

Govt. Degree College Baramulla

Syllabus of Zoology for U.G 6<sup>th</sup> Semester (Major/Minor)

Course Title: Cell Biology and Molecular Biology

Total Credits: 6 (4 T +2 P)

Maximum Marks: 150 (100T+50P)

Course Code:

**Learning Objectives:** The learning objectives for this syllabus aim to provide students with a comprehensive understanding of cell biology and molecular biology principles. By the end of the course, students should be able to explain the structural features and functions of cells, describe the processes of cell division, DNA replication, transcription, translation, and post-translational modifications, and analyze the regulation of gene expression and cell signaling pathways in both prokaryotic and eukaryotic organisms.

**Course outcome:** Understanding of the properties and functions of cells, their components, multiplications, and molecular regulations.

Unit No.	Unit Name	Credits Allotted
1	<b>Cell Biology I</b> 1.1. Cell theory, fluid mosaic model and Membrane transport (General Account) 1.2. Structure and functions: Nucleus, Mitochondria, ribosomes. 1.3. Structure and functions: Endoplasmic reticulum, Golgi complex, Lysosome, and peroxisome. 1.4. Cytoskeleton.	16 hours
2	<b>Cell Biology II</b> 2.1 Cell Division and Cell Cycle-Mitosis and Meiosis 2.2 Regulation of cell cycle. 2.3 Signaling molecules, Signaling Receptors and modes of cell-cell signaling. 2.4 Signal transduction pathways: MAP kinase and JAK/STAT pathways	16 hours
3	<b>Molecular Biology I</b> 3.1 DNA structure and types of RNA. 3.2 Replication in prokaryotes and eukaryotes 3.3 Detailed Mechanism of Transcription. 3.4 Post transcriptional modifications in eukaryotes.	16 hours
4	<b>Molecular Biology II</b> 4.1 Genetic code and structure of tRNA. 4.2 Translation in prokaryotes and eukaryotes. 4.3 Post translational Modifications. 4.4 Concept of operon: lac operon.	16 hours

### Practical ( 2 Credits)

1. Study of cell organelles from slides/models.
2. Squash preparation of onion root tip for mitosis.
3. Preparation of temporary stained mount of the Insect testis for various meiotic stages
4. Study of chromosome structure and aberrations from permanent slides/models.
5. Quantitative estimation of DNA/RNA.
6. DNA extraction from blood or body fluid
7. Identification of Mitochondria from chick epithelium using Geimsa Stain.
8. Dry Lab or Virtual demonstration of protein synthesis and lac-operon concept of gene regulation.
9. Visit to cell and molecular biology lab at SKAUST/ Kashmir University.

### Suggested readings

1. Albert, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., and Walter, P. (2022). *Molecular Biology of the Cell* (7th edition). W. W. Norton & Co Inc.
2. Gupta, P. K. (2017). *Cell and Molecular Biology* (5th edition). Rastogi Publications.
3. Karp, G. (2020). *Cell and Molecular Biology* (9th edition). John Wiley & Sons Inc.
4. Lodish, H., Berck, A., Kaiser, C. A., Krieger, M., Scott, M. P., Bretscher, A., Ploegh, H., and Matsudaira, P. (2016). *Molecular Cell Biology* (8th edition). W. H. Freeman.
5. Verma, P. S., and Agarwal, P. S. (2021). *Cell Biology, Cytology, Biomolecules and Molecular Biology*. S. Chand and Company Ltd.
6. Klug, W. S., Cummings, M. R., Spencer, C. A., Palladino, M., and Killian, D. (2019). *Concepts of Genetics* (11th edition). Pearson Education
7. Krebs, J. E., Goldstein, E. S., and Kilpatrick, S. T. (2017). *Lewin's Genes XII*. Jones & Bartlett Publishers.
8. **The Virtual Fly Lab, California State University at Los Angeles, on the World Wide Web at**  
<http://vflylab.calstatela.edu/>

**Govt. Degree College Baramulla**

**Syllabus of Zoology for U.G 6<sup>th</sup> Semester (Major)**

**Course code:**                      **Total Credits: 6 (4 T +2 P)**                      **Maximum Marks: 150 (100T+50P)**

**Course Title: General and Applied Ichthyology**

**Learning objectives:** The learning objectives for this syllabus aim to equip students with a thorough understanding of fish classification, anatomy, and physiology. By the end of the course, students will be able to classify fish taxa accurately and comprehend the anatomical structures and physiological processes involved in digestion, respiration, excretion, reproduction, and sensory perception in fish species.

**Course outcomes:** In the course "Introduction to Fish Classification," students will learn to categorize fish within the super class Pisces and distinguish between Elasmobranchs, Actinopterygii, and Dipnoi based on their unique characteristics.

Through "Fish Anatomy and Physiology" segments, students will grasp the intricacies of fish anatomy and physiology, including digestion, respiration, excretion, reproduction, and sensory perception, providing a comprehensive understanding of how fish function and adapt to their aquatic environments. They will also explore locomotion mechanisms and the significance of skeletal structures in fish movement.

Unit No.	Name of the Topic	Lectures Allotted
1	<b>Introduction to Fish Classification</b> 1.1. General characters and outline classification of super class Pisces. 1.2. Classification and general characters of Elasmobranchs/ Chondrichthyes:Sharks and Rays. Holocephali 1.3. Classification and general characters of Actinopterygii /Ray finned fishes. 1.4. Classification and general characters of Dipnoi (lung fishes) with specialized characters.	<b>(16 Hrs)</b>
2	<b>Fish Anatomy and Physiology-I</b> 2.1 Digestive system and physiology of digestion 2.2 Structure and function of gills, Mechanism of Respiration 2.3 Structure and function of kidneys (Excretion and Osmoregulation) 2.4 Air bladder: Origin, Development, types of air bladder, functions.	<b>(16 Hrs)</b>
3	<b>Fish Anatomy and Physiology-II</b> 3.1 Reproductive organs in fishes (Teleost) 3.2 Structure and function of endocrine organs 3.3 Structure and function of nervous system (Teleost) 3.4 Sense organs and their function	<b>(16 Hrs)</b>

4	<p><b>Unit IV: Skeleton and Movement</b></p> <p>4.1 Endoskeleton in fishes: Axial Skelton (Typical trunk vertebrae and caudal vertebrae); Appendicular skeleton (girdles)</p> <p>4.2 Structure and significance of Weberian ossicles</p> <p>4.3 Musculature in fish; Coloration in Fishes.</p> <p>4.4 Locomotion in fishes</p>	<b>(16 Hrs)</b>
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**Practical (Credits 2)**

1. Identification and classification of fresh water and marine fishes with the help of already preserved specimens/ ICT tools/Charts/Models/ Photographs.
2. Study of accessory respiratory organs in fishes with the help of ICT tools/ Charts/Model's/Photographs.
3. To study the general anatomy of fish
4. Study and mounting of scales of fishes (Carp, Schizothorax and Scoliodon)
5. Study of fish scales and determination of age
6. Identification of various stages of fry and fingerlings of major carps.
7. External characters and dissection of fish for internal anatomy: Structure of alimentary canal, gill rakers (Carp/or any other available fish).
8. Visit to fish farm.

**Books Recommended for General and Applied Ichthyology**

1. A Textbook of Fish Biology & Fisheries by S S Khanna and H R Singh (Narendra Publishing House)
2. Ichthyology: Lagler, K. F., Bardach, J. and Miller, R. (1977) John Wileys and sons.
3. An aid to the identification of common commercial fishes of India and Pakistan: Mishra K.S. (1982)
4. Fish and fisheries of India: Jhingran, V.G. (1985) Hindustan Publication Company, New Delhi.
5. An introduction to fishes: S.S. Khanna Central Book Depot, Allahabad.
6. General and Applied Ichthyology (fish and fisheries) S.K. Gupta, P.C. Gupta. S. Chand Publication
7. Biology of Fishes by Q. Bone and R. Moore (Taylor & Francis)
8. The Physiology of Fishes by D.H. Evans, J.B. Claiborne and S. Currie (CRC press)
9. Fishes: An Introduction to Ichthyology by Peter B. Moyle and Joseph J. Cech Jr. (Prentice Hall India Learning Private Limited)
10. An Introduction to fishes by G.S. Sandhu (Campus Books International)
11. Fish and Fisheries by B.N. Yadav (Daya Publishing House)
12. Fish and Fisheries by K. Pandey and J.P. Shukla (Rastogi Publication)

**Govt. Degree College Baramulla**

**Syllabus of Zoology for U.G 6<sup>th</sup> Semester (Major)**

**Total Credits: 6 (4+2)**

Course Code

**Maximum Marks: 150 (100+50)**

**Course Title: Evolution and Animal Behavior**

**Learning Objectives:**

Students will examine a broad spectrum of animal behavior encompassing concepts like territoriality, habitat selection, foraging strategies, biological rhythms, migration patterns in aquatic and avian species, as well as social behaviors such as habituation, aggression, and communication through various sensory modalities. They will also study the evolutionary processes shaping these behaviors, including classic theories like Lamarckism and Darwinism, as well as the modern synthetic theory of evolution. This exploration extends to understanding adaptive radiation, different patterns of evolution, and the driving forces behind evolutionary change such as mutation, selection, and genetic drift.

**Course outcome:**

Upon completing the course, students will have acquired a solid foundation in animal behavior and organic evolution, enabling them to comprehend and analyze complex behaviors and evolutionary processes across different species. Furthermore, students will gain practical knowledge of research methodologies used in the study of animal behavior and evolution, including field observations, experimentation, and data analysis.

Unit No.	Unit Name	Credits Allotted
1	<b>Animal Behavior I</b> 1.1 Home range, territoriality, dispersal & habitat selection 1.2 Food selection and optimal foraging theory 1.3 Biological rhythms 1.4 Migration in fishes and birds.	16 hours
2	<b>Animal Behavior II</b> 2.1 Habituation, Conditioning and Aggression 2.2 Communication in animals: auditory, visual, chemical and tactile. 2.3 Evolution of Sex and Reproductive Strategies. 2.4 Courtship, Mating Systems, Sexual Selection and Sperm Competition	16 hours
3	<b>Organic Evolution I</b> 3.1 Theories of Evolution: Origin of Life; Historical review of evolutionary concept- Lamarckism, Darwinism (Natural, Sexual and Artificial selection). 3.2 Modern synthetic theory of evolution.	16 hours

	3.3 Adaptive radiation- Patterns of evolution (Divergence, Convergence, Parallel and Co-evolution). 3.4 Forces of evolution- mutation, selection, migration, and genetic drift.	
4	<b>Organic Evolution II</b> 4.1 Direct evidence of evolution: Types of fossils; Incompleteness of fossil record; Dating of fossils. 4.2 Evolution of horse- <i>Eohippus</i> , <i>Mesohippus</i> , <i>Merychippus</i> and <i>Equus</i> . 4.3 Species concept - Biological species concept; Advantages and Limitations. 4.4 Modes of speciation –Allopatric and Sympatric; Species extinction: Mass extinction - Causes and names of five major extinctions.	16 hours

#### **PRACTICAL (Credits 2)**

- 1 To study nests and nesting habits of birds and social insects.
- 2 To study the behavioral responses of wood lice to dry and humid conditions.
- 3 To study geotaxis behavior in earthworm.
- 4 To study the phototaxis behavior in insect larvae.
- 5 Study of homology and analogy from suitable specimens- Forelimbs of vertebrates; wings in animals; Prawn appendages - serial homology.
- 6 Study and verification of Hardy-Weinberg equilibrium by Chi-square analysis.
- 7 Graphical representation and interpretation of data of height/ weight of sample of 100 humans in relation to their age and sex.
- 8 Visit to Forest/ Wildlife Sanctuary/Biodiversity Park/Zoological Park to study behavioral activities of animals and prepare a short report.

#### **Suggested Readings**

1. An introduction to Animal Behavior by Manning and Dawkins, Cambridge University Press
2. Animal Behavior- an Evolutionary Approach by John Alcock Sinauer Associates, Inc Publishers Sunderland, Massachusetts
3. Animal Behavior by Anbery.
4. Animal Behavior by M.P. Arora Himalaya Publishing House
5. Essential Animal Behavior by Graham Scott
6. Mechanism of Animal Behavior by Peter Marker and J. Hamilton, Jhon Wiley & Sons USA
7. Principles and Animal Development by S.C. Goel
8. Animal Behavior by Barret Adkins; Library Press, USA.