VIDYASAGAR UNIVERSITY

Midnapore, West Bengal

PROPOSED CURRICULUM&SYLLABUS (DRAFT) OF

BACHELOR OF SCIENCE WITH BIOCHEMISTRY

(MULTIDISCIPLINARY STUDIES)

3-YEAR UNDERGRADUATE PROGRAMME

(w.e.f. Academic Year 2023-2024)

Based on

Curriculum & Credit Framework for Undergraduate Programmes

(CCFUP), 2023 & NEP, 2020

VIDYASAGAR UNIVERSITY

BACHELOR OF SCIENCE IN LIFE SCIENCES with BIOCHEMISTRY

(*under CCFUP, 2023*)

Level	YR.	SEM	Course Type	Course Code	Course Title	Credit	L-T-P	Marks		
								CA	ESE	TOTAL
B.Sc. in Life Sciences with Biochemistry	1st	I	**SEMESTER-I**							
			Major-1 (Disc.-A1)	BCMPMJ101	**T: Biochemistry of Cell** *(To be studied by the students taken Disaster Management as Discipline-A)*	4	3-0-1	15	60	75
			SEC	BCMSEC01	**P: Tools and Techniques in Biochemistry**	3	0-0-3	10	40	50
			AEC	AEC01	Communicative English-1 (***common for all programmes***)	2	2-0-0	10	40	50
			MDC	MDC01	Multidisciplinary Course-1 (***to be chosen from the list***)	3	3-0-0	10	40	50
			VAC	VAC01	VAC-01: ENVS (***common for all programmes***)	4	2-0-2	50	50	100
			Minor-1 (Disc.-C1)	BCM MI01/C1	**T: Biochemistry of Cell** *(To be studied by the students taken Disaster Management as Discipline-C)*	4	3-0-1	15	60	75
			Semester-I Total			20				400
		II	**SEMESTER-II**							
			Major-2 (Disc.- B1)		***To be decided (Same as like A1 for students taken Disaster Management as Discipline-B)***	4	3-1-0	15	60	75
			SEC	BCMSEC02	**P: Protein Purification Techniques**	3	0-0-3	10	40	50
			AEC	AEC02	MIL-1 (***common for all programmes***)	2	2-0-0	10	40	50
			MDC	MDC02	Multi Disciplinary Course-02 (***to be chosen from the list***)	3	3-0-0	10	40	50
			VAC	VAC02	VAC-02 (***to be chosen from the list***)	4	4-0-0	10	40	50
			Minor-2 (Disc.-C2)	BCM MI02/C2	**T: Proteins and Enzymes** *(To be studied by the students taken Disaster Management as Discipline-C)*	4	3-1-0	15	60	75
			Summer Intern.	CS	Community Service	4	0-0-4	-	-	50
			Semester-II Total			24				400
			TOTAL of YEAR-1			44	-	-	-	800

PMJ= Major Programme (Multidisciplinary), MI = Minor, A/B = Choice of Major Discipline; C= Choice of Minor Discipline; SEC = Skill Enhancement Course, AEC = Ability Enhancement Course, MDC = Multidisciplinary Course, VAC = Value Added Course; CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial-Practical, MIL = Modern Indian Language, ENVS = Environmental Studies

MAJOR (MJ)

MJA1/B1: Biochemistry of Cell **Credits 04 Full Marks: 75**

MJA1/B1T: Biochemistry of Cell **Credits 03**

Course contents:

Unit 1: Bio-molecules in their cellular environment
The cellular basis of life. Cellular structures – prokaryotes and eukaryotes. Chemical principles in bio molecular structure. Major classes of bio-molecules. Role of water in design of bio-molecules.

Unit 2: Amino acids and peptides
Types of amino acids and their chemistry, derivatives of amino acids and their biological role. Introduction to biologically important peptides.

Unit 3: Sugars and polysaccharides
Basic chemistry of sugars, optical activity. Disaccharides, trisaccharides and polysaccharides - their distribution and biological role.

Unit 4: Nucleosides, nucleotides and nucleic acids
Structures and chemistry, DNA structures and their importance, different types of RNA. Unusual DNA structures, other functions of nucleotides.

Unit 5: Lipids
Various classes of lipids and their distribution, storage lipids, structural lipids in membranes, lipids as signals, cofactors and pigments.

Unit 6: Vitamins, coenzymes and metal ions
Occurrence and nutritional role. Coenzymes and their role in metabolism. Metal ion containing bio-molecules-heme, porphyrins and cyanocobalamin; their biological significance.

Unit 7: Signaling molecules
Second messengers - cAMP, cGMP, IP3, diacyl glycerol, Ca^{2+}, NO. Brief account of their importance and role in signalling and signal transduction.

MJA1/B1 P: Biochemistry of Cell (Practical) **Credits: 01**

Practical

1. General safety procedures in a laboratory. Use of auto pipettes. Making solutions and buffer preparation - acetate and tris buffers.
2. Qualitative tests for bio-molecules - carbohydrates, lipids, amino acids, proteins, bases and nucleic acids.
3. Separation of amino acids by paper chromatography.
4. Separation of sugars/bases by TLC and their identification.
5. Estimation of ascorbic acid in fruit juices.

Suggested Readings:

1. Lehninger: Principles of Biochemistry, 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York).
2. Textbook of Biochemistry with Clinical Correlations ,7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New York),

MINOR (MI)

MI-1/ C1: Same as MJ A1/B1 **Credits 04 (Full Marks: 75)**

***PLEASE SEE- MJ A1/B1:* Biochemistry of Cell**

MI-2/C-2: Proteins and Enzymes **Credits 04 (Full Marks: 75)**

MI-2/C-2T: Proteins and Enzymes **Credits 03**

Course contents:

Unit 1: Introduction to proteins
Polypeptides and proteins. Subunit structures, conjugated proteins, diversity of function.

Unit 2: Isolation and analysis of proteins
Techniques to isolate and analyze proteins- salt fractionation, ion-exchange chromatography, gel permeation, HPLC, SDS-PAGE, IEF. Protein primary structure - sequencing by Edman degradation, use of enzymes and chemical reagents to obtain overlap peptides. Synthesis of peptides using Merrifeld method.

Unit 3: Introduction to protein three-dimensional structures
Secondary structure- helices and sheets, Ramachandran maps. Nature of non-covalent bonds and covalent bonds in protein folding. Tertiary and quaternary structures.

Unit 4: Myoglobin and haemoglobin - structure and function
Oxygen binding curves, cooperativity models for haemoglobin.

Unit 5: Introduction to enzyme catalysis
Features of enzyme catalysis, superior catalytic power. General mechanisms of catalysis. Nomenclature.

Unit 6: Enzyme kinetics
Principles of reaction rates, order of reactions and equilibrium constants. Derivation of Michaelis- Menten equation. Significance of Km and Vmax. Catalytic efficiency parameters. Competitive and mixed inhibitions. Kinetics and diagnostic plots. Types of irreversible inhibitors.

Unit 7: Mechanisms of enzyme action and regulation
Mechanism of action of chymotrypsin. Inhibitors of enzymes - antibiotics. Regulation of enzyme activity and its importance - aspartate transcarbamoylase.

Unit 8: Enzymes in medicine and industry
Enzymes used in clinical biochemistry as reagents, diagnostics and therapy. Role of immobilized enzymes in industry.

MI-2/C-2P: Proteins and Enzymes **Credits 01**

Practical

1. Protein estimation by UV absorbance and Biuret method.
2. Protein assay by Lowry/Bradford method.
3. Ammonium sulphate fractionation of crude homogenate from germinated mung bean.

4. Setting up assay for acid phosphatase and activity measurements of the ammonium sulphate fractions (progress curve and effect of pH).
5. Determination of Km and Vmax of enzyme enriched fraction.
6. Inhibition of acid phosphatase activity by inorganic phosphate.

Suggested Readings:

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York),
2. Fundamentals of Enzymology (1999) 3rd ed., Price, N.C and Stevens, L., Oxford University Press Inc., (New York),

SKILL ENHANCEMENT COURSE (SEC)

SEC 1: Tools and Techniques in Biochemistry **Credits 03**

SEC1P: Tools and Techniques in Biochemistry **Full Marks: 50**

Course Outline:

Unit 1: Biochemical reagents and solutions
Safety practices in the laboratory. Preparation and storage of solutions. Concepts of solution concentration and storing solutions. Quantitative transfer of liquids. Concept of a buffer, Henderson-Hassel bach equation, working of a pH meter.

Exercise
- Preparation of a buffer of given pH and molarity.

Unit 2: Spectrophotometric Techniques:
Principle and instrumentation of UV-visible and fluorescence spectroscopy.

Exercises
- Determination of the absorption maxima and molar extinction coefficient (of a relevant organic molecule).
- Measurement of fluorescence spectrum.
- Determination of concentration of a protein solution by Lowry/BCA method.

Unit 3: Introduction and importance of virtual labs in biochemistry

Suggested Readings:

1. Physical Biochemistry: Principles and Applications (2010) 2nd ed., Sheehan, D., Wiley Blackwell (West Sussex), Physical Biochemistry: Applications to Biochemistry and Molecular Biology (1982) 2nd ed., Freifelder, D., W.H. Freeman and Company (New York),
2. An Introduction to Practical Biochemistry (1998) 3rd ed., Plummer D. T., TataMcGraw Hill Education Pvt. Ltd. (New Delhi),

SEC 2: Protein Purification Techniques **Credits 03**

SEC 2P: Protein Purification Techniques **Full Marks: 50**

Course Outline:

Unit 1: Purification and characterization of a protein from a complex mixture (native or heterologously expressed) involving the following methods/techniques

Exercises
- Preparation of the sample.
- Ion-exchange chromatography.
- Gel filtration chromatography.
- Affinity chromatography.
- Electrophoresis.

Unit 2: Demonstration of High Performance Liquid Chromatography (HPLC)

Suggested Readings:

1. Physical Biochemistry: Principles and Applications (2010) 2nd ed., Sheehan, D., WileyBlackwell (West Sussex),
2. Physical Biochemistry: Applications to Biochemistry and Molecular Biology (1982) 2nd ed., Freifelder, D., W.H. Freeman and Company (New York),
3. An Introduction to Practical Biochemistry (1998) 3rd ed., Plummer D. T., Tata McGraw Hill Education Pvt. Ltd. (New Delhi),