



## Andhra Pradesh State Council of Higher Education

### B.Sc., Honours in BOTANY:MAJOR

w.e.f AY 2023-24 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	Non-vascular Plants –(T)	3	3
			Non-vascular Plants –(P)	2	1
		4	Origin of Life and Diversity of Microbes –(T)	3	3
			Origin of Life and Diversity of Microbes –(P)	2	1
II	III	5	Vascular Plants –(T)	3	3
			Vascular Plants –(P)	2	1
		6	Plant Pathology and Plant Diseases–(T)	3	3
			Plant Pathology and Plant Diseases –(P)	2	1
		7	Plant Breeding–(T)	3	3
			Plant Breeding –(P)	2	1
		8	Plant Biotechnology–(T)	3	3
			Plant Biotechnology–(P)	2	1
	IV	9	Anatomy and Embryology of Angiosperms–(T)	3	3
			Anatomy and Embryology of Angiosperms–(P)	2	1
		10	Plant Ecology, Biodiversity and Phytogeography–(T)	3	3
			Plant Ecology, Biodiversity and Phytogeography–(P)	2	1
		11	Plant Resources and Utilization–(T)	3	3
			Plant Resources and Utilization–(P)	2	1
III	V	12	Cell Biology and Genetics–(T)	3	3
			Cell Biology and Genetics–(P)	2	1
		13	Plant Physiology and Metabolism–(T)	3	3
			Plant Physiology and Metabolism–(P)	2	1
		14 A	Organic Farming–(T)	3	3
			Organic Farming–(P)	2	1
			<b>OR</b>		
		14 B	Seed Technology–(T)	3	3
			Seed Technology–(P)	2	1
		15 A	Mushroom Culture Technology–(T)	3	3
			Mushroom Culture Technology–(P)	2	1
			<b>OR</b>		
		15 B	Plant Propagation Techniques–(T)	3	3

		Plant Propagation Techniques–(P)	2	1
--	--	----------------------------------	---	---

VII & VIII semesters detailed Syllabus will be available in due course of time.

Semester	Course No. & Title of the course	Hours/ week (Th.)	No. credits (Th.)	Hours/ week (Pr.)	No. credits (Pr.)
VII Core Courses	16 (A) Plant Systematics (OR) 16 (B) Plant Developmental Biology	3	3	2	1
	17 (A) Plant Molecular Biology (OR) 17 (B) Plant Genetic Engineering	3	3	2	1
	18 (A) Crop Physiology (OR) 18 (B) Plant Biochemistry	3	3	2	1
	19 (A) Phyto-medicines and Ethnobotany (OR) 19 (B) Herbal Technology	3	3	2	1
VII Skill Enhanced Courses (SEC)	20 (A) Soil fertility and Conservation (OR) 20 (B) Agroforestry	3	3	2	1
	21 (A) Phyto-biodiversity and Conservation (OR) 21 (B) Phytochemistry and Pharmacognosy	3	3	2	1
VIII Core Courses	22 (A) Bioinformatics and Computational Biology (OR) 22 (B) Omics in Plant Science	3	3	2	1
	23 (A) Plant Cytogenetics (OR) 23 (B) Biostatistics and Intellectual Property Rights	3	3	2	1
	24 (A) Biofertilizers and Biopesticides (OR) 24 (B) Industrial and Environmental Biotechnology	3	3	2	1
	25 (A) Gardening and Landscaping (OR) 25 (B) Floriculture	3	3	2	1

**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.
- 2.2. Plant physiological processes (Photosynthesis, Respiration, Transpiration, phytohormones).
- 2.3. Structure of flower – Micro and macro sporogenesis, pollination, fertilization and structure of mono and dicot embryos.
- 2.4 Mushroom cultivation, floriculture and landscaping.

**Unit 3: Essentials of Zoology**

- 3.1. The classification of Kingdom Animalia and Chordata.
- 3.2 Animal Physiology – Basics of Organ Systems & their functions, 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, cell cycle.

4.2. Chromosomes and heredity – Structure of chromosomes, concept of gene.

4.3. Central Dogma of Molecular Biology.

4.4. Origin of life

#### **Unit 5: Essentials of chemistry**

5.1. Definition and scope of chemistry, applications of chemistry in daily life.

5.2. Branches of chemistry

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

5.4. Green chemistry

#### **References**

1. Sharma O.P., 1993. Plant taxonomy. 2<sup>nd</sup> Edition. McGraw Hill publishers.
2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4<sup>th</sup> 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. 4<sup>th</sup> 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. 4<sup>th</sup> 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. 5<sup>th</sup> Edition. Pearson publishers.
9. Subrata Sen Gupta, 2014. Organic chemistry. 1<sup>st</sup> Edition. Oxford publishers.

#### **ACTIVITIES:**

1. Make a display chart of life cycle of nonflowering plants.
2. Make a display chart of 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. Ikebana.
8. Differentiate between edible and poisonous mushrooms.
9. Visit a nearby mushroom cultivation unit and know the economics of mushroom cultivation.
10. Draw the Ultrastructure of Prokaryotic and Eukaryotic Cell
11. Visit to Zoology Lab and observe different types of preservation of specimens
12. Hands-on experience of various equipment – Microscopes, Centrifuge, pH Meter, Electronic Weighing Balance, Laminar Air Flow
13. Visit to Zoo / Sericulture / Apiculture / Aquaculture unit
14. List out different hormonal, genetic and physiological disorders from the society

## **I -Semester**

**Course: 2**

**INTRODUCTION TO APPLIED BIOLOGY**

**Hours/Week: 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 and Immunology**

- 1.1. History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch and Joseph Lister.
- 1.2. Groups of Microorganisms – Structure and characteristics of Bacteria, Fungi, Archaea and Virus.
- 1.3. Applications of microorganisms in – Food, Agriculture, Environment, and Industry.
- 1.4. Immune system – Immunity, types of immunity, cells and organs of immune system.

### **Unit 2: Essentials of Biochemistry**

- 2.1. Biomolecules I – Carbohydrates, Lipids.
- 2.2. Biomolecules II – Amino acids & Proteins.
- 2.3. Biomolecules III – Nucleic acids -DNA and RNA.
- 2.4. Basics of Metabolism – Anabolism and catabolism.

### **Unit 3: Essentials of Biotechnology**

- 3.1. History, scope, and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.

- 3.2. Environmental Biotechnology – Bioremediation and Biofuels, Biofertilizers and Biopesticides.
- 3.3. Genetic engineering – Gene manipulation using restriction enzymes and cloning
- 3.4. vectors; Physical, chemical, and biological methods of gene transfer.
- 3.5. Transgenic plants – Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salt tolerance). Transgenic animals – Animal and disease models.

#### **Unit 4: Analytical Tools and techniques in biology – Applications**

- 4.1. Applications in forensics – PCR and DNA fingerprinting
- 4.2. Immunological techniques – Immunoblotting and ELISA.
- 4.3. Monoclonal antibodies – Applications in diagnosis and therapy.
- 4.4. Eugenics and Gene therapy

#### **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 and variance. Probability and tests of significance.
- 5.3. Introduction, Genomics, Proteomics, types of Biological data, biological databases- NCBI, EBI, Gen Bank; Protein 3D structures, Sequence alignment
- 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. 11<sup>th</sup> Edition. Pearson publications, London, England.
- 2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5<sup>th</sup> Edition. McGraw Education, New York, USA.
- 3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4<sup>th</sup> 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. 3<sup>rd</sup> Edition. Cambridge Publishers.

7. U. Sathyanarayana, 2005. Biotechnology. 1<sup>st</sup> 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. 5<sup>th</sup> Edition. Oxford publishers.
10. AP Kulkarni, 2020. Basics of Biostatistics. 2<sup>nd</sup> Edition. CBS publishers.

## **ACTIVITIES**

1. Identification of given organism as harmful or beneficial.
2. Observation of microorganisms from house dust under microscope.
3. Finding microorganism from pond water.
4. Visit to a microbiology industry or biotech company.
5. Visit to a waste water treatment plant.
6. Retrieving a DNA or protein sequence of a gene'
7. Performing a BLAST analysis for DNA and protein.
8. Problems on 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]