Gyanmanjari Innovative University

Syllabus
Gyanmanjari Science College
Semester-1 (B.Sc.)

Subject: Biochemistry- BSC1XX11304

Type of course: Multidisciplinary

Prerequisite: To equip students with the knowledge and skills necessary to understand the chemical processes underlying life and biological functions.

Rationale: Biochemistry provides students with a deeper appreciation of the chemical basis of life and how it operates globally.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
CI	T	P	C	SEE	CCE	
4	0	0	4	100	100	200

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; SEE - Semester End Evaluation; LWA - Lab Work Assessment; V – Viva voce; CCE-Continuous and Comprehensive Evaluation; ALA- Active Learning Activities.

Course Content:

Sr. No	Course Content	Hrs.	% Weightage
1	**Introduction of Biomolecule- I** • Introduction and classification • **Monosaccharides**: Introduction and characteristics (Chiral Center, Isomerism, epimers, cyclic hemiacetal (α and β), Anomers) • **Disaccharides:** Maltose, Fructose and Sucrose, Reducing and non-Reducing sugar • **Polysaccharides**: Storage polysaccharide- Starch and glycogen, Structural Polysaccharides-Cellulose, Chitin • General functions of Carbohydrates. **Evaluation method**	**18**	**20**

Sr. No.	Evaluation Methods	SEE	CCE
1	**(ALA) Minor project:** Faculty will provide topic for project preparation and students have to prepare it. Photographs need to upload on GMIU web portal.		10
2	**Sugar Identification Experiment:** Students will identify difference between reducing and non-reducing sugars using maltose, fructose, and sucrose.	10	
3	**Iodine Staining and Microscopic Observation:** Students prepare slides of plant material (e.g., potato, corn) and stain with iodine solution. Using a microscope, observe and identify starch granules, noting differences between different types of plant tissue.	10	
4	**ALA: Testing Carbs in Everyday Food:** Students will identify and classify carbohydrates found in food items using Iodine solution, Benedict's reagent, food samples (bread, fruit, potato, etc.), test tubes. Photos need to upload on GMIU web portal.		10
	Total	20	20

Rubrics: Sugar Identification Experiment:

Practical Handling -3
Correct Procedure-2
Observation of Results-2
Result Interpretation-2
Cleanliness & Lab Safety-1

Rubrics: Iodine Staining and Microscopic Observation:

Slide Preparation-2
Microscope Handling-3
Observation Skills-2
Result Interpretation-3

Introduction of Biomolecule- II

- Introduction, classification, and properties of amino acids
- Essential and non-Essential amino acids
- Non-protein amino acids
- General classification, structure, and properties of protein
- General functions of Protein.

Evaluation method

Sr. No.	Evaluation Methods	SEE	CCE
1	**(ALA) Protein-Protein Interaction- Online Tool Exploration:** Students will Learn how proteins interact within the cell. Introduce students to biological databases or tools like **STRING**. Students need to upload Pdf on GMIU web portal.		10
2	**Separation of Amino Acids:** Students will Separate and identify different amino acids using paper chromatography.	10	
3	**Detection of proteins in different food or liquid samples.** Faculty will provide samples and students have to perform the specific test and conclude the result.	10	
4	**(ALA) Protein Denaturation Experiment:** Students have to observe how heat or chemicals affect protein structure (denaturation) using egg whites (albumin), beakers, hot water bath, vinegar (or lemon juice), thermometer. Students have to upload report and photos in Pdf format on GMIU web portal.		10
	Total	20	20

Rubrics: Separation of Amino Acids:

Chromatography Setup-3

Execution of Experiment-3

Observation & Data Recording-2

Result Interpretation-2

2		18	20

<table>
<tr><td></td><td>Rubrics: Detection of proteins in different food or liquid samples:
Sample Handling-2
Test Procedure Execution-3
Observation Skills-2
Result Interpretation-3</td><td></td><td></td></tr>
<tr><td>3</td><td>Introduction of Biomolecules- III
• Introduction, classification, and properties of lipids
• Structure of triacylglycerol
• Essential fatty acids
• General functions of lipids.
Evaluation method
<table>
<tr><th>Sr. No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr>
<tr><td>1</td><td>ALA (Estimating Fat in Foods): To estimate the fat content in food samples. Students have to preform and prepare a report and photographs need to upload on GMIU web portal.</td><td></td><td>10</td></tr>
<tr><td>2</td><td>Comparative Analysis of Lipid Sources: Students will compare saturated and unsaturated fats (Oil Sample) using iodine test. Students will identify appropriate sample for specific test.</td><td>10</td><td></td></tr>
<tr><td>3</td><td>Soap Formation: To demonstrate saponification (hydrolysis of fats with a base).</td><td>10</td><td></td></tr>
<tr><td>4</td><td>ALA (Cooking Oil vs Butter Melting Observation): Students will Compare physical states and melting behavior of different lipids. Students have to preform and prepare a report and photographs need to upload on GMIU web portal</td><td></td><td>10</td></tr>
<tr><td></td><td>Total</td><td>20</td><td>20</td></tr>
</table>
Rubrics: Comparative Analysis of Lipid Sources:
Sample Identification & Handling-2
Test Procedure Execution-3</td><td>18</td><td>20</td></tr>
</table>

<table>
<tr><td></td><td>Observation Skills-2
Result Interpretation-3
Rubrics: Soap Formation:
Materials Preparation-2
Procedure Execution-3
Observation Skills-2
Result Interpretation-3</td><td></td><td></td></tr>
<tr><td>4</td><td>Introduction of Biomolecules- IV
• Introduction, properties and structure of DNA and RNA
• Types of DNA and RNA
• General functions of nucleic acids
• Importance of DNA and RNA
Evaluation method
<table>
<tr><th>Sr. No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr>
<tr><td>1</td><td>(ALA) DNA Extraction from Fruits: Students have to preform and prepare a report and photographs need to upload on GMIU web portal.</td><td></td><td>10</td></tr>
<tr><td>2</td><td>Role-Play: Central Dogma of Molecular Biology: Faculty will assign roles: DNA, mRNA, tRNA, ribosome, amino acids, Enact transcription and translation steps.</td><td>10</td><td></td></tr>
<tr><td>3</td><td>NCBI Gene Search: Learn to search for genes using the NCBI database.</td><td>10</td><td></td></tr>
<tr><td>4</td><td>Visual Tour: Faculty will assign the topic and students have to prepare a presentation and need to upload on GMIU web portal.</td><td></td><td>10</td></tr>
<tr><td></td><td>Total</td><td>20</td><td>20</td></tr>
</table>
Rubrics: Role-Play: Central Dogma of Molecular Biology:
Understanding of Assigned Role-3
Accuracy in Enacting Process-3
Communication and Presentation-4
Rubrics: NCBI Gene Search:
Search Strategy & Keywords-3
Data Extraction-3</td><td>18</td><td>20</td></tr>
</table>

	Result Presentation-4		
5	**Introduction of Biomolecules- V** **Definition, General properties, Types and Functions:** • Antigen-Antibody • Vitamins • Hormones • Siderophores • Bacterial chlorophyll **Evaluation method**	18	20

Sr. No.	Evaluation Methods	SEE	CCE
1	**(ALA) The Science of Immunization: Dosage Preparation and Delivery:** Students will prepare the dosage of antigens for New born to 12 years' children. Students need to upload report on GMIU web portal.		10
2	**Vitamin C Content in Fruits and Vegetables (Titration Experiment):** Students will determine the vitamin C content in various fruits and vegetables using an iodine titration method.	10	
3	**Chlorophyll Extraction:** Students will extract chlorophyll from chlorophyll rich sources and extract the pigment.	10	
4	**Hormonal Infographic:** Students create an infographic that highlights key hormones involved in mood regulation (e.g., dopamine, serotonin, cortisol) and metabolic processes (e.g., insulin, thyroid hormones), with visuals, causes of imbalance, and solutions.		10
	Total	20	20

Rubrics: Vitamin C Content in Fruits and Vegetables (Titration Experiment):
Understanding of Scientific Method-3
Accuracy of Procedure-3
Data Collection and Analysis-4

Rubrics: Chlorophyll Extraction:

	Accuracy of Extraction Procedure-3 Understanding of Chlorophyll and Solubility-3 Result Interpretation-4		
		90	**100%**

Distribution of Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	20%	20%	20%	20%	20%	00

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course, the students should be able to:	
CO1	Analyze the functions of carbohydrates and their significance in maintaining life processes.
CO2	Explore the biochemical properties and roles of proteins and their building blocks, amino acids.
CO3	Develop a thorough understanding of the structure, function, and biochemical roles of lipids.
CO4	Acquire in-depth knowledge of the structural features, biological functions, and biochemical importance of nucleic acids.
CO5	Understand the biological roles of hormones, vitamins, and immune system components such as antigens and antibodies.

Instructional Method:

The course delivery method will depend upon the requirement of content and needs of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done on the basis of the Active Learning Assignment.

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] Biochemistry by U. Satyanarayana and U. Chakrapani
[2] Biochemistry by Lehninger, Nelson, Cox
[3] Principles and Techniques of Biochemistry and Molecular Biology (6th edition) by Keith Wilson and John Walker.
[4] Biochemistry by Stryer
[5] Harper's Illustrated Biochemistry by Victor W. Rodwell, David A. Bender, Kathleen M. Botham, Peter J. Kennelly, P. Anthony Weil