ATMIYA UNIVERSITY
Faculty of Science
Department of Microbiology
B. Sc. Microbiology
Syllabus (Semester II)

For the students admitted from A.Y. 2023-2024& onwards

Department: Microbiology **Program: B.Sc. Microbiology**

Semester –II		
Course Code	**Course Title**	**Credit**
23UGMB201	**Basic Biochemistry**	**4 Credits**

Course Description: Aim of the course is to explore and understand different aspects of structure and function of living things by introducing chemistry of life at molecular level which reveals the biochemical organization and hierarchical assembly of smaller molecule into complexes responsible for specific biological processes.

Course Purpose:

1. Explain the classification of various biomolecules.
2. Illustrate the role of different biomolecules.
3. Explain the underlaying principles of the methods used to control the microbial growth by antibiotics.
4. Assess Understand the usages of analytical techniques and working principle of instruments.
5. Understand the mechanism of Enzyme and factor effecting on it..

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	**CO Statement**	**Bloom's taxonomy Level (K_1 to K_6)**
CO_1	Understand various biomolecules which are required for development and functioning of a cell.	K2
CO_2	Define role, structural and functional components of carbohydrates	K2
CO_3	Elaborate about lipid and fat, and importance of lipid in cellular life	K3
CO_4	Enlist multifarious function, types and classification of proteins, nucleic acids and vitamins.	K3
CO_5	calculate enzyme activity and other quantitative and qualitative parameters of enzyme	K4

Course Content	Hours
Module -I : Concept of bio-molecules	**12hrs**
• Introduction to Atoms, Elements & Molecules • Major Chemical bonds found in biological system: Ionic Bonds, Covalent Bonds, Hydrogen Bonds, Van der Waals interactions, Hydrophobic interactions • Introduction to pH and Buffers • Major Chemical reactions: Acid Base, Redox, Condensation-Hydrolysis Reactions • Water and its important properties	
Module-II: Carbohydrates	**12 hrs**
• Definition & Function of Carbohydrates • Classification of Carbohydrates: Aldose and Keto Sugar, Reducing and Non Reducing sugar • Stereo isomerism of monosaccharides, epimers, mutarotation and anomers of glucose. • Structure and properties of Monosaccharides and Disaccharides • Structure of Polysaccharides : Homo-polysacharide & Hetero-polysaccharide	
Module-III: Lipid	**12 hrs**
• Definition, Structure and Classification of Lipids, lipid micelles, monolayers, bilayers • Fatty acids: Nomenclature, Structure, Type and properties of fatty acids • Introduction to phospholipids: Examples and Significance • Introduction and Significance of Steroids • Lipid functions: cell signals, cofactors, prostaglandins, Introduction of lipid micelles, mono-layers, bilayers	
Module-IV: Proteins and Enzymes	**12hrs**
• Definition, Functions and Classification of Proteins • Amino acids: Classification, Physical & Chemical Properties • Structure of Proteins: Primary, secondary, tertiary and quaternary structures. • Definition, Nomenclature and Classification of Enzymes • Mechanism of enzyme action – Active Sites, Activation Energy, Lock & Key Model, Induced Fit model	
Module -V: Nucleic acids and Vitamins	**12hrs**
• Introduction to Nitrogen Base, Nucleosides & Nucleotides; Double helical model of DNA structure and types of DNA: A-DNA, B-DNA, Z-DNA • Introduction to RNA & its types • Vitamins – Definition • Vtamin Classification – water soluble and non soluble • Importance of vitamins	

Pedagogic tools:

- Chalk and Board
- PPT and Videos.
- Assignment
- Class Activity: Think-Pair-Share / Class Test

Text Books:

1. Jain, J.L., Sunjay Jain, Nitin Jain (2016). Fundamentals of Biochemistry, S. Chand Publication
2. Satyanarayana , U. (2013). Biochemistry, 4th Edition: Elsevier Publication

Reference Books:

1. Gupta, S.N. (2015). Biochemistry, 2nd Edition: Rastogi Publications-Meerut
2. Conn E.E.,Stumpf P.K. (2016). Outlines of Biochemistry. Wiley publication.
3. Nelson, D.L., Cox, M.M. (2013). Lehninger Principles of Biochemistry. W.H. Freeman publication.
4. Wilson, K., Walker, J. (2010). Practical Biochemistry – Principle and Technique, 7th Edition. Cambridge: Cambridge University Press.
5. Donald, Voet, Voet Judith G. (2010). Biochemistry, 4th Edition: CBS Publishers

Suggested reading / E-resources

- Krauss G. Biochemistry of Signal Transduction and Regulation. New York, NY: John Wiley & Sons; 2007.
- Seifert R, Weiland T. G Protein–Coupled Receptors as Drug Targets: Analysis of Activation and Constitutive Activity. New York, NY: Wiley-VCH; 2006.
- Alberts B. Molecular Biology of the Cell. London, UK: Garland; 2008Suggested

MOOCs

- https://onlinecourses.nptel.ac.in/noc20_cy10/preview
- https://www.edx.org/course/principles-of-biochemistry

Methods of Assessment & Tools:

Components of CIA: 30 marks

Sr. No.	Component	Content	Duration (if any)	Marks	Sub Total
A	Test 1	1st 2 units	$1^{1/2}$ hours	5 (Set for 30)	20
	Test 2	All 5 units	3 hours	15 (Set for 70)	
B	Assignments			5	5
	Class Activity			5	5
				Grand Total	**30**
Assignment	• Group Activity - Concept mapping- Concept based Question (Think-Pair-Share) • Class Test- Unit Wise				
Class activity	• Exhibition (Chart / Model Presentation) • Current Affairs- Group Discussion				

23UGMB202	**Basic Biochemistry Practical**	**4hrs/week**	**2 Credits**

Course Description: The Basic Biochemistry Practical course is designed to provide students with hands-on laboratory experience in biochemistry. During the course, students will learn various experimental techniques and procedures used in biochemistry research. They will gain practical skills in identification and quantification of biomolecules. Students will also learn how to interpret and analyze experimental data, as well as how to effectively communicate their findings through written reports. In addition, students will have the opportunity to explore the relationship between the structure and function of biomolecules through hands-on experiments.

Course Objectives: The objectives of a Basic Biochemistry Practical course are

to provide students with a solid foundation in basic biochemistry concepts and techniques, as well as to develop their skills in designing and conducting laboratory experiments. Additionally, the course aims to enhance students' understanding of the principles behind various biochemical techniques, and how they can be applied to solve real-world problems in biochemistry. By incorporating hands-on laboratory exercises, students can gain practical experience and improve their ability to perform accurate measurements and analyze experimental data. Furthermore, the course aims to foster critical thinking and problem-solving skills in students by challenging them to interpret experimental results and draw conclusions based on their findings.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	**CO Statement**	**Bloom's taxonomy Level(K_1 to K_6)**
CO_1	Differentiate between biomolecules by appropriate biochemical method	K2
CO_2	Relate the principles of enzyme kinetics	K1
CO_3	Determine the concentration of a specific biomolecule in a sample	K2
CO_4	Analyze experiments to analyze enzyme activity	K3
CO_5	evaluate the experimental design and data interpretation from bio-chemistry experiment	K4

List of Practical:

1. Qualitative Analysis of Carbohydrates
2. Qualitative Analysis of Proteins & Amino acids
3. Estimation of Protein by Foiln-Lowry's Method
4. Estimation of Protein by Biuret Method
5. Estimation of Reducing Sugar by DNSA Method
6. Estimation of DNA by DPA method
7. Estimation of RNA by Orcinol method
8. Estimation of amino acid by Rosen's method
9. Qualitative analysis of an enzyme – Amylase
10. Quantitative estimation of an enzyme – Amylase
11. Effect of pH and temperature on enzyme activity - Amylase

Reference Books:

1. Sawhney S.K., Singh, R. (2005). Introductory Practical Biochemistry: Alpha Science International.
2. Plummer D. (2017) Practical Biochemistry, 3rd Edition, McGraw Hill Education

Suggested reading / E-resources

- Virtual Lab: Carbohydrates Virtual Lab | Labster
- Chem Collective: Virtual Labs
- Amrita Vishwa Vidyapeetham Virtual Lab

Suggested MOOCs

• Free Online Course: Experimental Biochemistry from Swayam | Class Central

Methods of assessing the course outcomes

Components of CIA: 40 marks

Sr. No.	Component	Content	Duration (if any)	Marks	Sub Total
A	Test 1	After completion of 70% practical completion	6 hours	30 (Set for 60)	30
B	Assignments			05	05
	Class Activity			05	05

	Grand Total	**40**
Assignment	• Group Activity – Spot test • Log book preparation	
Class activity	• Exhibition (Chart / Model Presentation) • Group Discussion	

Course Code	Course Title	Credit
	Skill Course: Culture Handling and Preservation Techniques	**2 Credits**

Course Description:

The course is designed to provide a basic understanding of the principles and techniques involved in the handling and preservation of microbial cultures. Students will learn the various methods of microbial culture handling and importance of viability and purity of microbial cultures. The course will consist of lectures, laboratory practical and assignment. In the laboratory sessions, students will practice the techniques of microbial culture handling and preservation, including streak plating, subculturing, cryopreservation, and lyophilization. Students will also learn how to record results application.

Course Purpose:

The aim of the course is to equip students with a comprehensive understanding of the underlying principles and intricate techniques involved in the delicate art of microbial culture handling and preservation. By delving into various types of microbial cultures, we aim to impart knowledge on different methods for their preservation. Our hands-on laboratory sessions will enable students to gain practical experience in essential processes such as streak plating, subculturing, cryopreservation, and lyophilization. Ultimately, we endeavor to empower students with the necessary skills to apply their expertise in diverse fields that rely on effective microbial culture manipulation and conservation.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	CO Statement	Bloom's taxonomy Level (K_1 to K_6)
CO1	Explain various isolation techniques for microorganisms	K2
CO2	Demonstrate an appropriate media for cultivation of microorganisms	K2
CO3	Compare different bacterial preservation techniques	K2
CO4	Plan and experiment with microorganisms	K3
CO5	Choose an appropriate method for culture handling and preservation	K1

Course Content	Hours
Module-I: Basic methods in Microbiology	**15 hrs**
• Pure culture techniques- isolation- streak, spread, pour plate method • Cultivation of microbes on different media • Enumeration of bacteria • Culture preservation method: Glycerol stock, oil layer, water, soil • Advanced culture preservation: Lyophilization, cryopreservation	
Module-II: List of Practical's	**30 hrs**
• Media preparation and sterilization: Solid and liquid media • Enumeration of bacteria by Direct Microscopic Count • Enumeration of bacteria by Total Viable Count • Preservation techniques: Slant preparation, butt preparation, oil layer, Glycerol stock, Lyophilizer (Demonstration) • Preservation techniques: Slant preparation, butt preparation, • Preservation techniques: oil layer, Glycerol stock, Lyophilizer (Demonstration) • Motility: Hanging drop, Soft agar tube • Isolation of bacteria by streak, spread, pour plate method • Isolation of mold by streak, spread, pour plate method	

Text Books:

1. Pelczar, M.J., Chan, E.C.S., Kreig, N.R. (2001). Microbiology, 5th Edition. New Delhi: Tata Mc Graw Hill Publishing Company Ltd.
2. Dubey, R.C., Maheshwari, D.K. (2005). Practical Microbiology. New Delhi: S. Chand & Company Limited.

Reference Books:

1. Aneja, K.R. (2003). Experiential Microbiology, plant Pathology and Biotechnology, New Age International Publishers.
2. Sharma, K. (2005). Manual of Microbiology – Tools and Techniques. New Delhi: Ane books.
3. Patel. R.J., Patel. K.R. (2009). Experimental Microbiology, Vol-I, Ahmedabad: Aditya Publications.
4. Benson, H.J. (2002). Microbiological Applications – Laboratory Manual in General Microbiology – 8th edition: McGraw Hill Company.

Suggested readings / e-resources:

- Bacterial Isolation - Microbiology Resource Centre - Truckee Meadows Community College (tmcc.edu)
- Lecture notes, lecture 1 - Micro Chapter The microbial world The microbes - StuDocu

Suggested MOOCs:

- General Microbiology - Course (swayam2.ac.in)
- https://www.mooc-list.com/university-entity/british-society-antimicrobial-chemotherapy-bsac

Methods of assessing the course outcomes

Components of CIA: 100 marks

Sr. No.	Component	Content	Duration (if any)	Marks	Sub Total
A	Test	Module 1	$1^{1/2}$ hours	20 (Set for 30)	20
B	Assignment	-	-	20	40
C	Class activity	-	-	20	
D	Practical	After 70% practical completion	3 hours	40 (Set for 60)	40
Grand Total					**100**
Assignment	• Poster: 10 • Mind map: 10				
Class activity	• Written assignment: 10 • Record book: 10				