

ANDHRA KESARI UNIVERSITY



B.Sc. – Honours in BIOCHEMISTRY - MAJOR

w.e.f. 2023-24 AY onwards

COURSE STRUCTURE

Year	Semester	Course	Title	No. Hrs./ Week	No. of Credits
I	I	1	Introduction to Classical Biology	5	4
		2	Introduction to Applied Biology	5	4
	II	3	Biomolecules - (T)	3	3
			Biomolecules - (P)	2	1
		4	Cell Biology - (T)	3	3
			Cell Biology- (P)	2	1

I -Semester

Course: 1 INTRODUCTION TO CLASSICAL BIOLOGY

Hours/Week: 5

Credits: 4

Learning objectives

The student will be able to learn the diversity and classification of living organisms and understand their chemical, cytological, evolutionary and genetic principles.

Learning Outcomes

1. Learn the principles of classification and preservation of biodiversity
2. Understand the plant anatomical, physiological and reproductive processes.
3. Knowledge on animal classification, physiology, embryonic development and their economic importance.
4. Outline the cell components, cell processes like cell division, heredity and molecular processes.
5. Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

Unit 1: Introduction to systematics, taxonomy and Ecology.

- 1.1. Systematics – Definition and concept, Taxonomy – Definition and hierarchy.
- 1.2. Nomenclature – ICBN and ICZN, Binomial and trinomial nomenclature.
- 1.3. Ecology – Concept of ecosystem, Biodiversity and conservation,
- 1.4-Pollution and climate change.

Unit 2: Essentials of Botany.

- 2.1. The classification of plant kingdom – Eichler system of classification.
- 2.2. Vegetative parts of a Plant and physiological processes –outlines of water & mineral absorption, Ascent of sap, transpiration, Photosynthesis, Respiration and Growth hormones.
- 2.3. Structure of flower – Essential and Non – Essential organs, microsporangium - structure of anther, megasporangium, structure of ovule, pollination & fertilization.

2.4. floriculture, landscaping & plant Nursery (Basics)

Unit 3: Essentials of Zoology

3.1. The classification of Kingdom Animalia and Chordata.

3.2 Heart, lung, kidney, Organ Systems & their functions in Humans;
Hormones and Disorders

3.3 Developmental Biology – Basic process of development (Gametogenesis, Fertilization, Cleavage and Organogenesis)

3.4 Economic Zoology – Sericulture, Apiculture, Aquaculture

Unit 4: Cell biology, Genetics and Evolution

4.1. Cell theory, Ultrastructure of prokaryotic and eukaryotic cell.

4.2. Chromosomes and heredity – Structure of chromosomes nucleosome, DNA & RNA.

4.3. Cell Cycle, Mitosis & Meiosis.

4.4. Mendel's laws & Darwin theory of evolution.

Unit 5: Essentials of chemistry

5.1. Definition and scope of Chemistry, applications of Chemistry in daily life. Branches of Chemistry.

5.2. Chemical bonds – ionic, covalent, noncovalent – Vander Waals, hydrophobic, hydrogen bonds.

5.3. Green chemistry principles, prevention of waste, prevention of hazardous components,

5.4. Green synthesis of catechol, accident prevention & safety measures.

References

1. Sharma O.P., 1993. Plant taxonomy. 2nd Edition. McGraw Hill publishers.
2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4th edition. S. Chand publishers, New Delhi, India.
3. Jordan E.L., Verma P.S., 2018. Chordate Zoology. S. Chand publishers, New Delhi, India.
4. Rastogi, S.C., 2019. Essentials of animal physiology. 4th Edition. New Age International Publishers.
5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chand publishers, New Delhi, India.
6. Satyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.
7. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.

8. Karen Timberlake, William Timberlake, 2019. Basic chemistry. 5th Edition. Pearson publishers.

9. Subrata Sen Gupta, 2014. Organic chemistry. 1st Edition. Oxford publishers.

ACTIVITIES:

1. Make a display chart of the life cycle of nonflowering plants.
2. Make a display chart of the life cycle of flowering plants.
3. Study of stomata
4. Activity to prove that chlorophyll is essential for Photosynthesis
5. Study of pollen grains.
6. Observation of pollen germination.
7. Draw the Ultrastructure of Prokaryotic and Eukaryotic Cell
8. Visit to Zoology Lab and observe different types of preservation of specimens
9. Hands-on experience of various equipment – Microscopes, Centrifuge, pH Meter, Electronic Weighing Balance, Laminar Air Flow
10. Visit to Zoo / Sericulture / Apiculture / Aquaculture unit
11. List out different hormonal, genetic and physiological disorders from the societ

I -Semester

Course: 2 INTRODUCTION TO APPLIED BIOLOGY

Hour/Weeks: 5

Credits: 4

Learning objectives

The student will be able to learn the foundations and principles of microbiology, immunology, biochemistry, biotechnology, analytical tools, quantitative methods, and bioinformatics.

Learning Outcomes

1. Learn the history, ultrastructure, diversity and importance of microorganisms.
2. Understand the structure and functions of macromolecules.
3. Knowledge on biotechnology principles and its applications in food and medicine.
4. Outline the techniques, tools and their uses in diagnosis and therapy.
5. Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

Unit 1: Essentials of Microbiology

- 1.1. History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch.
- 1.2. Groups of prokaryotic microbes – Bacteria (Structure, and Types), archaeobacteria, Mycoplasma; Eukaryotic Microbes(outlines)
- 1.3. Applications of microorganisms in – Food, Agriculture, Environment, and Industry.
- 1.4. Viruses – plant virus – TMV (Structure and Disease Symptoms) Animal virus – polio virus (Structure and Disease Symptoms) & Bacteriophage(Structure and Reproduction Outlines)

Unit 2: Essentials of Biochemistry and Immunology

2.1. Biomolecules I

Introduction of carbohydrates & classification – mono di and Polysaccharides.

Lipids. Introduction, Structure & types – Biological importance.

2.2. Biomolecules II

Amino acids – classification, properties, structure & functions.

Proteins – classification, properties, structure & functions.

2.3. Biomolecules III DNA –

Structure & Types RNA –

Structure & Types

2.4. Immune **System** –

Immunity, types of
Immunity, cells & organs
of Immune Systems.

Unit 3: Essentials of Biotechnology

- 3.1. History, scope, and significance & branches of biotechnology.
- 3.2. Recombinant DNA Technology and Vectors-PBR322 & PUC18
- 3.3. Transgenic plants – Uses and applications-B. T Cotton. Transgenic animals – Dolly Sheep.
- 3.4. Environmental Biotechnology – Bioremediation, Bio – Fuels, Bio-fertilizers & Biopesticides.

Unit 4: Analytical Tools and Applications

- 4.1. Microscopy – Simple, compound and electron microscope.
- 4.2. Southern Blotting Northern Blotting and western blotting
- 4.3. Electrophoresis
- 4.4. Monoclonal antibodies and Its applications. Applications in forensics-DNA Fingerprinting and PCR

Unit 5: Biostatistics and Bioinformatics

- 5.1. Data collection and sampling. Measures of central tendency – Mean, Median, Mode.
- 5.2. Measures of dispersion – Range, standard deviation, Basics of Chi-square Test and t-test
- 5.3. Introduction to Bioinformatics – Genomics, Proteomics, types of biological databases – NCBI, EBI.
- 5.4. Accessing Nucleic Acid and Protein databases, NCBI, Genome Workbench

REFERENCES

1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11th Edition. Pearson publications, London, England.
2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5th Edition. McGraw Education, New York, USA.
3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.
4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.
6. Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3rd Edition. Cambridge Publishers.
7. U. Sathyanarayana, 2005. Biotechnology. 1st Edition. Books and Allied Publishers pvt. ltd., Kolkata.
8. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.

9. Arthur M. Lesk. Introduction to Bioinformatics. 5th Edition. Oxford publishers. 10. AP Kulkarni, 2020. Basics of Biostatistics. 2nd Edition. CBS publishers.

ACTIVITIES

1. Identification of a given organism as harmful or beneficial.
2. Observation of microorganisms from house dust under microscope.
3. Finding microorganisms from pond water.
4. Visit to a microbiology industry or biotech company.
5. Visit to a wastewater treatment plant.
6. Retrieving a DNA or protein sequence of a gene'
7. Performing a BLAST analysis for DNA and protein.
8. Problems in biostatistics.
9. Field trip and awareness programs on environmental pollution by different types of wastes and hazardous materials.
10. Demonstration on basic biotechnology lab equipment.
11. Preparation of 3D models of genetic engineering techniques.
12. Preparation of 3D models of transgenic plants and animals.

[NOTE: In the colleges where there is availability of faculty for microbiology and biotechnology, those chapters need to be handled by microbiology and biotechnology faculty. In other colleges, the above topics shall be dealt by Botany and Zoology faculty.

II SEMESTER

Course No-3: BIO MOLECULES

Credits 3

COURSE OBJECTIVES

1. Provides information about classification, physico-chemical properties of amino acids and structural organization of proteins.
2. To understand the structure, properties and biological importance of carbohydrates and lipids.
3. Explore the composition and structure of nucleic acids.

UNIT-I

Fundamentals of Biochemistry: History, scope and avenues of Biochemistry. Water as a biological solvent. Measurement of PH, Buffers, Biological relevance of Buffers. Outlines of surface tension, adsorption and osmosis and their biological relevance.

UNIT-II

Carbohydrates: Classification, monosaccharides, D and L designation, open chain and cyclic structures, epimers and anomers, mutarotation. Reactions of carbohydrates (due to functional groups - hydroxyl, aldehyde and ketone. Amino sugars, Glycosides. Structure and biological importance of disaccharides (sucrose, lactose, maltose, isomaltose, trehalose), trisaccharides (raffinose, melezitose). Structural polysaccharides (cellulose, chitin, pectin) and storage polysaccharides (starch, inulin, glycogen). Glycosaminoglycans.

UNIT – III

Lipids Classification, saturated and unsaturated fatty acids, structure and properties of fats and oils (acid, saponification and iodine values, rancidity). General properties and structures of phospholipids. Prostaglandins- structure, types and biological role. Lipoproteins- types and functions.

UNIT-IV

Amino Acids and Proteins Classification, structure, stereochemistry, chemical reactions of amino acids due to carbonyl and amino groups. 2. Titration curve of glycine and pK values. Essential and nonessential amino acids, non-protein amino acids. 3. Peptide bond - nature and conformation. Naturally occurring peptides - glutathione, enkephalin. 4. Proteins: Classification based on solubility, shape, and function. Determination of amino acid composition of proteins. 5. General properties of proteins, denaturation, and renaturation of proteins. 6. Structural organization of proteins- primary, secondary, tertiary, and quaternary structures (Eg. Hemoglobin and Myoglobin).

UNIT-V

Nucleic acids and porphyrins, Types of RNA and DNA. Structure of purines and pyrimidines, nucleosides, nucleotides. Stability and formation of phosphodiester linkages. 2. Effect of

acids, alkali and nucleases on DNA and RNA. 3. Structure of Nucleic acids- Watson-Crick DNA double helix structure, denaturation and renaturation of nucleic acids, T_m-values and their significance, cot curves and their significance. 4. Structure and properties of porphyrins: Heme, cytochromes and chlorophylls.

COURSE OUTCOMES

After successful completion of the practical course student should be able to

1. prepare buffers and apply the knowledge to calculate the pH values of charged biomolecules.
2. Identify various carbohydrates, aminoacids and lipids present in the nature by performing qualitative analysis.

II SEMESTER

Course No-3 BIO MOLECULES

Credits -1

1. Preparation of buffers (acidic, neutral, and alkaline) and determination of pH.
2. Qualitative identification of carbohydrates- glucose, fructose, ribose/xylose, maltose, sucrose, lactose, starch/glycogen.
3. Qualitative identification of amino acids- histidine, tyrosine, tryptophan, cysteine, arginine.
4. Qualitative identification of lipids- solubility, saponification, acrolein test, Salkowski test, Lieberman-Burchardtest.
5. Preparation of Osazones and their identification
6. Estimation of proteins in biological samples:
 - a. Biuret method.
 - b. Folin-Lowry method.
 - c. UV method.
 - d. Bradford's dye binding method
7. Estimation of amino acid by Ninhydrin method.
8. Estimation of tyrosine by Million's –reaction

Recommended Books

1. Fundamentals of Biochemistry –Jain, J.L., Jain, S., Jain, N. S. Chand & Co.
2. Biochemistry – Satyanarayana. U and Chakrapani. U, Books & Allied Pvt. Lt
3. Nelson.D.L. and Cox.M..M -Lehninger's Principles of Biochemistry- Freeman & Co.-
7 th Edition

II SEMESTER

Course No- 4 CELL BIOLOGY

Credits -3

COURSE OBJECTIVES

1. To study the cell organelles in prokaryotic and eukaryotic cells.
2. Detailed information on Cell division, Cell cycle regulation with cdk and cyclins, MPK, MPF.
3. To know the cell communication, molecules, proteins in cell adhesion and desmosomes, hemidesmosomes, gap junctions, extracellular matrix, integrins.
4. Knowledge on ER mediated Protein Sorting and Targeting
5. Knowledge on Composition of plasma membrane and various transport mechanisms.

UNIT-I

Prokaryotic and Eukaryotic cells: Cell organelles Structure, Composition and functions of nucleus, mitochondria plastids, endoplasmic reticulum, Golgi, lysosomes, vacuole, micro bodies, ribosomes, cytoskeleton.

UNIT-II

Cell division: mitosis, meiosis, cell cycle and its regulation, different phases of cell cycle. Apoptosis, Regulation of cell cycle, Cyclins, MPF, Cyclin dependent kinases, Growth factors, Nuclear Laminins, inhibition of cell cycle progression, MPF and progression to Metaphase, Proteolysis and MPF, Regulation of MPF activity. Check points in cell cycle regulation.

UNIT-III

Cell communication: general principles of cell communication, cell adhesion and roles of different adhesion molecules, cell junction/gap junctions, extracellular matrix, integrins. Signal transduction: Cell surface receptor, G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signalling pathways, bacterial and plant two component systems, bacterial chemotaxis, and quorum sensing.

UNIT-IV

Protein Sorting and Targeting: Overall pathway of synthesis of nuclear coded, secretory, lysosomal and membrane proteins. Import across ER – Signal hypothesis, post translational modifications of secretory/membrane proteins in ER, sorting of lysosomal proteins, Mannose - 6 - Phosphate receptors, synthesis, trafficking, and localization of mitochondrial proteins. Protein traffic into and out of nucleus.

UNIT-V

Bio membranes: Chemical composition of Membranes, Composition of plasma and organelle membranes of animal and plant cells. Lipids, proteins, and Carbohydrates of membranes

Distribution of membrane lipids. Assembly of membrane components. Molecular structure of membranes: Miscelle, and liposomes, biological membrane; Symmetry of the membrane; Membrane fluidity; fluid mosaic model of biological membranes. Nanomaterials and their applications.

Membrane Transport: Donnan membrane equilibrium, Diffusion across cellular membranes Mediated transport; Energetics of transport systems; Passive transport anion exchange proteins; Active transport; Active transport of Na^+ K^+ (Sodium potassium ATPase) Ca^{2+} (Ca^{2+} -ATPase). Active transport of sugars coupled to Phosphorylation; group translocation (Y-Glutamyl cycle). Proton motive force in bacterial transport processes. Ionophores Gap junctions; Endocytosis, Exocytosis. Nature of receptors.

Course Outcomes

Students will be able to:

- 1: Isolate the cells and count them
- 2: Analyse the viability and examine the division mechanisms of cells
- 3: Resolve the biological materials by electrophoresis
- 4: Do cell culture works

SEMESTER II
Course No- 4 CELL BIOLOGY
Credits -1

Practical Syllabus

1. Estimation of Chlorophyll
2. Isolation of chloroplast
3. Isolation of mitochondria from the liver
4. Mitosis experiment
5. Meiosis experiment
6. Nuclei staining by DAPI / PI
7. Apoptosis- DNA Ladder Pattern, Annexin V staining
8. low cytometric analysis

Recommended Books

1. Goldman, Emanuel, and Lorrence H. Green, eds. Practical handbook of microbiology. CRC Press, 2015.
2. Dubey, R. C., and D. K. Maheshwari. Practical microbiology. S. Chand, 2002.
3. Microbiology: A laboratory manual by Cappuccino and Sherman, Pearson

1.

ANDHRA KESARI UNIVERSITY-ONGOLE, PRAKASAM DISTRICT
Single Major Programme from the Year 2023-24 Onwards Programme- B.Voc
Honours. Horticulture/Agriculture/Medical Lab Technology
&
B.Sc.Honours Botany/Microbiology/Zoology/Aquaculture/Biochemistry/Biotechnology
Question Paper model, First Year-Semester-1
Course1 - Introduction to Classical Biology

Time: 3 Hours

Total Marks: 75

PART –A

Answer any Five of the following.

Note: Draw labelled diagrams wherever necessary and Each unit must carry two questions

5X5=25 Marks

1. Unit-1
2. Unit-1
3. Unit-2
4. Unit-2
5. Unit-3
6. Unit-3
7. Unit-4
8. Unit-4
9. Unit-5
10. Unit-5

PART –B

Answer any **Five** of the following

Note: Draw labelled diagrams wherever necessary

5X10=50 Marks

(Paper setters must give the 2 questions from Each unit)

11. Unit-1
12. Unit-1
13. Unit-2
14. Unit-2
15. Unit-3
16. Unit-3
17. Unit-4
18. Unit-4
19. Unit-5
20. Unit-5

ANDHRA KESARI UNIVERSITY-ONGOLE, PRAKASAM DISTRICT
Single Major Programme from the Year 2023-24 Onwards Programme- B.Voc
Honours. Horticulture/Agriculture/Medical Lab Technology
&
B.Sc.Honours Botany/Microbiology/Zoology/Aquaculture/Biochemistry/Biotechnology
Question Paper model, First Year-Semester-1
Course 2 - Introduction to Applied Biology

Time: 3 Hours

Total Marks: 75

PART –A

Answer any Five of the following.

Note: Draw labelled diagrams wherever necessary and Each unit must carry two questions
5X5=25 Marks

1. Unit-1
2. Unit-1
3. Unit-2
4. Unit-2
5. Unit-3
6. Unit-3
7. Unit-4
8. Unit-4
9. Unit-5
10. Unit-5

PART –B

Answer any **Five** of the following

Note: Draw labelled diagrams wherever necessary
(Paper setters must give the 2 questions from Each unit)

5X10=50 Marks

11. Unit-1
12. Unit-1
13. Unit-2
14. Unit-2
15. Unit-3
16. Unit-3
17. Unit-4
18. Unit-4
19. Unit-5
20. Unit-5

ANDHRA KESARI UNIVERSITY-ONGOLE, PRAKASAM DISTRICT
Single Major Programme from the Year 2023-24 Onwards
Programme- B.Sc. Biochemistry Honours -Question Paper model,
First Year-Semester-2
Course 3 – Biomolecules – (T)

Time: 3 Hours

Total Marks: 75

Section –A

Answer any Five of the following

5X5=25 Marks

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10

Section –B

Answer the following one question from each unit

5x10=50 Marks

Note: Draw diagram Compulsory

11a.

Or

11b.

12a

Or

12b.

13a.

Or

13b

14a.

Or

14b.

15a.

Or

15b.

ANDHRA KESARI UNIVERSITY-ONGOLE, PRAKASAM DISTRICT
Single Major Programme from the Year 2023-24 Onwards
Programme- B.Sc. Biochemistry Honours -Question Paper model,
First Year-Semester-2
Course 4 – Cell Biology – (T)

Time: 3 Hours

Total Marks: 75

Section –A

Answer any Five of the following

5X5=25 Marks

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10

Section –B

Answer the following one question from each unit

5x10=50 Marks

Note: Draw diagram Compulsory

11a.

Or

11b.

12a

Or

12b.

13a.

Or

13b

14a.

Or

14b.

15a.

Or

15b.

