

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**M.Sc. ZOOLOGY 1st SEMESTER (2024-25)**

***CORE-1: BIOSYSTEMATICS & NATURAL RESOURCE MANAGEMENT***

**Learning outcomes:**

By the completion of this course student can able to  
Get knowledge on bio systematic and natural resource management  
Analyze diversity of animals.  
Identify different animal species  
Generalize National legislation for protecting biological resources

***UNIT-I***

- 1.0. Definition and basic concepts of biosystematics and taxonomy
  - 1.1. Historical resume of Systematics
  - 1.2. Importance and applications of biosystematics in biology
  - 1.3. Material basis of biosystematics–different attributes

***UNIT-II***

- 2.0. Trends in biosystematics–concepts of different conventional and aspects
  - 2.1. Chemotaxonomy
  - 2.2. Cyto taxonomy
  - 2.3. Molecular taxonomy
- 3.0. Molecular perspective on the conservation of diversity
  - 3.1. Diversity and ecosystem process: Theory, achievements and future directions

***UNIT-III***

- 4.0. Dimensions of speciation and taxonomy characters
  - 4.1. Dimensions of speciation-types of lineage changes, production of additional Lineage
  - 4.2. Species concepts–species category, different species concepts :sub-species and Other infra Specific categories
  - 4.3. Theories of biological classification, hierarchy of categories
  - 4.4. International Code of Zoological Nomenclature(ICZN)–its operative principles, Interpretation and Application of important rules, Zoological nomenclature, Formation of scientific names of various Taxa

***UNIT-IV***

- 5.0. Natural resource management
  - 5.1. Classical concepts of biogeography–continental drift, endemism, refugia, bio Geographical regions of India and their salient features
  - 5.2 Concepts of natural resources–renewable and non-renewable resources, Over exploitation of Resources- deforestation, water table depletion and land Degradation
  - 5.3 Environmental Impact Assessment-principle ,scope and purpose ,major Conservation movements in India.
  - 5.4 National legislations for protecting biological resources – Biodiversity Act, 2002 And Biodiversity Rules, 2004

### **Suggested Reading Material:**

1. **M. Kato** - *The Biology of Biodiversity*, Springer.
2. **J.C. Avise** - *Molecular Markers, Natural History, and Evolution*, Chapman & Hall, New York.
3. **E.O. Wilson** - *Biodiversity*, Academic Press, Washington.
4. **G.G. Simpson** - *Principles of Animal Taxonomy*, Oxford IBH Pub. Co.
5. **E. Mayer** - *Elements of Taxonomy*.
6. **E.O. Wilson** - *The Diversity of Life (The College Edition)*, W.W. Norton & Co.
7. **B.K. Tikadar** - *Threatened Animals of India*, ZSI Publication, Calcutta

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**  
**M.Sc. ZOOLOGY**  
**I SEMESTER PRACTICAL SYLLABUS**

**CORE-1: BIOSYSTEMATICS & NATURAL RESOURCE MANAGEMENT LAB**

1. Identification and enumeration of zooplanktons and their ecological significance.
2. Enumeration of the diversity (plants and animals), their use, and management in a community or nearby place.
3. A practical approach to biosystematics and taxonomy.
4. Examples representing different taxa in the order of evolution.
5. Molecular perspective of diversity – Identification of species by molecular methods and separation of proteins with examples.
6. Methods of collection, preservation, and identification of plankton and representative forms of terrestrial and aquatic fauna

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM  
M.SC. ZOOLOGY**

**I SEMESTER (2024-25)  
CORE-2: MOLECULAR CELL BIOLOGY**

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***Learning Outcomes:***

***By the completion of this course, students will be able to:***

- ***Gain knowledge of molecular cell biology.***
- ***Understand cell structure and cell signaling processes.***
- ***Recognize the mechanisms of the cell cycle.***
- ***Analyze the genetic code for different amino acids.***

***UNIT-I***

- 1.0 Introduction: Experimental systems in Cell Biology
- 2.0 Bio-membranes
  - 2.1 Molecular composition and arrangement, functional consequences
  - 2.2 Transport across the cell membrane: diffusion, active transport, pumps, uniports, symports, and antiports
  - 2.3 Membrane potential
  - 2.4 Co-transport by symporters or antiporters
  - 2.5 Transport across epithelia: transport of macromolecules

***UNIT-II***

- 3.0 Cell-Cell Signaling
  - 3.1 Cell surface receptors
  - 3.2 Second messenger systems
  - 3.3 MAP kinase pathways
  - 3.4 Apoptosis: Definition, mechanism, and significance
- 4.0 Cell-Cell Adhesion and Communication
  - 4.1 Ca<sup>++</sup>-dependent homophilic cell-cell adhesion
  - 4.2 Ca<sup>++</sup>-independent homophilic adhesion
  - 4.3 Gap junctions and connections, integrins, and collagens

***UNIT-III***

- 5.0 Cell Cycle
  - 5.1 Cyclins and Cyclin-dependent kinases (CDKs)
  - 5.2 Regulation of CDK-Cyclin activity
- 6.0 Functional Biology of Nucleic Acids
  - 6.1 Morphological and functional elements of eukaryotic chromosomes
  - 6.2 Protein synthesis and transcription in prokaryotes and eukaryotes
  - 6.3 Post-transcriptional processing
  - 6.4 DNA replication: semi-conservative mechanism, enzymology of DNA replication
  - 6.5 Replication of circular DNA, initiation, elongation, termination, and proofreading

***UNIT-IV***

- 7.0 Intracellular Protein Traffic

- 7.1 Membrane proteins, Golgi sorting, and post-translational modifications
- 7.2 Biogenesis of mitochondria and nuclei
- 7.3 Trafficking mechanisms
- 7.4 Regulation of the genetic code: Wobble's concept, translation in prokaryotes *and eukaryotes*

#### ***ADDITIONAL INPUTS***

1. Chromosomal organization of genes and non-coding DNA
2. DNA repair mechanisms:
  - High fidelity of DNA sequence
  - Repair of damage caused by UV light
  - Eukaryotic repair systems

#### **Suggested Reading Material:**

1. **Molecular Cell Biology** by J. Darnell, H. Lodish, and D. Baltimore, Scientific American Book Inc., USA.
2. **Molecular Biology of the Cell** by B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts, and J. D. Watson, Garland Publishing Inc., New York

### **GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM M.Sc. ZOOLOGY**

I SEMESTER PRACTICAL SYLLABUS CORE-2:

#### **MOLECULAR CELL BIOLOGY LAB**

- Light microscopic examination of tissues
- Preparation of different cell types:
  - Hepatic parenchymal cells
  - Adipocytes
  - Macrophages
  - Neuronal cells
  - Epithelial cells
- Stages of Mitosis and Meiosis
- Squash preparation
- Estimation of DNA & RNA

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

## **M.Sc. ZOOLOGY**

I SEMESTER (2024-25)

### **CORE-3: GENERAL AND COMPARATIVE PHYSIOLOGY**

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#### ***Learning Outcomes:***

By the completion of this course, students will be able to:

- Gain knowledge of general and comparative physiology.
- Understand concepts of osmoregulation, thermoregulation, and the homoeothermic and poikilothermic nature of animals.
- Compare various physiological processes in different animals.
- Generalize physiological adaptations of animals to different environments.

#### ***UNIT-I***

- 1.1 Aims and scope of Comparative Physiology
- 1.2 Muscle structure and properties, molecular basis of muscle contraction, sliding filament theory
- 1.3 filament theory
- 1.4 Nerve structure, nerve impulse, ionic basis of resting and action potentials
- 1.5 Synaptic transmission and neurotransmitters
- 1.6 Blood coagulation – Factors affecting coagulation

#### ***UNIT-II***

- 1.1 Osmoregulation in aquatic and terrestrial environments, mechanism of ionic regulation
- 1.2 Thermoregulation
- 1.3 Homoeothermic animals
- 1.4 Poikilotherms
- 1.5 Hibernation and aestivation

#### ***UNIT-III***

- 1.1 Respiratory organs and respiratory pigments across different phylogenetic groups; mechanisms of O<sub>2</sub> and CO<sub>2</sub> uptake
- 1.2 Circulation of fluids and their regulation
- 1.3 Comparative physiology of digestion and absorption of carbohydrates and proteins
- 1.4 Patterns of excretion among different animal groups
- 1.5 Receptor physiology – Comparative study

#### ***UNIT-IV***

- 1.1 Physiological adaptations of animals to different environments
- 1.2 Freshwater environment
- 1.3 Terrestrial environment
- 1.4 Yoga, meditation, and their physiological effects

#### ***Additional Inputs:***

- Twitch summation, tetanus, and fatigue
- Mechanoreceptors

- Chemoreceptors
- Marine environment
- Shores and estuaries

***Suggested Reading Material:***

1. *Eckert, R. Animal Physiology: Mechanisms and Adaptation, W.H. Freeman and Company, New York.*
  2. *Hochachka, P.W. and Somero, G.N. Biochemical Adaptation, Princeton, N.J.*
  3. *Hoar, W.S. General and Comparative Animal Physiology, Prentice Hall of India.*
  4. *Schmidt-Nielsen. Animal Physiology: Adaptation and Environment, Cambridge.*
  5. *Stam, F.L. Physiology: A Regulatory Systems Approach, Macmillan Publishing Co., New York.*
  6. *Plummer, L. Practical Biochemistry, Tata McGraw-Hill.*
  7. *Prosser, C.L. and Brown. Comparative Animal Physiology.*
  8. *Wilson, K. and Walker, J. Practical Biochemistry.*
  9. *Willmer, P., Stone, G., and Johnson, I. Environmental Physiology, Blackwell Science, Oxford, U.K., 944p.*
  10. *Newell, R.C. (ed.) Adaptation to Environment: Essays on the Physiology of Marine Animals, Butterworths, London, U.K., 539pp.*
- Townsend, C.R. and Callow, P. Physiological Ecology: An Evolutionary Approach to Resource Use, Blackwell Science Publication, Oxford*

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM  
M.Sc. ZOOLOGY  
I SEMESTER PRACTICAL SYLLABUS  
CORE-3: GENERAL AND COMPARATIVE PHYSIOLOGY LAB

1. Metabolic rate of fish
2. Digestive enzymes
3. Oxygen consumption vs. temperature
4. Oxygen consumption vs. body weight
5. Osmotic regulation
6. Ion concentration measurements
7. Spotters
8. Effect of starvation on glycogen levels in fish/crab
9. Estimation of levels of lactic acid and amino acid

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**  
**M.Sc. ZOOLOGY**  
**I SEMESTER – 2024-25**  
**SEC-1 (A): TOOLS, TECHNIQUES AND RESEARCH BIOLOGY**

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**Learning Outcomes:**

By the completion of this course, students will be able to:

- Gain knowledge on tools, techniques, and research biology.
- Understand principles and uses of analytical instruments.
- Explore employability opportunities in labs.

**UNIT-I**

**1.0 Principles and uses of analytical instruments**

- 1.1 pH meter
- 1.2 Spectrophotometer
- 1.3 Ultra-centrifuge
- 1.4 Radioactivity counter
- 1.5 NMR Spectrophotometer

**2.0 Separation techniques in Biology**

- 2.1 Molecular separation by chromatography and electrophoresis
- 2.2 Auto-radiography

**UNIT-II**

**3.0 Microscopy**

- 3.1 Principles of light, dark field, phase contrast, fluorescence, transmission electron, scanning electron microscopes

**4.0 Microbiological techniques**

- 4.1 Media preparation & sterilization techniques in microbial culture
- 4.2 Inoculation & growth monitoring
- 4.3 Fermentation, types of fermenters, uses of fermenters
- 4.4 Biochemical mutants & their uses

**UNIT-III**

**5.0 Cell culture techniques**

- 5.1 Introduction to animal cell culture
- 5.2 Culture media types
- 5.3 Laboratory facilities
- 5.4 Substrate on which cells grow
- 5.5 Treatment of substrate surfaces
- 5.6 Feeder layer

**UNIT-IV**

**6.0 Research, Experiment, and Sampling Design**

- 6.1 Research – basic and applied research, essential steps in research
- 6.2 Research – definition, importance, and applications
- 6.3 General methods in biological research – natural observation, field study, and experimentation

### **Collection, Analysis, and Interpretation of Data**

7.0 Data collection methods for primary data – observation, interview, questionnaires, methods, and experiments

7.1 Methods for secondary data – scientific journals, books, reports, databases

### **Suggested Reading Material:**

1. Animal Cell Culture – A Practical Approach, Ed. John R.W. Masters, IRI Press
2. Introduction to Instrumental Analysis, Robert Braun, McGraw Hill International Editions
3. A Biologist's Guide to Principles and Techniques of Practical Biochemistry, K. Wilson & K.H. Goulding, ELBS Edn.
4. Caughley, G., and A. Gunn. 1996. *Conservation Biology in Theory and Practice*, Blackwell Science, Cambridge, Massachusetts, U.S.A.
5. Cox, G.W. 2005. *Conservation Biology: Concepts and Applications*, McGraw-Hill, Dubuque, Iowa, U.S.

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM  
M.Sc. ZOOLOGY  
I SEMESTER - PRACTICAL SYLLABUS  
SEC-1 TOOLS, TECHNIQUES AND RESEARCH BIOLOGY LAB

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1. Spectrophotometer – Estimation of biomolecules
2. Centrifugation – Demonstration and working
3. Separation Techniques – Paper chromatography
4. Electrophoresis – Demonstration and usage
5. Demonstration and working of:
  - a) Atomic Absorption Spectrophotometer
  - b) High Pressure Liquid Chromatography
  - c) ELISA Reader
  - d) Liquid Scintillation Counter
6. pH Meter – Preparation of Phosphate buffer
7. Microscope –
  - a) Demonstration of oil immersion – WBC & RBC
  - b) Preparation of tissue for SEM & TEM procedure
8. Cell Culture –
  - a) Preparation of media
  - b) Inoculation

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM M.SC. ZOOLOGY –  
IV SEMESTER 2024-26  
SEC-2 METABOLIC CELL FUNCTION AND REGULATION**

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Learning outcomes:

By the completion of this course, students will be able to:

- Gain knowledge on basic concepts of cell function and regulation
- Understand the basic principles of thermodynamics
- Classify different types of enzymes
- Generalize the process of immobilization

**UNIT-I**

1. Thermodynamic principles and steady-state conditions of living organisms
  - 1.1. Organization and methods to study metabolism
2. Degradation of glucose, palmitic acid, phenylalanine

**UNIT-II**

3. Energy metabolism and high energy compounds
  - 3.1. Redox potentials
  - 3.2. Mitochondrial electron transport chain
  - 3.3. Oxidative phosphorylation
4. Biosynthesis of Urea, Glucose, Glycogen, Oleic acid, and Prostaglandins

**UNIT-III**

5. Nature of Enzymes
  - 5.1. Classification and nomenclature of enzymes
  - 5.2. Kinetic analysis of enzyme-catalyzed reactions

**UNIT-IV**

6. Metabolic profile of adipose, neural, hepatic, and muscle tissues
7. Metabolic Engineering
8. Immobilized enzymes and their applications

**Suggested Reading Material:**

1. Voet, D. and J.G. Voet. Biochemistry. J.Wiley & Sons
2. Foster, R.L. Nature of Enzymology
3. Lodish et al. Molecular Cell Biology
4. Annual Reviews of Biochemistry
5. Garrett and Grisham. Biochemistry

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM  
M.Sc. ZOOLOGY IV SEMESTER PRACTICAL SYLLABUS

Z401 - Metabolic Cell Function and Regulation Lab

- 1.ENZYME KINETICS
- 2.DEHYDROGENASE
- 3.LACTIC ACID ESTIMATION
- 4.PROTEIN, GLUCOSE, LIPID ESTIMATION
- 5.DNA&RNA ESTIMATION
- 6.TRANSAMINASE

