



**University of Kerala**

**Four Year Under Graduate Programme  
(UoK FYUGP)**

**Syllabus**

**Major Discipline Biochemistry**

**May 2024**



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## **About Discipline**

### **B. Sc. – Honours in Biochemistry/ B. Sc. Honours with Research in Biochemistry**

#### **Introduction**

Biochemistry is one of the most fascinating subjects as it deals with the chemical language of Life, be it human, animal, plant or microorganism. Biochemistry is one of the most upcoming and highly in demand subject in the Indian as well as the foreign universities. The basic foundation in Biochemistry is a necessary pre-requisite for any kind of life science, biotechnological, medical, paramedical and biological research activity. In the vibrant academic landscape of Kerala, a four-year undergraduate program (FYUGP) in Biochemistry of Kerala University offers a comprehensive journey into this interdisciplinary field, encompassing a wide scope, defined aims, and abundant job opportunities.

#### **Scope:**

The scope of Biochemistry is expansive, touching upon various facets of life sciences and industry. From understanding the intricate workings of cells and organisms to elucidating the molecular basis of diseases, Biochemistry plays a pivotal role. In FYUGP, students delve into diverse areas such as nutrition, enzymology, immunology, metabolism, nanobiotechnology, forensics genetics, and molecular biology. They explore how biomolecules function, interact, and regulate biological processes, paving the way for innovations in healthcare, agriculture, biotechnology, and environmental sciences.

#### **Aim:**

The aim of a FYUGP in Biochemistry in Kerala University is to equip students with a strong foundation in theoretical knowledge and practical skills essential for a career in this dynamic field. Through rigorous coursework, laboratory experiments, and research projects, students develop critical thinking abilities, analytical skills, and a deep understanding of biochemical principles. They are prepared to tackle real-world challenges, contribute to scientific advancements, and make meaningful contributions to society.

**Job Opportunities:**

The FYUGP in Biochemistry opens doors to diverse and rewarding career opportunities. Graduates are sought after in both academic and industrial sectors. They can pursue roles in research institutions, universities, government agencies, and biotechnology companies. Moreover, the program lays a solid foundation for further education and specialization in fields such as medicine, biotechnology, pharmacology, and bioinformatics.

Biochemistry is a career oriented, high demand fundamental course with applications in all biological research, be it plants, animal, human and microbes. It provides opportunity to students to develop their career in the following areas:

- Biochemical research
- pharmaceuticals
- Healthcare industry
- Diagnostics research
- Food and packaging industries
- Food and beverage industries,
- Medical Instrument companies
- Research Companies and Laboratories
- Drug manufacturing industries
- Public Health Entities
- Blood research and Services
- Industrial Laboratories
- Cancer research institutes
- Research Departments
- Educational Institutes
- Environmental Pollution Control
- Agriculture and fisheries
- Forensic Science
- Hospitals
- Public Health Laboratories
- Cosmetic Industries etc.
- Genomics Industries
- Diagnostics and testing Industries

Students passionate about their job to study structures and functions of proteins, carbohydrates, fats, lipids, process of metabolism, molecular basis of the action of genes, biochemical pathways, and diagnosis of different ailments can make a career in the Biochemistry field after pursuing this course.



## **Graduate Attributes**

Graduate attributes bridge the gap between academia and the real world, fostering lifelong learning and meaningful contributions. They denote the skills, competencies and high-level qualities that a student should acquire during their university education. Apart from gathering content knowledge, these attributes go beyond the assimilation of information to its application in various contexts throughout a graduate's life. It aims in inculcating the art of critical thinking, problem solving, professionalism, leadership readiness, teamwork, communication skills and intellectual breadth of knowledge. The University of Kerala envisages to pave the path in guiding the student's journey to shape these attributes uniquely, making them integral to personal growth and success in various spheres of life. The University strives to ensure that these graduate attributes are not just checkboxes, but they play a pivotal role in shaping the students into capable, compassionate and responsible individuals with a high degree of social responsibility.

## Programme Outcomes (PO)

No.	Programme Outcomes (POs)
PO-1	<b>Critical thinking</b> <ul style="list-style-type: none"><li>○ analyze information objectively and make a reasoned judgment</li><li>○ draw reasonable conclusions from a set of information, and discriminate between useful and less useful details to solve problems or make decisions</li><li>○ identify logical flaws in the arguments of others</li><li>○ evaluate data, facts, observable phenomena, and research findings to draw valid and relevant results that are domain-specific</li></ul>
PO-2	<b>Complex problem-solving</b> <ul style="list-style-type: none"><li>○ solve different kinds of problems in familiar and no-familiar contexts and apply the learning to real-life situations</li><li>○ analyze a problem, generate and implement a solution and to assess the success of the plan</li><li>○ understand how the solution will affect both the people involved and the surrounding environment</li></ul>
PO-3	<b>Creativity</b> <ul style="list-style-type: none"><li>○ produce or develop original work, theories and techniques</li><li>○ think in multiple ways for making connections between seemingly unrelated concepts or phenomena</li><li>○ add a unique perspective or improve existing ideas or solutions</li><li>○ generate, develop and express original ideas that are useful or have values</li></ul>
PO-4	<b>Communication skills</b> <ul style="list-style-type: none"><li>○ convey or share ideas or feelings effectively</li><li>○ use words in delivering the intended message with utmost clarity</li><li>○ engage the audience effectively</li><li>○ be a good listener who are able to understand, respond and empathize with the speaker</li><li>○ confidently share views and express himself/herself</li></ul>
PO-5	<b>Leadership qualities</b> <ul style="list-style-type: none"><li>○ work effectively and lead respectfully with diverse teams</li><li>○ build a team working towards a common goal</li><li>○ motivate a group of people and make them achieve the best possible solution.</li><li>○ help and support others in their difficult times to tide over the adverse situations with courage</li></ul>

<b>PO-6</b>	<b>Learning ‘how to learn’ skills</b> <ul style="list-style-type: none"> <li>○ acquire new knowledge and skills, including ‘learning how to learn skills, that are necessary for pursuing learning activities throughout life, through self-paced and self-directed learning</li> <li>○ work independently, identify appropriate resources required for further learning</li> <li>○ acquire organizational skills and time management to set self-defined goals and targets with timelines</li> <li>○ inculcate a healthy attitude to be a lifelong learner</li> </ul>
<b>PO-7</b>	<b>Digital and technological skills</b> <ul style="list-style-type: none"> <li>○ use ICT in a variety of learning and work situations, access, evaluate, and use a variety of relevant information sources</li> <li>○ use appropriate software for analysis of data</li> <li>○ understand the pitfalls in the digital world and keep safe from them</li> </ul>
<b>PO-8</b>	<b>Value inculcation</b> <ul style="list-style-type: none"> <li>○ embrace and practice constitutional, humanistic, ethical, and moral values in life including universal human values of truth, righteous conduct, peace, love, nonviolence, scientific temper, citizenship values</li> <li>○ formulate a position/argument about an ethical issue from multiple perspectives</li> <li>○ identify ethical issues related to work, and follow ethical practices, including avoiding unethical behaviour such as fabrication, falsification or misrepresentation of data, or committing plagiarism, and adhering to intellectual property rights</li> <li>○ adopt an objective, unbiased, and truthful actions in all aspects of work</li> </ul>

### **Programme Specific Outcomes (PSO)**

<b>No.</b>	<b>Upon completion of the programme the graduate will be able to</b>	<b>PO No.</b>
PSO-1	Students will demonstrate a comprehensive understanding of fundamental biochemical principles, including the structure and function of biomolecules, enzymes, metabolic pathways, and the molecular basis of cellular processes.	2

PSO-2	Students will possess advanced laboratory skills necessary for employability, analysis, biochemical research and application of clinical biochemistry in disease diagnosis.	6
PSO-3	Students will be able to communicate and critically evaluate scientific literature and apply biochemical principles to solve real- world problems in areas such as medicine, nutrition and dietetics, forensics, nanobiotechnology, agriculture and environmental science.	1,2,4
PSO-4	Students will acquire core knowledge in the basic areas of biochemistry, as well as horizontal knowledge in related life science fields to pursue either higher education or employment in various fields, or entrepreneurship.	2,4

### **Members of the Board of studies in Biochemistry and teachers participated in the syllabus preparation in FYUGP 2024**

1. Prof. A. Helen. Chairperson, Department of Biochemistry, University of Kerala
2. Prof. Annie Abraham, Rtd. Professor, University of Kerala
3. Prof. Ganga Prasad A, Rtd. Professor, University of Kerala
4. Prof. Padmakumaran Nair KG, Professor, NSS College, Panthalam
5. Dr. Sindhu Rani JA, Associate Professor, NSS College, Nilamel
6. Dr. Arun A Rauf, Associate Professor, University of Kerala
7. Dr. Biju PG, Assistant Professor, University of Kerala
8. Dr. Radhika A, Associate Professor, Govt. College, Kariavattom
9. Dr. Arun U, Assistant Professor, Govt. Arts & Science College, Kulathoor
10. Mr. Vishnu SL, Assistant Professor, SN College for Women, Kollam
11. Dr. Rejiya CS, Academic Council Member, Assistant Professor, Sree Ayyappa College, Eramallikkara
12. Dr. C. R. Dhanya, Associate Professor, Govt. College, Kariavattom
13. Dr. Chithra V, Assistant Professor, NSS College, Panthalam
14. Dr. Anila L, Associate Professor, NSS College, Nilamel
15. Dr. Sini H, Associate Professor, Govt. College, Kariavattom
16. Dr. Boban PT, Associate Professor, Govt. College, Kariavattom
17. Dr. Hari Sankar HS, Assistant Professor, TKM College of Arts & Science, Kollam
18. M.S. Soumya, Assistant Professor, TKM College of Arts & Science, Kollam
19. Dr. Vinod BS, Assistant Professor, S.N. College, Kollam
20. Dr. Ambili S, Assistant Professor, S.N. College, Kollam
21. Dr. Sheena Philip, Assistant Professor, University College, Palayam



22. Dr. Reji Susan Biju AS, A J College of Science & Technology, Thonnakkal
23. Dr. Joicy Abraham, A J College of Science & Technology, Thonnakkal
24. Dr. Swathy SS, A J College of Science & Technology, Thonnakkal
25. Dr. Manju L, Assistant Professor, St. Xaviers College, Thumba
26. Dr. Jisha S, Assistant Professor, Bishopmore College, Mavelikara, Alappuzha
27. Dr. Lekshmi Vijayanath, Assistant Professor & HOD, Emmanuel College, Vazhichal
28. Ms. Bijila V.X, Assistant Professor, Emmanuel College, Vazhichal
29. Ms. Reni Christabel HP, Assistant Professor, Emmanuel College, Vazhichal
30. Ajitha Nair VA, Assistant Professor, Emmanuel College, Vazhichal
31. Dr. Nisha V R, Assistant Professor, Emmanuel College, Vazhichal
32. Ms. Anupama SS, Assistant Professor, Women's College, Thiruvananthapuram
33. Dr. Remya, Assistant Professor, Assistant Professor, SN College for Women, Kollam
34. Dr. Manju C.S, Assistant Professor, Govt. Arts & Science College, Kulathoor

## COURSE CONTENT

**Year of Admission : 2024**

**Discipline : FYUGP Biochemistry**

<b>Sl No</b>	<b>Semester</b>	<b>Course code</b>	<b>Course Title</b>	<b>L: T: P : HOURS</b>
<b>1.</b>	<b>I</b>	<b>UK1DSCBCH104</b>	<b>Physical aspects of biochemistry</b>	<b>3: 0: 1, 75 hrs</b>
<b>2.</b>	<b>I</b>	<b>UK1MDCBCH101</b>	<b>Nutritional biochemistry for health &amp; fitness</b>	<b>3: 0: 0, 45 hrs</b>
<b>3.</b>	<b>II</b>	<b>UK2DSCBCH105</b>	<b>Molecules of life</b>	<b>3: 0: 1, 75 hrs</b>
<b>4.</b>	<b>II</b>	<b>UK2MDCBCH100</b>	<b>Biochemistry of lifestyle diseases</b>	<b>3: 0: 0, 45 hrs</b>
<b>5.</b>	<b>III</b>	<b>UK3DSCBCH201</b>	<b>Enzymes and enzyme kinetics</b>	<b>3: 0: 1, 75 hrs</b>
<b>6.</b>	<b>III</b>	<b>UK3VACBCH201</b>	<b>Drug Abuse and Prevention</b>	<b>3: 0: 0, 45 hrs</b>
<b>7.</b>	<b>IV</b>	<b>UK4VACBCH200</b>	<b>Play of hormones</b>	<b>3: 0: 0, 45 hrs</b>
<b>8.</b>	<b>VI</b>	<b>UK6SECBCH300</b>	<b>Analytical biochemistry</b>	<b>2: 0: 1, 60 hrs</b>

Discipline	BIOCHEMISTRY				
Course Code	UK1DSCBCH104				
Course Title	<b>PHYSICAL ASPECTS OF BIOCHEMISTRY</b>				
Type of Course	<b>DSC 5</b>				
Semester	I				
Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Basic knowledge in biology and chemistry				
Course Summary	The course lays a foundation of basic biochemistry and outlines the concepts of water, buffer systems, colloids, basic separation methods and radiation biology.				

### Detailed Syllabus:

Module	Unit	Content	Hrs
<b>I</b>	<b>Colloids and solutions</b>		<b>10</b>
	1	Classification and biological significance of colloids	
	2	Osmosis and diffusion (Definition and biological significance) Basics of Donnan Membrane Equilibrium	
	3	Isotonic, hypotonic, hypertonic and Iso-osmotic solutions, surface tension and viscosity	
	4	Structure and properties of water, Ionization of water, Concepts of acids and bases. pH & pOH	
	5	Buffers, Henderson Hasselbalch equation, Buffers in biological system and its biomedical importance	
<b>II</b>	<b>Bio-organic chemistry</b>		<b>8</b>
	6	Introduction to major biomolecules and classification	
	7	Major types of Covalent bonds in biomolecules: Disulphide bonds, Peptide Bonds, Glycosidic bonds, Phosphodiester bonds	
	8	Non covalent bonds and its biological significance: Hydrogen bond, Ionic bond, Hydrophobic bond, van der Waals forces)	
	9	Common Functional groups in biomolecules and their significance, Isomerism in biomolecules	
<b>III</b>	<b>Biochemical Separation techniques</b>		<b>9</b>
	10	Dialysis: Principle and procedure	

	11	Chromatography : Principle and procedure (Paper and TLC)	
	12	Electrophoresis: Principle and procedure (Agarose gel electrophoresis and SDS PAGE)	
	13	Centrifugation: Principle and applications of Differential and density gradient, Svedberg constant.	
<b>IV</b>	<b>Colorimetry and spectrophotometry</b>		<b>9</b>
	14	Beer Lambert's law, Molar extinction coefficient and absorption spectra.	
	15	Principle and instrumentation of Colorimetry and Spectrophotometry.	
	16	Applications of colorimetry and spectrophotometry in the field of Biochemistry	
<b>V</b>	<b>Basics of radiobiology</b>		<b>9</b>
	17	Radioactive isotopes- half life, important stable isotopes used in biochemical research ( $^{32}\text{P}$ , $^{125}\text{I}$ , $^{131}\text{I}$ , $^{60}\text{Co}$ , $^{14}\text{C}$ , etc)	
	18	Classification of radiation damage , Effects of radiation in humans	
	19	Harmful effects of radiation, Stochastic and deterministic (non-stochastic) effects	
		<b>Practical</b>	<b>30</b>
	20	<ul style="list-style-type: none"> <li>● Basic laboratory practices</li> <li>● Weighing in chemical balance</li> <li>● Preparation of solutions (Molar, Normal and Percentage solutions)</li> <li>● Dilution from stock solution</li> <li>● Preparation of Buffers and determination of pH.</li> <li>● Demonstration of paper chromatography</li> <li>● Verification of Beer Lambert's law and colorimetric estimation of concentration of unknown solution.</li> <li>● Lab/Institution Visit</li> </ul>	

### Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discuss the basics aspects and biological significance colloids and solutions	R, U	1
CO-2	Describe the concepts of important linkages in biomolecules	R, U	2
CO-3	Demonstrate and explain the basic techniques used in the field of biochemistry	R, U, Ap	3,4

CO-4	Explain the concepts of radiation biology	R, U	3,4
CO-5	Restate good laboratory practices, carry out safe laboratory experiments and prepare solutions & buffers.	R, U, Ap	3,4

**R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create**

**Name of the Course: Physical Aspects of Biochemistry**

**Credits: 3:0:1 (Lecture:Tutorial:Practical)**

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	1	1	R, U	F, C	LT	
2	2	2	R, U	F, C	LT	
3	3	3,4	R, U, Ap	F, C	LT	
4	4	3,4	R, U	F, C	LT	
5	5	3,4	R, U, Ap	F, C, P	LT	P

**F-Factual, C- Conceptual, P-Procedural, M-Metacognitive**

**Mapping of COs with PSOs and POs :**

	PSO 1	PSO 2	PSO 3	PSO4	PS O5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6
<b>CO 1</b>	2	-	-	-	-	-		2				
<b>CO 2</b>	3	-	-	-	-	-		2				
<b>CO 3</b>	-	-	2	3	-	-	2	2		2		3
<b>CO 4</b>	-	-	1	3	-	-	2	2		2		3
<b>CO 5</b>	-		2	3	-	-		2		3		3

**Correlation Levels:**

Level	Correlation
	Nil
1	Slightly/Low
2	Moderate/Medium
3	Substantial/High

**Assessment Rubrics:**

- Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

**Mapping of COs to Assessment Rubrics :**

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	√	√		√
CO 2	√	√		√
CO 3	√	√		√
CO 4	√	√		√
CO 5	√	√		

Discipline	BIOCHEMISTRY				
Course Code	UK1MDCBCH101				
Course Title	<b>Nutritional Biochemistry for Health &amp; Fitness</b>				
Type of Course	MDC2				
Semester	I				
Academic Level	100 -199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2 hours	4
Pre-requisites	Nil				
Course Summary	The course outlines a general introduction to metabolism, role of nutrition in health, biochemical response to exercise and dietary management of health and disease.				

### Detailed Syllabus:

Module	Unit	Content	Hrs
<b>I</b>	<b>Introduction to Metabolism</b>		<b>6</b>
	1	Definition and significance of Metabolism	
	2	Anabolism and Catabolism	

	3	Basic awareness about energy yielding metabolic pathways (Reaction sequence not required).	
	4	Significance of ATP as energy currency	
	5	Phosphocreatine system (basic idea)	
<b>II</b>	<b>Nutrition for Health</b>		<b>6</b>
	6	Basic concept and definition of balanced diet, calorific value, SDA and RDA	

	7	Macronutrients: Requirement of carbohydrates, proteins and lipids for health and fitness. Glycemic index, biological value of protein (definition).	
	8	Micronutrients (vitamins and minerals): Sources and functions	
	9	Water: Hydration and electrolyte balance.	
	10	Food guide pyramid, seasonal foods and traditional foods	
<b>III</b>	<b>Biochemical Response in Exercise</b>		<b>6</b>
	11	Physiological responses to exercise and physical activity.	
	12	Glycolytic system and oxidative system: as primary energy source	
	13	Role of carbohydrates, fats, and proteins in exercise metabolism	
	14	Metabolic adaptations to aerobic and anaerobic exercise.	
	15	Impact of exercise on hormones and neurotransmitters: dopamine, serotonin, oxytocin and endorphins (feel good hormones)	
<b>IV</b>	<b>Nutritional Management in Health and Disease</b>		<b>6</b>
	16	Nutritional considerations for weight management and body composition goals	
	17	Role of nutrition in metabolic syndrome, diabetes, and cardiovascular health	
	18	Dietary approaches for managing inflammation	
	19	Nutritional interventions for common sports injuries and musculo-skeletal health	



<b>V</b>	<b>Gut Microbiome</b>		<b>6</b>
	20	Gut microbiome	
	21	Gut brain axis	
	22	Prebiotics and probiotics (artificial and natural)	
	23	Microbial dysbiosis, Disorder associated with gut microbiome	
	24	Recent advance in microbiome research: Pharma biotics and Poop pill	
		<b>Activities</b>	<b>15</b>

	25	1. Diet chart preparation 2. Study of impacts of exercise on emotions (questionnaire method) Questionnaire on nutritional status in community (maintenance of record)	
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### Course Outcomes

<b>No.</b>	<b>Upon completion of the course the graduate will be able to</b>	<b>Cognitive Level</b>	<b>PSO addressed</b>
CO-1	Summarize the basic concepts of metabolism related to energy production	R, U	1
CO-2	Associate the major proximate principles of food to health and fitness	R, U	2,3
CO-3	Describe the physiological and biochemical response of the body to exercise	R, U	3
CO-4	Recognise the importance of nutrition in the management of health and disease	R, U	2,3

CO-5	Discuss the latest developments in the concepts of gut microbiome.	R, U	2
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**R-Remember, U-Understand, Ap-Applly, An-Analyse, E-Evaluate, C-Create**

**Name of the Course: Nutritional Biochemistry for Health and Fitness**

**Credits: 2:0:1 (Lecture:Tutorial:Practical)**

CO No.	CO	PO/PS O	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	1	1	R, U	F, C	LT	
2	2	2,3	R, U	F, C	LT	
3	3	3	R, U	F, C	LT	
4	4	2,3	R, U	F, C	LT	
5	5	2	R, U	F, C	LT	P

**F-Factual, C- Conceptual, P-Procedural, M-Metacognitive**

**Mapping of COs with PSOs and POs :**

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	-	-	-	-		2				
CO2	-	2	3	-	-	-	2	2		2		3
CO3	-	-	3	-	-	-	2	3		2		
CO4	-	3	-	3	-	-		2				3
CO5	-	2	-	-	-	-						3

**Correlation Levels:**

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

### Assessment Rubrics:

- Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

### Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	√	√		√
CO 2	√	√		√
CO 3	√	√		√
CO 4	√	√		√
CO 5	√	√		√

### References

1. Textbook of Human Nutrition. Anjana Agarwal and Shobha A Udipi. Jaypee Brothers Medical Publishers (P) Ltd.
2. Nutrition (4th edition). Insel P, Ross D, McMahon K and Bernstein M. Jones and Bartlett Publishers. Boston 2012 , 387-502.
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6. Handbook of Foods And Nutrition. Blank, F. C. (2007). Agrobios (India)
7. Srilakshmi, B. (2014). Food Science. New Age International Publishers (India).
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Discipline	BIOCHEMISTRY				
Course Code	UK2DSCBCH105				
Course Title	<b>MOLECULES OF LIFE</b>				
Type of Course	<b>DSC12</b>				
Semester	II				
Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Nil				
Course Summary	This course will help to create a strong foundation in biochemistry for students, with a focus on basic biomolecules. The course also covers the basics of qualitative analysis of biomolecules.				

### Detailed Syllabus:

Module	Unit	Content	Hrs
<b>I</b>	<b>Amino acids and proteins</b>		<b>10</b>
	1	General Structure and Function of aminoacids	
	2	Standard and non protein amino acids (2 examples each)	
	3	Single letter and three letter representation (Alanine, Serine, Cysteine, Glutamate, Lysine, Phenylalanine and Proline)	
	4	Zwitter ionic form and isoelectric pH (significance)	
	5	Essential and non-essential aminoacids	
	6	Classification of Proteins (Structural, Functional and nutritional)	
	7	Structural organization of proteins (basics only)	
	8	Basic functions of Plasma proteins	
	<b>Carbohydrates</b>		<b>10</b>
	9	Monosaccharides – glucose and fructose (Open and Haworth projection formula). D & L isomerism, epimers, anomers and mutarotation	
	10	Disaccharides – lactose, sucrose (Components, bond involved and occurrence)	
<b>II</b>	11	Polysaccharide: Structural and storage polysaccharides (Cellulose, glycogen and starch-Components, bond involved and occurrence)	
<b>III</b>	<b>Lipids</b>		<b>9</b>
	12	Basic functions of lipids	
	13	Essential and non-essential fatty acids	
	14	Structure and function of triglycerides (simple triglyceride)	
	15	Structure and function of phospholipids (Lecithin)	
	16	Structure and functions of cholesterol.	
	<b>Nucleic acids</b>		<b>6</b>
	17	Base composition, Purines and pyrimidines (names only)	

<b>IV</b>	18	Nucleosides & Nucleotides (Basic structure)	
	19	Basic structural features of B-DNA	
	20	Basic function of mRNA, tRNA and rRNA	
<b>V</b>	<b>Enzymes</b>		<b>10</b>
	21	Basic difference between chemical and biological catalyst	
	22	Concept of holoenzyme, apoenzyme, prosthetic group (with suitable example) and active site of enzyme	
	23	Lock and Key hypothesis, Koshland hypothesis	
	24	Units of enzyme activity-IU	
	25	Competitive inhibition-significance (with reference to Ethanol in methanol poisoning)	
	26	Therapeutic enzymes (Basic idea on application of Urokinase and Lipase)	
	27	Industrial enzymes (Basic idea on application of Lipase and pectinase)	
	<b>Practicals: Biomolecules</b>		<b>30</b>
	28	Qualitative analysis of Carbohydrates- Solubility test, Molisch's test, reduction test (Benedicts, Fehlings, Barfoeds, Picric acid test) and starch (Iodine test). Qualitative analysis of Amino acids and protein: Amino acids: Solubility test, ninhydrin test. Protein: Solubility, Xanthoproteic test, Biuret, Folin's test Qualitative analysis of fatty acids: Solubility test, test for unsaturation	
		Rough record for Practical work has to be maintained	

### Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the basic molecules that make up life	U	1
CO-2	Evaluate the structure of carbohydrates, lipids, amino acids , proteins and nucleic acids	R, U,E	1,2
CO-3	Acquire an understanding of enzymes, activity and applications	U, A, E	3,4
CO-4	Analyse qualitatively some important biomolecules in the laboratory	U,A,C	3,4

**R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create**

**Name of the Course: Molecules of Life      Credits: 3:0:1 (Lecture:Tutorial:Practical)**

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	1	1	U	F, C	LT	
2	2	1,2	R, U,E	F, C	LT	
3	3	3,4	U, A, E	F, C	LT	
4	4	3,4	U,A,C	F, C	LT	P

**F-Factual, C- Conceptual, P-Procedural, M-Metacognitive**

**Mapping of COs with PSOs and POs :**

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
<b>CO 1</b>	3	-	-	-	-	-	2	3		2		
<b>CO 2</b>	2	3	-	-	-	-						3
<b>CO 3</b>	-	-	2	3	-	-	2	3		2		
<b>CO 4</b>	-	-	2	3	-	-	2	3		2		

**Correlation Levels:**

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

**Assessment Rubrics:**

- Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments

### Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	√	√		√
CO 2	√	√		√
CO 3	√	√		√
CO 4	√	√		√
CO 5	√	√		√

### REFERENCES

1. Nelson D. L., Cox M. M. (2021) Lehninger Principles of Biochemistry, (8th ed.) W.H. Freeman & Co Ltd.
2. Biochemistry (2004) by Donald Voet, Judith G. Voet Publisher: John Wiley & Sons Inc ISBN: 047119350X ISBN-13: 9780471193500, 978-0471193500.
3. Biochemistry by Lubert Stryer, 4th Edition, W.H Freeman and Company ISBN 0-7167-2009-4.2.
4. J L Jain, Sunjay Jain, Nitin Jain, Fundamentals of Biochemistry Paperback – 1 January 2016; ISBN : 9788121924535
5. Thomas M. Devlin (Editor) Textbook of Biochemistry with Clinical Correlations, 7th Edition, ISBN, 9789354641558. Publisher, Wiley Blackwell. Year, 2022.

Discipline	BIOCHEMISTRY				
Course Code	UK2MDCBCH100				
Course Title	<b>Biochemistry of Lifestyle Diseases</b>				
Type of Course	MDC4				
Semester	II				
Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-	1	3
Pre-requisites	NIL				
Course Summary	<p>The course covers fundamental concepts of lifestyle-related diseases such as cardiovascular diseases, diabetes, cancer, and chronic respiratory diseases, including their causes, diagnosis, prevention, and management. Specific topics include obesity classification, coronary artery diseases, cancer types and risk factors, diabetes mellitus types and diagnostic methods, and chronic respiratory disease prevention. Course activities include surveys on modern lifestyle and visits to Primary Health Centers for practical understanding.</p>				

### Detailed Syllabus:

Module	Unit	Content	Hrs
<b>I</b>	<b>LIFE STYLE: BASIC CONCEPTS</b>		<b>6</b>
	1	Definition of health, Definition of lifestyle diseases/noncommunicable diseases - four major types of diseases-CVD, Diabetes, Cancer, and Chronic Respiratory diseases.	
	2	Obesity: classification according to BMI (brief description) symptoms, Causes, treatment Prevention and management  Sedentary life style	
	3	Significance of diet and exercise: Role of antioxidants and fibre containing food- PUFA- impact of junk foods	
<b>II</b>	<b>CORONARY ARTERY DISEASES</b>		<b>6</b>
	4	Coronary Artery diseases - Angina, myocardial infarction, congenital heart disease, CVD (definition).	



	5	Causes (confirmed & indirect risk factors – brief description only),	
	6	Diagnosis (electrocardiography, exercise stress test, coronary angiography -brief description only)	
	7	Prevention (lifestyle, diet, drugs), Management (drugs, angioplasty, stenting, bypass surgery- brief description only): Normal value of cholesterol in blood	
<b>III</b>	<b>CANCER</b>		<b>7</b>
	8	Cancer - Types of cancer, benign and malignant tumor	
	9	Risk factors-tobacco and alcohol abuse, lack of physical activity and unhealthy food habits : GTT	
	10	Diagnosis- blood tests, X-rays, CT scans & endoscopy - brief description only	
	11	Prevention - dietary, medication, vaccination, Periodic Health Check ups , Significance of diet and exercise	
	12	Treatment modalities (name only) -surgery, chemotherapy, radiation, Management :Palliative care (brief description only).	
<b>IV</b>	<b>DIABETES MELLITUS</b>		<b>7</b>
	13	Diabetes mellitus: Four types of diabetes: Type 1, Type 2, Gestational, and Pre-Diabetes. Symptoms (polyuria, polydypsia, polyphagia),	
	14	Modifiable and non-modifiable risk factors.	
	15	Definition of fasting blood sugar, post prandial blood sugar, random blood sugar and their normal values.	
	16	Significance of glucose tolerance test, Drugs lowering blood glucose level (names only).	
	17	Diagnosis, prevention and management of diabetes	
<b>V</b>	<b>CHRONIC RESPIRATORY DISEASE</b>		<b>4</b>
	18	Definition: Chronic respiratory disease	
	19	Effect of smoking to lungs. Modifiable and Non modifiable risk factors. Prevention and management of the disease.	
	20	Activities 1. Survey of family members/ neighbors on modern lifestyle and public health issues discussed during the course. Analysis of data and its interpretation.	<b>15</b>

	2. Visit to near by PHC	
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**Course Outcomes**

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Identify healthy and unhealthy life habits and adopt better life style.	U	1,3,4
CO-2	Enumerate the different causes and risk factors of life style diseases	R, U	1,2,3
CO -3	List out the methods to diagnose the diseases and gain a knowledge regarding interpretation of the test result.	R,U	2,3
CO -4	Spell out the methods of prevention, treatment and management of the diseases	R,U	3
CO-5	Gain knowledge about the normal levels of different clinical parameters.	R,U	2

**R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create**

**Name of the Course: Biochemistry of Lifestyle Diseases**

**Credits: 3:0:0 (Lecture:Tutorial:Practical)**

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	1	1,3,4	U	F, C	LT	
2	2	1,2,3	R, U	F, C	LT	
3	3	2,3	R,U	F, C	LT	
4	4	3	R,U	F, C	LT	
5	5	2	R,U	F, C, P	LT	P

**F-Factual, C- Conceptual, P-Procedural, M-Metacognitive**

**Mapping of COs with PSOs and POs :**

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
<b>CO 1</b>	1	-	2	3	-	-		2				
<b>CO 2</b>	1	2	3	-	-	-	2	2				3
<b>CO 3</b>	-	2	3	-	-	-	2	2				2
<b>CO 4</b>	-	-	3	-	-	-		2				
<b>CO 5</b>	-	3	-	-	-	-						3

**Correlation Levels:**

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

**Assessment Rubrics:**

- Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam Multiple choice questions

**Mapping of COs to Assessment Rubrics :**

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	√	√		√
CO 2	√	√		√
CO 3	√	√		√
CO 4	√	√		√
CO 5	√	√		√

## References

1. Textbook of Medical Biochemistry for Medical Students by DM Vasudevan and Sreekumari S. 5<sup>th</sup> edition, Japee Brothers, Medical Publishers, ISBN 81-8448-124-1:9788184481242.
2. Guide to Prevention of Lifestyle Diseases by R. Kumar (Author), M. Kumar (Author), Deep & Deep Publications, ISBN-13: 978-8176295185.
3. Cell and Molecular Biology by Gerald Karp, John Wiley & Son, Inc. New York ISBN 978 0470-16961-2, 5th Edition.
4. Guyton, A., & Hall, J. E. (1996). Textbook of Medical Physiology (9th edition). Prism Saunders.
5. Satyanarayana, U., & Chakrapani, U. (2021). Essentials of Biochemistry (3rd ed.).

Discipline	BIOCHEMISTRY				
Course Code	UK3DSCBCH201				
Course Title	<b>Enzymes and Enzyme Kinetics</b>				
Type of Course	DSC14				
Semester	III				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites					
Course Summary	This course offers an understanding of basic concepts of enzymes and its role in various biochemical processes. This course also envisages to give students the critical analytical ability of the scientific phenomena involving enzymes and proficiently work with enzyme systems in both academia and industry.				

### Detailed Syllabus: Enzymes and Enzyme Kinetics

Module	Unit	Content	Hrs
<b>I</b>	<b>Introduction to Enzymes</b>		<b>9</b>
	1	Models of enzyme substrate complex formation: Induced fit, Lock and key, transition state models. Enzyme specificity.	
	2	Enzyme classification and nomenclature. (Class and subclass with one example).	
	3	Units of enzyme activity- IU, Specific activity Katal, and Turnover number.	
	4	Coenzymes and their biochemical roles (CoA, TPP, PLP, NAD/NADP, FAD, FMN, Biotin, folic acid, Vitamin B12)	
	5	Concept of ES complex and features of active site	
<b>II</b>	<b>Enzyme Kinetics</b>		<b>9</b>
	6	Factors affecting the velocity of enzyme catalyzed reaction - enzyme concentration, substrate concentration, temperature, pH, inhibitors and activators (explanation with graphical representation)	
	7	Michaelis Menten equation; Km and Vmax values and their significance	
	8	Lineweaver-Burk plot, derivation of LB equation and its importance.	
	9	Allosteric enzymes: Regulation, mechanism and examples (ATCase and Glycogen phosphorylase)	
<b>III</b>	<b>Enzyme Inhibition and Regulations</b>		<b>9</b>

	10	Enzyme inhibition – competitive, non-competitive, uncompetitive and feedback inhibitions.	
	11	Allosteric inhibition, suicide inhibition, role in drug design	
	12	Zymogens and their activation, Multi enzyme systems: FAS as example	
<b>IV</b>	<b>Industrial Enzymology</b>		<b>9</b>
	13	Isolation and purification of enzymes and criteria of purity.	
	14	Enzyme technology: Methods for large scale production of enzymes, immobilized enzymes and their comparison with soluble enzymes	
	15	Application of immobilized and soluble enzymes in health and industry	
<b>V</b>	<b>Clinical Enzymology</b>		<b>9</b>
	16	Diagnostic enzymes in different diseases: Liver, pancreatic and muscle enzymes in diagnosis	
	17	Isoenzymes definition, clinical applications	
	18	Enzymes as reagents, analytical agents and therapeutic agents.	
		<b>Practicals</b>	<b>30</b>
		<ul style="list-style-type: none"> <li>● Demonstration of factors affecting enzyme activity. <ul style="list-style-type: none"> <li>○ pH</li> <li>○ temperature</li> <li>○ substrate concentration</li> <li>○ enzyme concentration</li> </ul> </li> <li>● Estimation of AST and ALT</li> <li>● Extraction and assay of urease, acid phosphatase &amp; beta amylase.</li> </ul>	

### Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe the fundamental concepts of enzymes, catalytic mechanisms, specificity	R,U	1, 4
CO-2	Differentiate types of enzyme inhibitions and regulations	R, U, E	1, 3
CO-3	Understand and analyse industrial applications of enzymology	R,U, Ap	1, 3, 4
CO-4	Understand and analyse clinical applications of enzymology	R, U, Ap	1, 3, 4
CO-5	Develop basic skills in isolation of enzymes, assays, and related experimental techniques	R, U, An, E	2

**R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create**

*Note: 1 or 2 COs/module*

**Name of the Course: Credits: 4:0:0 (Lecture:Tutorial:Practical)**

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Describe the fundamental concepts of enzymes, catalytic mechanisms, specificity	1, 4	R,U	F, C	L/T	
CO-2	Differentiate types of enzyme inhibitions and regulations	1, 3	R, U, E	F, C	L/T	
CO-3	Understand and analyse industrial applications of enzymology	1, 3, 4	R,U, Ap	C, M	L/T	
CO-4	Understand and analyse clinical applications of enzymology	1, 3, 4	R, U, Ap	C, M	L/T	
CO-5	Develop basic skills in isolation of enzymes, assays, and related experimental techniques	2	R, U, An, E	P		P

**F-Factual, C- Conceptual, P-Procedural, M-Metacognitive**



**Mapping of COs with PSOs and POs :**

	PSO 1	PSO 2	PSO 3	PSO4	PSO5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1			2	-	-		2				
CO 2		2	3		-	-	2			2		3
CO 3		2	3	2	-	-	2			2		3
CO 4		2	3	2	-	-	2	2		2		3
CO 5		2			-	-						3

**Correlation Levels:**

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

**Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

### Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	√	√		√

CO 2	√	√		√
CO 3	√	√		√
CO 4	√	√		√
CO 5	√	√		√

### References

1. Nelson D. L., Cox M. M. (2021) Lehninger Principles of Biochemistry, (8th ed.) W.H. Freeman & Co Ltd.
2. Berg J.M., Gatto G.J., Hines J, Tymoczko J.L., Stryer L. (2023) Biochemistry (10th ed.) W.H. Freeman & Co Ltd.
3. West E.S., Todd W.R., Mason H.S., Van Bruggen J.T., (2017) TextBook of Biochemistry (4th ed.)
4. Voet D., Voet J., Pratt C.W., (2018) Voet's Principles of Biochemistry (5th ed.)
5. Experimental Biochemistry: A Student Companion, Beedu Sasidhar Rao & Vijay Deshpande (ed), I.K International Pvt. LTD, New Delhi.
6. Introductory Practical biochemistry, S. K. Sawhney & Randhir Singh (eds) Narosa Publishing House, New Delhi.
7. Standard Methods of Biochemical Analysis, S. K. Thimmaiah (ed), Kalyani Publishers, Ludhiana

Discipline	BIOCHEMISTRY				
Course Code	UK3VACBCH201				
Course Title	Drug Abuse and Prevention				
Type of Course	VAC2				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-		3
Pre-requisites	NIL				
Course Summary	The course focuses on the basic concept of drug abuse, signs & symptoms, causes & consequences, management & prevention of drug abuse. Course provides knowledge on the practical applications for the successful prevention of drug abuse.				

### Detailed Syllabus:

Module	Unit	Content	Hrs
<b>I</b>	<b>Introduction to Drugs and Drug Abuse</b>		<b>12</b>
	1	Definition of drugs and their various forms. Prevalence and impact of drug abuse on individuals and society. Prevalence of menace of Drug Abuse.	
	2	Introduction to drugs of abuse: Short Term, Long term effects & withdrawal symptoms. Differentiating Drug Abuse from Drug Dependence. Physical and psychological dependence- concepts of drug tolerance.	
	3	Stimulants: Amphetamines, Cocaine, Nicotine. Depressants: Alcohol, Barbiturates- Nembutal, Seconal, Phenobarbital Benzodiazepines – Diazepam, Alprazolam, Flunitrazepam.	

	4	Narcotics: Opium, morphine, heroin. Hallucinogens: Cannabis & derivatives (marijuana, hashish, hash oil). Steroids. Inhalants.	
<b>II</b>	<b>Nature of the Problem</b>		<b>6</b>
	5	Vulnerable Age Groups.	
	6	Signs and symptoms of Drug Abuse (a)- Physical indicators (b)- Academic indicators (c)- Behavioral and Psychological indicators	
<b>III</b>	<b>Causes and Consequences of Drug Abuse</b>		<b>4</b>
	7	Causes -Psychological and Sociological	
	8	Consequences of Drug Abuse -For individuals, For families, For society & Nation.	
<b>IV</b>	<b>Management &amp; Prevention of Drug Abuse</b>		<b>8</b>
	9	Management of Drug Abuse. Prevention of Drug Abuse	
	10	Narcotic Drugs and Psychotropic substances Act 1985	
	11	Case studies and real-life examples of successful prevention .	
	12	Role of Family, School, Media, Legislation & Deaddiction Centers.	
<b>V</b>	<b>Activities</b>		<b>15</b>
	13.	<ul style="list-style-type: none"> <li>● Visit to Deaddiction centre and report submission</li> <li>● Seminar Presentation</li> <li>● Collaboration with college Vimukthi club to give awareness class to students and community.</li> <li>● Discussion on the importance of community involvement and collaboration in prevention efforts.</li> <li>● Case study and real life examples of successful prevention of drug abuse.</li> </ul>	

### Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the basic concepts & overview of drug abuse.	R, U	2
CO-2	Identify the signs & symptoms of drug abuse	R, U	3

CO-3	Differentiate the psychological & sociological causes of drug abuse and its consequences for individuals , family, society & nation.	R, U	3
CO-4	Gain knowledge on the management & prevention of drug abuse or apply through activities	R, U , Ap	2

**R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create**

*Note: 1 or 2 COs/module*

**Name of the Course: Credits: 3:0:0 (Lecture:Tutorial:Practical)**

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	1	2	R, U	F, C	LT	
2	2	3	R, U	F, C	LT	
3	3	3	R, U	F, C	LT	
4	4	2	R, U , Ap	F, C	LT	

**F-Factual, C- Conceptual, P-Procedural, M-Metacognitive**

**Mapping of COs with PSOs and POs :**

	PS O1	PS O2	PS O3	PSO 4	P S O 5	PS O6	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
<b>CO 1</b>	-	2	-	-			3	-	-	-		3		3
<b>CO 2</b>	-	2	-	-					2	-	-	-	-	3
<b>CO 3</b>	-	-	2	-			-	3	-	-	-			3
<b>CO 4</b>	-	-	-	3			-	-	-	-	-	3		3

**Correlation Levels:**

<b>Level</b>	<b>Correlation</b>
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

**Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam-Multiple choice/case studies
- Programming Assignments
- Final Exam -Multiple choice/case studies

**Mapping of COs to Assessment Rubrics :**

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	√	√		√
CO 2	√	√		√
CO 3	√	√		√
CO 4	√	√		√

## References

1. National Institute on Drug Abuse (NIDA)
2. Substance Abuse and Mental Health Services Administration (SAMHSA)
3. Centers for Disease Control and Prevention (CDC)
4. World Health Organization (WHO)
5. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment, Government of India, 2004.
6. The Narcotic Drugs and Psychotropic Substances Act, 1985, (New Delhi: Universal, 2012)

### Journal Articles:

1. McLellan AT, Lewis DC, O'Brien CP, Kleber HD. "Drug dependence, a chronic medical illness: implications for treatment, insurance, and outcomes evaluation." JAMA. 2000.
2. Volkow ND, Koob GF, McLellan AT. "Neurobiologic Advances from the Brain Disease Model of Addiction." N Engl J Med. 2016.
3. Gilman JM, Ramchandani VA, Crouss T, Hommer DW. "Subjective and neural responses to intravenous alcohol in young adults with light and heavy drinking patterns." Neuropsychopharmacology. 2012.
4. Volkow ND, Baler RD, Compton WM, Weiss SR. "Adverse health effects of marijuana use." N Engl J Med. 2014.
5. Degenhardt L, Hall W. "Extent of illicit drug use and dependence, and their contribution to the global burden of disease." Lancet. 2012

Discipline	BIOCHEMISTRY				
Course Code	UK4VACBCH200				
Course Title	<b>Play of Hormones</b>				
Type of Course	VAC 1				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-		3
Pre-requisites	NA				
Course Summary	The course is intended to impart basic knowledge of the endocrine changes in a life time and its impact on the personal life				

### Detailed Syllabus:

Module	Unit	Content	Hrs
<b>I</b>	<b>Introduction to hormones</b>		9
	1	Classification, site of synthesis and function.	
	2	Disorders caused by hormone imbalance	
	3	Hormones on teenage emotions and mental health.	
<b>II</b>	<b>Role of hormones in male and female reproductive system</b>		9
	4	Role of hormones during menstrual cycle	
	5	Hormonal imbalance in male and female; symptoms (psychological and reproductive).	
	6	Semenarche, Menarche, Perimenopause, menopause (definition), symptoms, hormonal status and their impact.	
<b>III</b>	<b>Hormones during pregnancy and lactation</b>		9
	7	Endocrine fluctuations during pregnancy	
	8	Endocrine fluctuations during lactation	
	9	Postpartum depression	



<b>IV</b>	<b>Stress and hormones</b>		9
	10	Role of hormones in stress.	
	11	An overview of stress hormones- Epinephrine, norepinephrine and cortisol	
	12	Hormonal anxiety	
<b>V</b>	<b>Management of hormonal imbalance</b>		9
	13	Happy hormones. Physical activity and hormones.	
	14	Sleep cycle and hormones, obesity parameters, waist circumference is one of potentially modifiable risk factor for low testosterone and symptomatic androgen deficiency.	
	15	Awareness to society	

### Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Gain a thorough grasp of how hormones regulate homeostasis by understanding their physiology and biochemistry.	U, An	1
CO-2	Analyse the role of hormones in human reproductive system	U, An, E	3
CO-3	Understand hormonal changes during pregnancy and lactation	U, An, E	1
CO-4	Apply understanding of hormonal action in stress condition	Ap, E, An	3
CO-5	Inculcate an awareness to society on how to manage imbalances associated with hormone release	C, Ap, U	1

**R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create**

**Name of the Course: Play of Hormones**

**Credits: 3:0:0 (Lecture:Tutorial:Practical)**

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	1	1	U, An	F.C	LT	
2	2	3	U, An, E	F.C	LT	
3	3	1	U, An, E	F.C	LT	
4	4	3	Ap, E, An	F.C	LT	
5	5	1	C, Ap, U	F.C	LT	

**F-Factual, C- Conceptual, P-Procedural, M-Metacognitive**

**Mapping of COs with PSOs and POs :**

	PSO 1	PSO 2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3				-			2				
CO 2			2				2	2		2		
CO 3			2				2	2		2		
CO 4			3				2	2		2		
CO 5	1				-			2				

**Correlation Levels:**

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

**Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

**Mapping of COs to Assessment Rubrics :**

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	√	√		√
CO 2	√	√		√
CO 3	√	√		√
CO 4	√	√		√

CO 5	√	√		√
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## References

1. Text Book of Biochemistry, 5th edition by DM Vasudevan and Sreekumar S, JAYPEE Publishers, New Delhi, ISBN81-8448-124-1, 9788184481242.

Discipline	BIOCHEMISTRY				
Course Code	UK6SECBCH300				
Course Title	<b>Analytical Biochemistry</b>				
Type of Course	<b>SEC5</b>				
Semester	VI				
Academic Level	300-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	.NIL				

Course Summary	The course provides an overview of phytochemical analysis, health and environmental risks of pesticides, qualitative methods employed in the detection of adulterants in common food commodities, methods used for chemical and bacteriological analysis of water and methods employed in the detection of toxic metals in food and biological samples.
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### Detailed Syllabus:

Module	Unit	Content	Hrs
<b>I</b>	<b>Phytochemical Analysis</b>		<b>9</b>
	1	Preparation of plant materials for extraction (Pre-washing, drying and grinding), methods of solvent extraction (sonication, soxhlet extraction, maceration using solvents in the increasing order of polarity) and freeze drying.	
	2	Plant metabolites-Distinction between primary and secondary metabolites, Major classes and importances of secondary metabolites- Alkaloids, terpenoids, flavonoids, phenolics, steroids, coumarins, quinines, glycosides, amines and non-protein amino acids, gums, and resins (structure not needed).	
	3	Phytochemical analysis of secondary metabolites- Alkaloid (Dragendorff's test, Wagner test), Anthraquinone (Borntrager's test), Cardiac glycosides (Kellar – Kiliani test), Flavonoid (Shinoda test), Phenol (Phenol test), Reducing sugar (Fehling test), Saponin (Foam test), Steroid (Zaks test), Tannin (Braymer's test), Terpenoid Salkowski test).	
	4	Isolation of bioactive compounds using separation techniques such as TLC, column chromatography, flash chromatography, Sephadex chromatography and HPLC	
<b>II</b>	<b>Pesticides: Health &amp; Environmental Risks</b>		<b>10</b>
	5	Classification of Pesticides- based on chemical nature- (organochlorine, organophosphate, carbamates, pyrethrum, biopesticides), site of action (stomach toxicants, contact toxicants, fumigants, systemic toxicants, chemical repellents).	
	6	Environmental consequences of pesticide use and natural pesticides.	
	7	Pesticide labels and labelling, Material Safety Data Sheet (MSDS), determination of the signal word-based on toxicity category (category I, II, III and IV), importance of reading and understanding pesticide labels.	
	8	Tests on pesticides for determining human health risk- types of toxicity- (acute - LD50 or LC50), toxic effects on mammalian tissues- teratogenicity, gene mutation, chromosome aberration, neurotoxicity, immunotoxicity).	
	9	Pesticide residue in foods: Maximum residue level (MRL), Acceptable daily intake (ADI), analysis of pesticide residue in foods- Gas chromatography.	
<b>III</b>	<b>Food Adulteration and Detection</b>		<b>7</b>
	10	Definition of adulterants, Familiarisation of common adulterants	

	11	Basic concepts of toxicity and hazard (physical, chemical and biological) in food	
	12	Detection of adulterants in milk, edible oils, fats, cereal flour, sugar, pulses, cereals, green vegetables and honey, Spices and condiments (turmeric powder, chilli powder, coriander powder, black pepper powder, asafoetida)- qualitative aspects only	
<b>IV</b>	<b>Water Analysis</b>		<b>9</b>
	13	Physical parameters-temperature, pH, colour, odour, turbidity, total dissolved solids.	
	14	Chemical parameters- total hardness (titrimetric method), detection of chloride (Argentometric method), Nitrate (Phenoldisulphonic acid (PDA) method, fluoride (zirconium alizarin method).	
	15	Dissolved oxygen, BOD (Winkler method), COD (dichromate method), pesticide residue (gas chromatography).	
	16	Toxic metal detection- Cadmium, Lead, Mercury (Atomic Absorption Spectroscopy (AAS).	
	17	Bacteriological analysis- test for coliform bacteria-multiple tube dilution method (presumptive, confirmed and completed test).	
<b>V</b>	<b>Analysis of Toxic Metals in Food and Biological Samples</b>		<b>10</b>
	18	Toxicology of metals - analysis of metal elements in food using colorimetry- copper (carbamate method), lead and mercury - by dithizone method, arsenic (molybdenum blue method)	
	19	Outline study of action and detection of alcohol in beverage (colorimetric method using sodium dichromate)	
	20	Mechanism of toxic action of lead, mercury, arsenic, cyanide and carbon monoxide (outline only). Detection of copper, lead, mercury, arsenic, cyanide and carbon monoxide in biological samples.	

	<b>Practical</b>		<b>30</b>
	21	Qualitative analysis of phytochemicals in Plant extract.	
	22	Quantitative Analysis of Phytochemicals-Total Phenolic Content (Modified Folin-Ciocalteau method), Total Flavonoid Content (Zhishen et al method), Total Alkaloid Content ( Sodium metaperiodate method)	
	23	Testing of adulterants like metanil yellow (in turmeric & jaggery), rhodamine-B (in chilli powder),chicory (in coffee), sodium bicarbonate (in flour & jaggery), lead chromate (in pulses), vanaspati, coal tar dye & starch (in ghee), added sugar (in honey) prohibited colors, argemone oil & cotton seed oil (in edible oil).	
	24	Paper Chromatography/Thin layer Chromatography	

### Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
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CO-1	Describe the methods used in phytochemical extraction and qualitatively analyze different phytochemicals present in an extract.	R, U, Ap	1, 2, 4
CO-2	Identify and explain the different types of pesticides, their toxicological impact, and tests to detect toxicity.	R, U	1, 2,
CO-3	Understand the type of adulterants mixed in common food products and describe and analyze the qualitative methods used in adulterant detection.	R, U, Ap	1, 3, 4
CO-4	Outline and describe the different methods used in the chemical and bacteriological analysis of water.	R, U	1, 2, 4
CO-5	Discuss the methods used in the analysis of toxic metals in food and biological samples and explain the mechanism of action of toxic elements in our body system.	R, U	1, 2, 3, 4

**R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create**

**Name of the Course: Analytical Biochemistry**

**Credits: 3:0:1 (Lecture:Tutorial:Practical)**

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Describe the	1, 2, 4	R, U, Ap	F, C, P	L	P

	methods used in phytochemical extraction and qualitatively analyze different phytochemicals present in an extract.					
CO-2	Identify and explain the different types of pesticides, their toxicological impact, and tests to detect toxicity.	1, 2,	R, U	F, C, P	L	P
CO-3	Understand the type of adulterants mixed in common food products and describe and analyze the qualitative methods used in adulterant detection.	1, 3, 4	R, U, Ap	F, C, P	L	P
CO-4	Outline and describe the different methods used in the chemical and bacteriological analysis of water.	1, 2, 4	R, U	P	L	P
CO-5	Discuss the methods used in the analysis of toxic metals in food and biological samples and explain the mechanism of action of toxic elements in our body system	1, 2, 3, 4	R, U	F, C, P	L	

**F-Factual, C- Conceptual, P-Procedural, M-Metacognitive**

**Mapping of COs with PSOs and POs :**

	PSO 1	PSO 2	PSO 3	PSO4	PSO5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	2	-	1	-	-	1	-	-	-	-	-
CO 2	1	1	-	-	-	-	1	-	-	-	-	-
CO 3	2	-	3	2	-	-	1	-	-	-	-	-



<b>CO 4</b>	1	2	-	1	-	-	2	-	-	-	-	-
<b>CO 5</b>	2	3	2	3	-	-	3	-	-	-	-	-

**Correlation Levels:**

<b>Level</b>	<b>Correlation</b>
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

**Assessment Rubrics:**

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

**1Mapping of COs to Assessment Rubrics :**

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	√	√		√
CO 2	√	√		√
CO 3	√	√		√
CO 4	√	√		√
CO 5	√	√		√

**References**

- Laboratory Handbook on Biochemistry. S.Shanmugam, J.Satish Kumar,K. Panneerselvam Publisher: PHI Learning Private Limited New Delhi ISBN 976-81-2030-4103-
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