

# SYLLABUS

## B.Sc. (Honours) - Biochemistry

(1<sup>st</sup> Semester)

Three/Four Years Undergraduate Degree Course [CBCS Semester Mode]

[As per the "Guidelines for Multiple Entry and Exit in Academic Programmes offered in Higher Education Institutions" issued by UGC New Delhi under NEP 2020]

Session: 2023-27

**SCHOOL OF STUDIES IN BIOCHEMISTRY  
JIWAJI UNIVERSITY  
GWALIOR - 474 011 (MP)**

*M. J. Jaimal*

*Neelam Swarlam*

*[Signature]*

**Jiwaji University, Gwalior**  
**B.Sc. (Honours) Biochemistry 2023-27**

**Course Structure and Scheme of Examination**

**FIRST SEMESTER (Examination Dec 2023)**

Course Code	Course Name	Total Marks	Credit	End Sem Exam Marks		Sessional Marks	
				MAX	MIN	MAX	MIN
BCH CC-I-T (Major Course)	Biomolecules (Theory)	100	4	60	21	40	14
BCH CC-II-T (Minor Course)	Cell Biology (Theory)	100	4	60	21	40	14
BCH CC-I-P (Major Course)	Biomolecules-Lab	100	2	60	21	40	14
BCH CC-II-P (Minor Course)	Cell Biology-Lab	100	2	60	21	40	14
GE-I-T	Zoology-I (Theory) (Perspectives in Ecology)	100	4	60	21	40	14
AECC-I-T	English Communication (Theory)	100	4	60	21	40	14
	<b>Grand Total</b>		<b>20</b>				

*M. Prasad*  
*Deputy Director*

## **B.Sc. [Honors] Biochemistry [CBCS Structure]**

**Major Core & Minor Courses (BCH CC – I & II)**

**Generic Electives Course (GE – I)**

**Ability Enhancement Compulsory Course – I (AECC – I)**

**BCH CC – I (Major Course): Biomolecules (Theory)**

**BCH CC – II (Minor Course): Cell Biology (Theory)**

**BCH CC – IP (Major Course): Biomolecules (Practical)**

**BCH CC – IIP (Minor Course): Cell Biology (Practical)**

**GE – I - T - Zoology – I Perspectives in Ecology (Theory)**

**AECC – I – T: English Communication (Theory)**

*M. J. J. J.*

*netu bisantara*

*CC*



## Major Core Course (Theory)

### BCH CC-I (Major Course): Biomolecules (Theory)

Total Hrs: 60

Credit: 4

#### UNIT-I The foundations of biochemistry

1. Cellular and chemical foundations of life
2. Water: Unique properties, weak interactions in aqueous systems, ionization of water, buffers, water as a reactant and fitness of the aqueous environment.

#### UNIT-II Carbohydrates and glycobiology

1. Monosaccharides - structure of aldoses and ketoses, ring structure of sugars, conformations of sugars, mutarotation, anomers, epimers and enantiomers, structure of biologically important sugar derivatives, oxidation of sugars.
2. Formation of disaccharides, reducing and nonreducing disaccharides.
3. Polysaccharides - homo- and heteropolysaccharides, structural and storage polysaccharides. Structure and role of proteoglycans, glycoproteins and glycolipids (gangliosides and lipopolysaccharides).

#### UNIT-III Lipids

1. Building blocks of lipids - Definition, Classification and structure.
2. Storage lipids - triacyl glycerol and waxes.
3. Structural lipids in membranes - glycerophospholipids, galactolipids and sulpholipids, sphingolipids and sterols.
4. Structure, distribution and role of membrane lipids. Plant sterols.
5. Specialized functions of lipids: Lipids as signals, cofactors and pigments

#### UNIT-IV Amino acids and Proteins

1. Structure and classification, physical, chemical and optical properties of amino acids
2. Non-protein amino acids. Physical and chemical properties of amino acids. Titration of amino acids, separation
3. Peptide Bonds: Rigid and planar nature of the peptide bond. Structure and function of some naturally occurring polypeptides.
4. Proteins: Structural levels Primary, Secondary, Super Secondary, Tertiary and Quaternary structures. Determination of primary structure of

#### UNIT-V Nucleic acids

1. Nucleotides - structure and properties.
2. Nucleic acid structure - Watson - Crick Model of DNA.
3. Structure of major species of RNA - mRNA, tRNA and rRNA.
4. Nucleic acid chemistry - UV absorption, effect of acid and alkali on DNA. Other functions of nucleotides - source of energy, component of coenzymes, second messengers.
5. Vitamins- Structure and active forms of water soluble and fat soluble vitamins, deficiency diseases and symptoms, hypervitaminosis

*my journal*  
*rahul sharma*

**Major Core Course (Practical)**

**BCH CC-IP (Major Course): Biomolecules (Practical)**

**Total Hrs: 30**

**Credit: 2**

1. Safety measures in laboratories.
2. Preparation of normal and molar solutions.
3. Preparation of buffers.
4. Determination of pKa of acetic acid and glycine.
5. Qualitative tests for carbohydrates, lipids, amino acids, proteins and nucleic acids.
6. Separation of amino acids/ sugars/ bases by paper chromatography.
7. Estimation of vitamin C.

**Suggested Readings:**

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292-3414-8.
2. Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New York), ISBN: 978-0-470-28173-4.
3. Harper's illustrated biochemistry (2018) 30th ed., Botham K, Mayes P, Murray RK, Granner DK. McGraw-Hill Companies New York, ISBN 0-07-138901-6/ ISSN 1043-9811
4. Biochemistry (2011) 4th ed., Voet D & Voet JG, John Wiley & Sons Inc., Singapore, ISBN: 978-0-470-91410-6

*Pranjwal*

*Volini Divadani*

*CC*



**Minor Core Course (Theory)**

**BCH CC-II (Minor Course): Cell Biology (Theory)**

**Total Hrs: 60**

**Credit: 4**

**UNIT-I Introduction to cell biology**

1. Prokaryotic (archaea and eubacteria) and eukaryotic cell (animal and plant cells), cells as experimental models.
2. Tools of cell biology: Light microscopy, phase contrast microscopy, fluorescence microscopy, confocal microscopy, electron microscopy, FACS. Centrifugation for subcellular fractionation.

**UNIT-II Structure of different cell organelles**

1. Cell wall and extracellular matrix: Prokaryotic and eukaryotic cell wall, cell matrix proteins. Cell-matrix interactions and cell-cell interactions. Adherence junctions, tight junctions, gap junctions, desmosomes, hemidesmosomes, focal adhesions and plasmodesmata.
2. Structure of nuclear envelope, nuclear pore complex. ER structure. Organization of Golgi. Lysosome.
3. Structure and functions of mitochondria, chloroplasts and peroxisomes.

**UNIT-III Protein trafficking**

1. Selective transport of proteins to and from the nucleus. Regulation of nuclear protein import and export.
2. Targeting proteins to ER, smooth ER and lipid synthesis. Export of proteins and lipids from ER and into ER.
3. Lipid and polysaccharide metabolism in Golgi. Protein sorting and export from Golgi. Mechanism of vesicular transport, cargo selection, coat proteins and vesicle budding, vesicle fusion. Protein import and mitochondrial assembly, protein export from mitochondrial matrix.
4. Import and sorting of chloroplast proteins.

**UNIT-IV Cytoskeletal proteins**

1. Structure and organization of actin filaments. Microfilament polymerization, organization of actin filaments. Non-muscle myosin.
2. Intermediate filament proteins, assembly and intracellular organization. Assembly, organization and movement of cilia and flagella.

**UNIT-V Cell cycle, cell death and cell renewal**

1. Eukaryotic cell cycle, restriction point, and checkpoints.
2. Cell division
3. Apoptosis and necrosis - brief outline

*Myamal*  
*shree bharadwaj*  
*aw*

**Minor Core Course (Practical)**

**BCH CC-IIP (Minor Course): Cell Biology (Practical)**

**Total Hrs: 30**

**Credit: 2**

1. Visualization of animal and plant cell by methylene blue.
2. Identification of different stages of mitosis in onion root tip.
3. Identification of different stages of meiosis in grasshopper testis.
4. Micrographs of different cell components (dry lab).
5. Sub-cellular fractionation.
6. Visualization of nuclear fraction by acetocarmine stain.
7. Staining and visualization of mitochondria by Janus green stain.

**Suggested Readings:**

1. The Cell: A Molecular Approach (2009) 5th ed., Cooper, G.M. and Hausman, R.E., ASM Press & Sunderland (Washington DC), Sinauer Associates, MA, ISBN: 978-0-87893-300-6.
2. Molecular Cell Biology (2012) 7th ed., Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J., W.H. Freeman & Company (New York), ISBN:13: 978- 1-4641-0981-2 / ISBN:10: 1-4641-0981-8.
3. Molecular Biology of the Cell (2015) 6th ed., Alberts, B., Johnson, A., Lewis, J., and Enlarge, M., Garland Science (Princeton), ISBN: 0-8153-1619-4 / ISBN:0-8153-1620-8.

*Original*  
*value circular*  


## **B.Sc. [Honors] Biochemistry [CBCS Structure]**

### **Generic Electives Course (GE – I) Theory**

**Zoology – I Perspectives in Ecology (Theory)**  
(Theory Course is offered by SOS in Zoology)

*Myamal*

*natini bivarlam*

*Geo*



## Generic Elective – I (Theory)

### Zoology – I Perspectives in Ecology (Theory) (Theory Course is offered by SOS in Zoology)

Total Hrs: 60

Credit: 4

#### Unit I: Introduction to Ecology

1. History of ecology.
2. Autecology and synecology.
3. Levels of organization, Laws of limiting factors.
4. Study of physical factors.

#### Unit II: Population

1. Unique and group attributes of population: Density, natality, mortality, lifetables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion.
2. Exponential and logistic growth of population, equation and patterns, r and K strategies
3. Population interactions, Gause's Principle with laboratory and field examples.
4. Lotka-Volterra equation for competition and Predation, functional and numerical responses.

#### Unit III: Community

1. Community characteristics: species richness, dominance, diversity, abundance and vertical stratification.
2. Ecotone and edge effect.
3. Ecological succession with one example.

#### Unit IV: Ecosystem

1. Basic concept: Types of ecosystems with one example.
2. Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains.
3. Food web, Energy flow through the ecosystem.
4. Ecological pyramids and Ecological efficiencies.

#### Unit V: Applied Ecology

1. Ecology in Wildlife Conservation and Management.
2. Act and Legislation of wildlife conservation.
3. Nutrient and biogeochemical cycle with on example of Nitrogen cycle.
4. Zoo-geographical region of wildlife distribution.

#### Suggested Readings:

1. Colinvaux, P.A. (1993): Ecology, 2<sup>nd</sup> Ed., Wiley, John & Sons, Inc

*Prasanna*  
*Relin Divakar*  
*CS*

2. Krebs, C.J. (2001): Ecology, 6<sup>th</sup> Ed., Benjamin Cummings
3. Odum, E.P. (2008): Fundamentals of Ecology, Indian Edition, Brooks/Cole
4. Robert Leo Smith, Ecology & Field Biology, Harper & Row Publisher
5. Ricklefs, R.E. (2000): Ecology, 5<sup>th</sup> Ed., Chiron Press
6. Chanda S. K. (1992): Conserving wildlife in India.

*Myamal*

*velin dionan*

*es*

**B.Sc. [Honors] Biochemistry [CBCS Structure]**

**Ability Enhancement Compulsory Course – I  
[AECC-I]**

**AECC-I English Communication (Theory Course)**

*Prasanna*

*Prasanna*

*Prasanna*

## Ability Enhancement Compulsory Course – I (AECC-I)

### English Communication (Theory)

Total Hrs: 60

Credit: 4

#### Unit – I: Introduction

1. Meaning of Communication
2. Process of Communication
3. Modes of Communication
4. Theories of Communication

#### Unit – II: Types of Communication

1. Verbal and Non-verbal communication (Spoken and Written),
2. Intra-personal, Inter-personal and Group communication
3. Personal, Social and Business
4. Barriers and Strategies

#### Unit – III: Speaking Skills

1. Monologue & Dialogue
2. Group Discussion and Interview
3. Effective Communication
4. Public Speech

#### Unit – IV: Reading and Understanding

1. Literary/Knowledge Texts
2. Close Reading of Comprehension
3. Analysis and Interpretation
4. Making notes & Summary

#### Unit – V: Writing Skills

1. Report Writing and Documentation
2. Letter writing
3. Paraphrase writing
4. Translation (from Hindi to English and vice-versa)

#### Suggested Readings:

1. Fluency in English - Part II, OUP India, 2006, ISBN-10: 0195686527; ISBN-13: 978-0195686527
2. Business English, Pearson Education, 2008, ISBN-10: 8131720772; ISBN-13: 8131720226
3. Language, Literature and Creativity by SP Kumar, Orient Blackswan, 2012, ISBN-10: 8125052631; ISBN-13: 978-8125052630
4. Language through Literature by Gauri Mishra, Ranjana Kaul and Brati Biswas, 2016, Primus Books, ISBN-10: 9789384082901; ISBN-13: 9384082901
5. Business English by Prem P Bhalla, V&S Publisher; ISBN-10: 9789350571736; ISBN-13: 9789350571736
6. Advanced Writing Skills by DS Paul, 2022, Goodwill Publishing House, ISBN-10: 8172455380; ISBN-13: 8172455385

*Original*  
*Subscribed*  
*CEO*