S. K. Sawhney, Randhir Singh, 2nd Ed, 2005.
3. Biochemical Tests–Principles and Protocols. Anil Kumar, Sarika Gargand Neha Garg. Vinod Vasishtha Viva Books Pvt Ltd, 2012.
4. Harold Varley, Practical Clinical Biochemistry, CBS. 6 edition, 2006.
5. Keith Wilson and John Walker. Principles and Techniques of Practical Biochemistry, 4thedition, Cambridge University press, Britain.1995.

Web resources

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

Mapping with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3				3	3	3	3
3CO2	2	3	3				3	3	3	3
CO3	2		3	2			3	3	3	3
CO4	2		3				3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER III

MEDICAL LABORATORY TECHNOLOGY PRACTICAL

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24SBC31	Medical Laboratory Technology – Practical	SEC (Entrepreneurial Based)	1	-	1	-	2	2	25	75	100

Learning Objectives

The objectives of this course are to

- Introduce the methods of sample collection (blood & urine) for analytical purpose.
- Understand the estimation procedure for various important biomolecules.
- Help students learn the routine qualitative analysis of urine sample for diagnostic purpose.
- Train students on various hematological tests and its significance.

I.HEMATOLOGY EXPERIMENTS 15 Hrs

1. **Collection and preservation of blood and urine samples**.
    a. Blood grouping
    b. Blood clotting time
    c. Bleeding time
    d. RBC Counting
    e. Total and differential count of white blood cells
    f. Packed cell volume
    g. Erythrocyte sedimentation rate
    h. HCG kit test

2. **Qualitative analysis of normal constituents of urine 15 Hrs**
    a)Urea b) Creatinine c)Phosphorus, d)Calcium

    Abnormal constituents

    a) Calcium
    b) Sugar (Glucose, fructose, pentose)
    c) Protein
    d) Amino acids (Tyrosine, Histidine, Tryptophan)
    e) Ketone bodies
    f) Bile pigments with clinical significance.

Course Outcomes

CO	On completion of this course, students will be able to	Programme outcome
CO1	Acquaint knowledge on collection of biological samples (urine, blood) and their preparation for diagnostic purpose.	PO1,PO2
CO2	Estimate the important biomolecules in biological samples and relate their clinical significance	PO1,PO2,PO3,PO6
CO3	Qualitatively analyze urine sample for normal and abnormal constituents in urine and interpret the results	PO1,PO2,PO3
CO4	Perform the routine haematological tests.	PO1,PO2,PO3,PO6

Text Books

1. Manickam, S. S. (2018).Biochemical Methods (3rd ed.). New age International Pvt Ltd publishers - ISBN 10: 8122421407 / ISBN 13: 9788122421408
2. Plummer, D.T.(n. d.).An Introduction to Practical Biochemistry. Tata Mc GrawHill- ISBN: 97800708416
3. Alan H Gowenlock.1998.Varley's Practical Clinical Biochemistry, 6th edition, CBS Publishers, India.
4. B.Godkar.2020.Textbook of Medical Laboratory Technology Vol 1 & 2 Paperback, 3rd edition, Bhalani Publishers.
5. Kanai L Mukerjee.1996. Medical Lab Technology, Vol I & II, 1st edition Tata Mc graw Hill, Pennsylvania.
6. Ranjna Chawla. 2014. Practical Clinical Biochemistry Methods and interpretations 58(Paperback).4th edition, Jaypee Brothers Medical Publishers, New York.

Reference books

1. Singh,S.K.(2005).IntroductoryPracticalBiochemistry(2nded.).AlphaScience International, Ltd- ISBN 10: 8173193029 / ISBN 13: 9788173193026
2. Ashwood, B. a. (2001). Tietz Fundamentals of Clinical chemistry. WB SaundersCompany,OxfordSciencePublicationsUSA-ISBN10:0721686346/ ISBN 13: 978072168634

Web resources

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_biochem istry pdf. pdf? sequence=1&isAllowed=y
4. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochem istry pdf. pdf? sequence=1&isAllowed=y *

Mapping with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	3					3	3	3	3
CO2	3	3					3	3	3	3
CO3	3	3	3			3	3	3	3	3
CO4	3	3	2				3	3	3	3
CO5	3	3	3			3	3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER III

LIFE STYLE DISEASES

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24SBC3A	Life style Diseases	SEC (Discipline)	1	-	-	-	1	1	25	75	100

Learning Objectives

The objectives of this course are to

- Create awareness on lifestyle diseases among adolescents.
- List out the lifestyle diseases.
- Explain the common lifestyle diseases and their prevention.
- Acquaint the disorders associated with women's health.
- Impart life skills so as to prevent lifestyle diseases.

Module I: Lifestyle diseases: Definition, Factors contributing to lifestyle diseases –Physical inactivity, Poor food habits, disturbed biological clock, sleep deprivation. **3Hrs**

Module II: Top lifestyle diseases, Impact of Lifestyle diseases on family, society and economy of country. **3Hrs**

Module III: Causes, symptoms**,** types, preventive measures and treatment of Obesity, cardiovascular diseases, diabetes and cancer. **3Hrs**

Module IV: Women's lifestyle diseases: Polycystic Ovarian Disease, Infertility, Breast and cervical cancer and Osteoporosis. **3Hrs**

Module V: Prevention of lifestyle diseases: Balanced diet, sufficient intake of water, physical activity, sleep-wake cycle, stress management and meditation. **3Hrs**

Course outcomes

CO	On completion of the course the students will be able to	Program Outcomes
CO1	Define Lifestyle diseases and describe the contributing factors	PO1
CO2	Enumerate the top lifestyle diseases and its impact on life.	PO1,PO4,PO5
CO3	Elaborate the treatment and prevention measures of common lifestyle diseases.	PO1,PO4,PO5
CO4	Highlight the lifestyle diseases that affects the women's health	PO1,PO4,PO5
CO5	Illustrate the various measures for prevention of lifestyle diseases	PO1,PO4,PO5

Textbooks

1. James R, Lifestyle Medicine,2nd Edition, CRC Press, 2013
2. Akira Miyazaki, New Frontiers in Lifestyle-Related Disease,Springer,2008

Reference books

1. Steyn K, Lifestyle and related risk factors for chronic diseases
2. Willett WC, Prevention of chronic disease by means of diet and lifestyle.
3. Kumar M & R. Kumar, Guide to prevention of lifestyle diseases. Deep & Deep publications

Web resources

1. https://youtu.be/jDdL2bMQXfE
2. https://youtu.be/7WnpSB14nDM
3. https://youtu.be/ollz9MqtW-U

Mapping with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2						3	3		3
CO2	2			2	3		3	3		3
CO3	2			2	3		3	3		3
CO4	2			2	3		3	3		3
CO5	2			2	3		3	3		3

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER IV
BIOCHEMICAL TECHNIQUES

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24CBC4A	Biochemical Techniques	Core	3	2	-	-	5	5	25	75	100

Learning objectives

The objectives of this course are to

- Introduce the basic principles, types and applications of various sedimentation techniques.
- Provide an understanding of the underlying principles of chromatographic techniques
- Demonstrate experimental skills in various electrophoretic techniques.
- Appraise the use of colorimetric and spectroscopic techniques in biology
- Impart knowledge about the measurement of radioactivity and safety aspects of radioactive isotopes.

Module I	**Electrochemical techniques**	
	Measurement of pH, standard Hydrogen electrode, Henderson Hesselbalch equation, pH, pOH, type of Buffers, 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 ultracentrifuge–Determination of molecular weight(Derivation excluded)	**15 Hrs.**
Module II	**Chromatography**	
	Chromatography-adsorption, partition. Principle, instrumentation and applications of paper chromatography, thin layer chromatography, ion-exchange chromatography, gel permeation chromatography and affinity chromatography.	**15Hrs.**
Module 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.	**15Hrs**

Module IV	**Electromagnetic radiations**	
	Basics of Electromagnetic radiations-Energy, wavelength, 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.	**15Hrs**
Module 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.	**15Hrs**

Course Outcomes

CO	**On completion of this course, students will be able to**	**Program outcomes**
CO1	Describe types of rotors and identify the centrifugation technique for the separation of biomolecules.	PO1,PO2,PO6
CO2	Demonstrate the principles, operational procedure and applications of planar and column chromatography.	PO1,PO2,PO6
CO3	Specify the factors and explain the separation of DNA and protein using electrophoretic technique.	PO1,PO2,PO6
CO4	State Beer's Law and illustrate the instrumentation and uses of colorimeter and spectrophotometer.	PO1,PO2,PO6
CO5	Enumerate various methods of measurement of radioactivity and safety aspects of radioactive isotopes.	PO1,PO2,PO6

Textbooks

1. Avinash Upadhyay, Kakoli Upadhyay & Nirmalendu Nath 2002, Biophysical Chemistry, Principles and Techniques, 3rd edition, Himalaya Publishing House.
2. L. Veerakumari, 2009 ,Bioinstrumentation,1st edition, MJP Publishers.
3. Keith Wilson & John Walker, 2000, Practical Biochemistry-Principles and techniques, Cambridge University Press, 4thedition.

Reference books

1. Terrance G. Cooper the tools of Biochemistry,1977,JohnWiley & Sons, Singapore.
2. Guru Mani, Research Methodology for Biological Sciences, 2011, 1stedition, MJP Publishers.
3. Saroj Dua, Neera Garg, Biochemical Methods of Analysis, 2010, 1stedition, Narosa Publishing house.

Web Resources

1. https://www.britannica.com/science/chromatography
2. https://www.youtube.com/watch?v=xgxFBQZYXlE3.
3. https://www.youtube.com/watch?v=7onjVBsQwQ8

Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3				2	3	3	3	3
CO2	2	3				2	3	3	3	3
CO3	2	3				2	3	3	3	3
CO4	2	3				2	3	3	3	3
CO5	2	3				2	3	3	3	3

S-Strong (3) M-Medium (2) L-Low

SECOND YEAR: SEMESTER IV

PRACTICAL IV: BIOCHEMICAL TECHNIQUES

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24CBC41	Practical IV-Biochemical techniques	Core Practical	-	-	3	-	3	3	25	75	100

Learning objectives

The objectives of this course are to:

- Acquaint the students with colorimetric estimations of biomolecules.
- Equip skills on various separation techniques.
- Impart knowledge about the estimation of minerals and vitamins.

I.Colorimetry 20 Hrs

1. Estimation of amino acid by Ninhydrin method.
2. Estimation of protein by Biuret method.
3. Estimation of DNA by Diphenylamine method.
4. Estimation of RNA by Orcinol method.
5. Estimation of Phosphorus by Fiske and Subbarow method.

II. Chromatography 15 Hrs

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.

III. Demonstration 10 Hrs

1. Separation of Serum and Plasma from blood by centrifugation.
2. Separation of Serum proteins by SDS-PAGE.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Estimate the amount of biomolecules by Colorimetric method.	PO1,PO3,PO6
CO2	Quantify the amount of minerals by Colorimetric Method	PO1,PO3,PO6
CO3	Separate and identify sugars, lipids and amino acids by Chromatography	PO1,PO3
CO4	Operate centrifuge for the separation of serum and plasma	PO1,PO3,PO6
CO5	Demonstrate the separation of proteins electrophoretically	PO1,PO3,PO6

Textbooks

1. J. Jayaraman, Laboratory Manual in Biochemistry New Age International (P) Limited Fifth edition 2015.
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 Press2010, Seventh edition.

Reference books

1. S. K. Sawhney Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd 2nd edition, 2005.
2. David T. Plummer, 2001, An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw- Hill publishing company limited.
3. Varley's Practical Clinical Biochemistry by Alan H Gowenlock, published by CBS Publishers and distributors, India Sixth Edition,1988.

Web resources

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

Mapping with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2		3			2	3	3	3	3
CO2	2		3			2	3	3	3	3
CO3	2		3				3	3	3	3
CO4	2		3			2	3	3	3	3
CO5	2		3			2	3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER IV

BASICS OF FORENSIC SCIENCE

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24SBC4A	Basics of Forensic Science	SEC (Discipline)	1	1	-	-	2	2	25	75	100

Learning Objectives

The main objectives of this course are to

- Gain knowledge on the basic practices of forensic analysis.
- Perform investigation using fresh blood.
- Carry out the analysis using body fluids.
- Investigate the presence of forms of drugs and poisons in body fluids.
- Execute the identification test on multiple samples.

Module I	**Forensic Science**: Definition, History and Development. Crime scene management and investigation; collection preservation. Packing and forwarding of physical and trace evidences for analysis.	**6 Hrs**
Module II	**Investigation of Blood**: Blood–grouping and typing of fresh blood samples including enzyme. Cases of disputed paternity and maternity problems. DNA profiling – RFLP	**6 Hrs**
Module III	**Analysis of body fluids**-Analysis of illicit liquor including methyl and Ethyl alcohol in body fluids and breathe. Chemical examination, Physiology and pharmacology of insecticides and pesticides.	**6 Hrs**
Module IV	**Psychotropic drugs**–Sedatives (Barbiturate and Benzodiazepines) Stimulants (Caffeine and Nicotine), opiates and drugs of abuse. Identification of poisons from viscera, tissues and body fluids.	**6 Hrs**
Module V	**Identification tests**- Identification of hair: determination of species origin, Sex, site and individual identification from hair. Classification and identification of fibres. Examination and identification of saliva and urine.	**6 Hrs**

Course Outcomes

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Gain knowledge on basics of forensic science and method for Collection and preservation of samples	PO1,PO2,PO6
CO2	Assess the paternity, maternity problems and DNA profiling	PO1,PO2
CO3	Identify the presence of alcohol, insecticides and pesticides in Body fluids	PO1,PO2
CO4	Detail on the test performed to identify the presence of drugs and Poisons in body fluids	PO1,PO2
CO5	Identify species and sex from the available body fluids	PO1,PO2

Reference books

1. An Introduction to Forensic DNA Analysis by Norah Rudin & Keith Inman USA, Second edition.
2. Forensic Science Handbook, Volume 2 &3 by Saferstein, Richard E.
3. Forensics by Embar-Seddon, Aynand Pass. Allan D.
4. Forensic Medicine by Adelman, Howard C & Kobilinsky, Lawrence Page 24 of 63

Mapping with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	3					3		3	3
CO2	2	3					3		3	3
CO3	2	3					3		3	3
CO4	2	3					3		3	3
CO5	2	3					3		3	3

S-Strong (3) M-Medium (2) L-Low (1)

SECOND YEAR: SEMESTER IV

BIOINFORMATICS PRACTICAL

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
24SBC41	Bioinformatics – Practical	SEC (Discipline)	1	-	1	-	2	2	25	75	100

Learning Objectives

The main objectives of this course are to

- Impart knowledge on bioinformatics and applications
- Learn about biological databases
- Understand the local and global sequence alignment
- Provide insights on BLAST and file format conversion tools
- Familiarize about structural proteomics and visualization tools

I.BIOLOGICAL DATABASE 8Hrs

1. Nucleotide Sequence databases
2. Protein Sequence databases
3. Structure databases
4. Motif and domain databases
5. Metabolic pathway databases

II.SEQUENCE ANALYSIS 10Hrs

1. Dynamic programming
2. Pair wise Sequence alignment
3. Multiple Sequence alignment
4. Similarity Search
5. File format conversion

III.PROTEIN STRUCTURE PREDICTION 12Hrs

1. Primary structure prediction
2. Secondary structure Prediction
3. Tertiary structure Prediction
4. Function Prediction

Course outcome

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Gain hands on experience with computational tools and techniques to analyze biological data including sequence analysis and databases	PO1,PO2
CO 2	Learn about different biological databases	PO1,PO2,PO6
CO3	Aligning sequences to identify conserved regions	PO1,PO2.PO6
CO4	Using tools like BLAST to compare sequences and identify similarities.	PO1,PO2,PO6
CO5	learn to apply these tools to understand gene and protein structure and function	PO1,PO2,PO6

Text Books:

1. D.W. Mount (2001), Bioinformatics, Cold spring Press
2. Westhead D.R, Parish J.H and Twyman R.M. (2003), Instant notes in BioInformatics, Cambridge University press
3. Attwood.T.K. Parry D.J. and Smith, (2001), Introduction to BioInformatics, Oxford University Press

Reference Books:

1. Veerabalarastogi, (2008), Biotechnology, Ane books India
2. Dr.K.ManiN.Vijayaraj, (2002), Bioinformatics, Kalaikathirachchagam
3. Rastogi.S.C, Namita, (2008), Bioinformatics, Ane books India

Mapping with Program Outcome

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	2				2	3	2	3	3
CO2	3	2				2	3	2	3	3
CO3	3	2				2	3	2	3	3
CO4	3	2				2	3	2	3	3
CO5	3	2				2	3	2	3	3

S-Strong(3) M-Medium(2) L-Low(1)