

ANDHRA KESARI UNIVERSITY



B.Sc., Honours in AQUACULTURE: MAJOR

w.e.f AY 2023-24 onwards

COURSE STRUCTURE

SEMESTER	Code	Title of the paper	Hr /week	Credits
I	1	Introduction to Classical Biology	5	4
	2	Introduction to Applied Biology	5	4
II	3	Taxonomy and Functional Anatomy of Fin Fish and Shellfish - (T)	3	3
		Taxonomy and Functional Anatomy of Fin Fish and Shellfish - (P)	2	1
	4	Biology of fin fish & shell fish - (T)	3	3
		Biology of fin fish & shell fish- (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 society

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 – DollySheep.
- 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. CBSpublishers.

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 Taxonomy and Functional Anatomy of Fin Fish and Shellfish
credits :3

Course Outcomes

1. Acquire knowledge on the Classification of major groups of Finfish and Shell fish
2. Students will be familiar with the general characters of Finfish and Shell fish
3. Gain knowledge on the structure and functions of Digestive system
4. Understand the difference between the brain of fish and prawn
5. Acquire knowledge on the functional anatomy of fish and prawn

Unit I: General characters & Classification of Cultivable fin fish and shell fish

- 1.1 General Characters of Crustacea
- 1.2 Classification of Crustacean: Major groups up to orders and their important characters.
- 1.3 General Characters of fishes
- 1.4 Classification of Fishes: Major groups up to subclass and their important characters.

Unit 2: Digestive and Respiratory systems of Fish and shell fish

- 2.1: Digestive system of fish
- 2.2 Respiratory system of fish
- 2.3 Digestive system of Prawn
- 2.4 Respiratory system of prawn

Unit 3: Circulatory systems of Fish and shell fish

- 3.1 Cardiovascular system: Structure of heart in fishes
- 3.2 Blood vascular system in prawn

Unit 4: Nervous system of Fish and shell fish

- 4.1 Nervous system in fish: Structure and functions of Brain
- 4.2 Central Nervous system in prawn.

Unit 5 Reproductive system of Fish and shell fish

- 5.1 Urino-genital system in fishes
- 5.2 Reproductive system in prawn

II SEMESTER

Course No.: 3 Taxonomy and Functional Anatomy of Fin Fish and Shellfish

Credits :1

1. Study of mouth parts in herbivorous and carnivorous fishes
2. Comparative study of digestive system of herbivorous and carnivorous fishes
3. Demonstration of brain of fish
4. Demonstration of cranial nerves of fish
5. Demonstration of Nervous system of prawn
6. Exposure of gills of prawn
7. Exposure of gills of fish

REFERENCE BOOKS

1. Bond E. Carl. 1979. *Biology of Fishes*, Saunders.
 2. Halver JE. 1972. *Fish Nutrition*. Academic Press.
 3. Hoar WS and Randall DJ. 1970. *Fish Physiology*, Vol. I-IX, Academic Press, New York.
 4. Lagler KF, Bardach, JE, Miller, RR, Passino DRM. 1977. *Ichthyology*, 2nd Ed. John Wiley & Sons, New York.
 5. Lovell J. 1989. *Nutrition and Feeding of Fish*. Van Nostrand Reinhold, New York.
 6. Moyle PB and Joseph J. Cech Jr. 2004. *Fishes: An Introduction to Ichthyology*. 5th Ed. Prentice Hall.
 7. Nikolsky GV. 1963. *Ecology of Fishes*, Academic Press.
 8. Norman JR and Greenwood PH. 1975. *A History of Fishes*, Halsted Press.
 9. Potts GW and Wootten RJ. 1984. *Fish Reproduction: Strategies and Tactics*, Academic Press.
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II SEMESTER
Course No.: 4 -Biology of Fin Fish & Shellfish
credits :3

Course outcomes:

1. Gain Knowledge of feeding habits, gut content analysis and growth factors in fishes.
2. Understand the commercial importance of crustaceans and Fish
3. Understand and learn breeding in fishes, breeding habits, method of induced breeding in fishes.
4. To create awareness on parental care of Fishes and embryonic and larval development and environmental factors affecting development of major aquaculture organisms.
5. Acquire knowledge about Endocrine system in fishes.

SYLLABUS

UNIT- I: Specialised organs in fish

- 1.1 Sense organs of fishes and crustaceans .
- 1.2 Specialized organs in fishes – electric organ, venom and toxins
- 1.3 Buoyancy in fishes- swim bladder and mechanism of gas secretion
- 1.4 Fish and Crustaceans of commercial importance

UNIT- II: Food, Feeding and Growth

- 2.1 Natural fish food, feeding habits, feeding intensity, stimuli for feeding, utilization of food, gut content analysis, forage ratio
- 2.2 Principles of Age and growth determination; growth regulation, Growth rate measurement – scale method, otolith method, skeletal parts as age indicators
- 2.3 Length-frequency method, age composition, age-length keys, absolute and specific growth, back calculation of length and growth, annual survival rate,
- 2.4 Length-weight relationship.

UNIT- III: Reproductive Biology

- 3.1 Breeding in fishes, breeding places, breeding habits & places, breeding in natural environment and in artificial ponds, courtship and reproductive cycles
- 3.2. Induced breeding in fishes
- 3-3 Breeding in shrimp, oysters, mussels, clams, pearl oyster, pila, and cephalopods.

UNIT- IV: Development

- 4.1. Parental care in fishes, ovo-viviparity, oviparity, viviparity, nest building and brooding
- 4.2 Embryonic and larval development of fishes
- 4.3 Embryonic and larval development of shrimp, crabs and molluscs of commercial importance
- 4.4 Environmental factors affecting reproduction and development of cultivable aquatic fin & shell fish

UNIT- V: Hormones & Growth.

- 1.1 Endocrine system in fishes.
- 1.2 Neuro-secretory cells, androgenic gland, ovary, chromatophores,
- 1.3 Molting, molting stages, metamorphosis in crustacean shell fish

II SEMESTER
Course No.: 4 -Biology of Fin Fish & Shell Fish
credits :1

1. Length-weight relationship of fishes
2. Gut content analysis in fishes and shrimp
3. Mouth parts and appendages of cultivable prawns, shrimps and other crustaceans
4. Study of eggs of fishes, shrimps, prawns and other crustaceans
5. Study of oyster eggs
6. Embryonic and larval development of fish
7. Study of gonadal maturity and fecundity in fishes and shellfish
8. Observation of crustacean larvae
9. Study of nest building and brooding of fishes

PRESCRIBED BOOK(S)

1. Bone Q et al., 1995. Biology of fishes, Blackie academic & professional, LONDON.
2. Saxena AB 1996. Life of Crustaceans. Anmol Publications Pvt.Ltd., New Delh

REFERENCES:

1. Tandon KK & Johal MS 1996. Age and Growth in Indian Fresh Water Fishes. Narendra Publishing House, New Delhi.
2. Raymond T et al., 1990. Crustacean Sexual Biology, Columbia University Press, New York
3. Guiland J.A (ed) 1984. Penaeid shrimps- Their Biology and Management. 1.18Barrington FJW 1971. Invertebrates: Structure and Function.ELBS
4. 1.19Parker F & Haswell 1992. The text book of Zoology, Voll. Invertebrates (eds. Marshal AJ & Williams). ELBS & Mc Millan & Co.

ANDHRA KESARI UNIVERSITY-ONGOLE, PRAKASAM DISTRICT
Single Major Programme from the Year 2023-24 Onwards
Programme- B.Sc. Aquaculture Honours -Question Paper model,
First Year-Semester-1

Course 1 – Introduction to Classical Biology

Time: 3 Hours

Total Marks: 75

Section –A

Answer any Five of the following

Draw Labell diagrams wherever necessary

5X5=25 Marks

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

Section –B

Answer any Five of the following

Draw Labell diagrams wherever necessary

5x10=50 Marks

- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.
- 20.

ANDHRA KESARI UNIVERSITY-ONGOLE, PRAKASAM DISTRICT
Single Major Programme from the Year 2023-24 Onwards
Programme- B.Sc. Aquaculture Honours -Question Paper model,
First Year-Semester-1
Course 2 – Introduction to Applied Biology

Time: 3 Hours

Total Marks: 75

Section –A

Answer any Five of the following

Draw Labell diagrams wherever necessary

5X5=25 Marks

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

Section –B

Answer any Five of the following

Draw Labell diagrams wherever necessary

5x10=50 Marks

- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.
- 20.

ANDHRA KESARI UNIVERSITY-ONGOLE, PRAKASAM DISTRICT
Single Major Programme from the Year 2023-24 Onwards
Programme- B.Sc. Aquaculture Honours -Question Paper model,
First Year-Semester-2

Course 3 – Taxonomy & Functional Anatomy of Fin Fish and Shellfish

Time: 3 Hours

Total Marks: 75

Section –A

Answer any Five of the following

Draw Labell diagrams wherever necessary

5X5=25 Marks

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

Section –B

Answer any Five of the following

Draw Labell diagrams wherever necessary

5x10=50 Marks

- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.
- 20.

ANDHRA KESARI UNIVERSITY-ONGOLE, PRAKASAM DISTRICT

Single Major Programme from the Year 2023-24 Onwards
Programme- B.Sc. Aquaculture Honours -Question Paper model,
First Year-Semester- 2

Course 4 – Biology of Fin Fish & Shell fish

Time: 3 Hours

Total Marks: 75

Section –A

Answer any Five of the following

Draw Labell diagrams wherever necessary

5X5=25 Marks

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

Section –B

Answer any Five of the following

Draw Labell diagrams wherever necessary

5x10=50 Marks

- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.
- 20.