# DEPARTMENT OF ZOOLOGY

**PERIYAR UNIVERSITY**

**PERIYAR PALKALAI NAGAR**

**SALEM – 636 011**

SYLLABUS FOR

**M.Sc., Zoology Degree Course under**
**Choice Based Credit System (CBCS)**
**With effect from the Academic Year 2012 onwards**

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course Scheme
***(With effect from the Academic Year 2012-2013 onwards)***

| Subject Code | Title of the Paper | Weekly Contact Hours | Credits | Internal Marks | External Marks | Total Marks |
|---|---|---|---|---|---|---|
| **SEMESTER-I** | | | | | | |
| 12 ZOO C01 | Functional Morphology of Invertebrates & Chordates | 5 | 4 | 25 | 75 | 100 |
| 12 ZOO C02 | Cell and Molecular Biology | 5 | 4 | 25 | 75 | 100 |
| 12 ZOO C03 | Genetics | 5 | 4 | 25 | 75 | 100 |
| 12 ZOO C04 | Biochemistry | 5 | 4 | 25 | 75 | 100 |
| 12 ZOO P01 | Lab Course-I (Covering core I-IV) | 5 | 3 | 40 | 60 | 100 |
| 12 ZOO E01 | Microbiology | 5 | 4 | 25 | 75 | 100 |
| | **Total** | **30** | **23** | | | |
| **SEMESTER-II** | | | | | | |
| 12 ZOO C05 | Animal Physiology & Animal Behaviour | 5 | 4 | 25 | 75 | 100 |
| 12 ZOO C06 | Developmental Biology | 5 | 4 | 25 | 75 | 100 |
| 12 ZOO C07 | Impact of Climate Change on Biodiversity | 5 | 4 | 25 | 75 | 100 |
| 12 ZOO P02 | Lab Course-II (Covering core VI-VIII) | 5 | 3 | 25 | 75 | 100 |
| 12 ZOO E02 | Economic Zoology | 5 | 4 | 25 | 75 | 100 |
| 12 ZOO E03 | Bioinformatics | 5 | 4 | 25 | 75 | 100 |
| | **Total** | **30** | **23** | | | |
| **SEMESTER-III** | | | | | | |
| 12 ZOO C08 | Immunology | 5 | 4 | 25 | 75 | 100 |
| 12 ZOO C09 | Concepts of Animal Biotechnology & Nanotechnology | 5 | 4 | 25 | 75 | 100 |
| 12 ZOO C10 | Research Methodology | 5 | 4 | 25 | 75 | 100 |
| 12 ZOO C11 | Endocrinology | 5 | 4 | 25 | 75 | 100 |
| 12 ZOO P03 | Lab Course-III (Covering core X-XIII) | 5 | 3 | 40 | 60 | 100 |
| 12 ZOO E04 | Cancer and Stem Cell Biology | 5 | 4 | 25 | 75 | 100 |
| | **Total** | **30** | **23** | | | |
| **SEMESTER-IV** | | | | | | |
| 12 ZOO C12 | Environmental Biology | 5 | 4 | 25 | 75 | 100 |
| 12 ZOO C13 | Evolution | 5 | 4 | 25 | 75 | 100 |
| 12 ZOO P04 | Project work &*Viva voce* | 15 | 12 | 100 | 100<br>50+50<br>Int.+Ext | 200 |
| 12 ZOO E05 | Aquaculture and Fishery Biology | 5 | 4 | 25 | 75 | 100 |
| | **Total** | **30** | **24** | | | 2300 |

**Total weekly contact hours: 120** **Total number of credits: 93**

# PERIYAR UNIVERSITY, SALEM-636 011
# M. Sc. Degree Course in Zoology

**Rules and Regulations, Course Scheme and Scheme of Examinations governing the**
***(For those admitted in June 2012 and later)***

## I. Course objectives

**To enable the learners to**

i. learn the application of Zoological principles to the animal and human biology
ii. understand the impact of Zoology on basic human needs such as, health care, agriculture, industrial, chemical, energy etc.,
iii. know the current development in Zoological Sciences
iv. evaluate the future priorities in Zoology Research
v. know the practical areas for application of Advanced Zoological Research
vi. develop skill in the various modern bio-techniques.

## II. Eligibility for Admission

Applicants seeking admission into the M.Sc. Degree Course in Zoology should have a Bachelor's Degree in Zoology/ Biology/ Animal Science/ Human Genetics/ Microbiology with specialization in Zoology/ Wild Life Biology / Animal Biology and Animal Biotechnology/ Biotechnology with Zoology of the Periyar University or any other Degree accepted by the Syndicate of the Periyar University as equivalent thereto. They should have secured a minimum of 50% of marks in Part III of the degree course. In the case of SC/ST students, the required minimum marks for admission will be 45%.

The admission to the course will be based on the performance of the applicants in the qualifying examination as well as in the Entrance Test, if any.

## III. Duration of the Course

The duration of the course is two academic years. Each academic year consists of two semesters. The duration of a semester is 90 working days.

## IV. Registration under CBCS

Students will be supplied with registration cards (in quadruplicate) for the purpose of exercising their options for various soft-core and optional papers offered in various semesters. At the beginning of each semester, the students should register their options for soft core and optional papers for that semester in the registration card. It should be duly signed by the Head of the Parent Department and Coordinator of Academic Affairs/ Controller of Examination with the prior permission of The Head of the Institution. One copy of the registration card should be sent to the Controller of Examinations, one to Head of the Parent Department and the final copy is retained by the student himself/herself.

The major Department will enlighten the students about the soft core papers which would be of supporting nature for the study of their hard core papers. The students should select any one of the soft core and optional papers offered in the respective semesters other than the one they have already studied either as a full paper or a part thereof. The department conducting a particular soft core or optional paper will select and finalize the list of students to be admitted to that soft core or optional paper.

The number of students for each of such paper shall be decided by the Principal in consultation with the Head of the Department.

**V. Attendance**

Each student must put in a minimum attendance of 75 % for the classes in each semester so as to become eligible to appear for the Terminal Examination.

Shortage of attendance in regular classes on the part of any student not exceeding 10% below the prescribed minimum of 75% may be condoned on medical grounds. Such condonation shall be granted by the principal on merits. The application for condonation shall be accompanied by a condonation fee as prescribed by the Principal. If a student earns less than 75% attendance in his/her regular classes in a particular semester and is either ineligible for condonation of shortage of attendance or is not granted condonation then he/she shall not be permitted to appear for the Terminal examinations and he/she will have to repeat the semester.

**VI. Evaluation Procedure**

Evaluation is based on 50% Continuous Internal Assessment (CIA) and 50% Terminal Examination.

A mark statement will be issued to every student at the end of every semester. The mark statement will contain the number of credits for each paper, the mark scored by the students in the individual paper and Cumulative Weighted Average Mark (CWAM).

The CWAM will be computed as follows:

$$\text{CWAM} = \frac{\Sigma\ (\text{Marks} \times \text{Credits})}{\Sigma\ (\text{Credits})}$$

Where the summation is taken over all the papers appeared up to the current semester except the comprehension and viva voce papers.

The Cumulative Weighted Average Marks (CWAM) will be calculated by taking into account the performance of the student in all the semesters including the paper(s), in which the candidate has failed, if any.

The absentees for the Terminal Examination will be treated on par with failures.

**VII. Passing Minimum**

For a pass in each paper, a student should secure a minimum of 45% of marks in the Terminal Examination and a minimum of 50% marks in aggregate (i.e., internal and external marks put together) except for comprehension and *viva voce*.

For a pass in the Project Report and *viva voce* paper, a candidate should secure a minimum of 45% of marks in Project Report and *viva voce* separately and 50% marks in aggregate in Project report and *viva voce* put together.

There is no internal assessment for comprehension and *viva voce*. For a pass in the comprehension and *viva voce* paper, a candidate should secure a minimum of 40% of marks in the Terminal Examination.

**VIII. Eligibility Condition for Getting the Degree**

A candidate undergoing M. Sc degree course in Zoology will be eligible for the award of M. Sc Degree in Zoology, if he/she completes the entire course and passes all the examinations for the course, earning a total of 72 credits, comprising of 54 Hard core credits, 9 Soft core credits and 9 Optional credits.

**IX. Classification of Successful Candidates**

The successful candidates will be classified as per the details given in the following table:

| S.No. | RANGE OF CWAM | CLASS |
|---|---|---|
| 1. | 50 and above but below 60 | Second |
| 2. | 60 and above but below 75 | First |
| 3. | 75 and above | First Class with Distinction |

**X. Award of Ranks**

For ranking purpose, the CWAM of the students will be considered. Ranks will be given to the students to complete all papers in their first appearance and submit their project report without obtaining any extension.

**XI. Other Provisions**

Students failing in any paper in any semester must reappear for the examination in that paper and it is not necessary to repeat the course. A student who has already passed a paper will not be permitted to reappear in that paper for the purpose of improving CWAM. A student who fails to attend the examination can reappear in the subsequent Terminal Examinations. However, a student who cannot appear for the examination due to lack of attendance, can appear for the examination only after earning the required minimum attendance. Repeat Examination will be conducted for the final semester paper(s) within a month after the publication of final semester results. Hence, a student who fails in the final semester examination can appear for the above paper only in the repeat examination or the next year even semester examination.

**XII. Transitory Provision**

Candidates who have been admitted to the M.Sc. degree course in Zoology in June / July of the concern academic year and have failed in one or more papers can appear for the examinations under the syllabi which were in force at the time of their admission only up to five academic years. Thereafter, such candidates, if they have still arrears, can appear for the examination only under the revised scheme of examinations. However, the papers for which such candidates will have to appear in the revised scheme for completing the course will be decided by the Principal, in consultation with the Head of the Department concerned and the Controller of Examinations.

*Core Paper I* *Paper Code: 12 ZOO C01*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-I

**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## FUNCTIONAL MORPHOLOGY OF INVERTEBRATES AND CHORDATES

### UNIT I

Organization: Symmetry in animal organization – Asymmetry, radial, biradial and bilateral symmetry– Significance.Coelom – Evolution of coelom. Acoelomate, pseudocoelomate, coelomate groups (Enterocoel, mesenchyme) – Significance. Metamerism – corm theory, Embryological theory – Significance.Locomotion: Movement in Protozoans, Annelids, Molluscs and Echinoderms

### UNIT II

Chemical Co-ordination:Endocrine glands in Crustaceans and Insects – Pheromones and allelochemicals. Reproduction: Pattern of sexual and asexual reproduction – Invertebrate larval forms and theirphylogenic significance.Minor Phyla:Organisation and affinities of
1. Chaetognatha, 2. Rotifera, 3.Sipunculida, 4.Phoronida

### UNIT III

Chordates: Comparative study functional Morphology of vertebrates. Integumentary System: Exoskeletal structures and their modifications. Digestive System: Alimentary canal and associated glands.Respiratory System: Gill respiration in cyclostomes and fishes – Pulmonary respiration in Tetrapods

### UNIT IV

Circulatory System: Types & evolution of heart and aortic arches.Excretory System: Types & evolution of kidneys. Nervous System: Brain and spinal cord – cranial nerves, spinal nerves and visceral nerves – Autonomicnervous systems – Sympathetic – Parasympathetic

### UNIT V

Reproductive System:Reproductive systems – Accessory reproductive glands.

Vertebrate Fossils: Evolutionary significance of Ostracoderms, Placoderms, Crossopterygians, Labyrinthodonts, Dinosaurs, Archaeopteryx and Mesozoic mammals.

**REFERENCE BOOKS:**


1. Barnes RD (1982) Invertebrate Zoology.4th edition, Holt Saunders International Edition.

2. Barrington EJW (1979) Invertebrate Structure and Functions.2nd edition, ELBS and Nelson.

3. Colbert H and Edwin (1989) Evolution of the Vertebrates. 2nd edition, Wiley Eastern Limited, New Delhi.

4. Pough H, Heisher JB and McFarland WN (1990) Vertebrate Life. Macmillan Publishing Co., New York.

5. Hyman GH The Invertebrates, Vol. I to VII, McGraw Hill Book Co., Inc., New York.

6. Jollie M (1962) Chordate Morphology. Reinholt Publishing Corporation, New York.

7. Kotpal RL Minor Phyla, Rastogi Publication, Meerut, India.

8. Moore RC, Lolicker and Fischer AG (1952) Invertebrate Palaeontology, McGraw Hill Book Co., Inc., New York.

9. Kashyap V (1997) Life of Invertebrates. Vikas Publishing House Pvt.Ltd., New Delhi.

10. Waterman AJ (1971) Chordate Structure and Function. The Macmillan Company.

*Core Paper II* *Paper Code: 12 ZOO C02*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-I
**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## CELL AND MOLECULAR BIOLOGY

### UNIT I

Discovery of cell: Cell theory, protoplasm theory, prokaryotic and eukaryotic cell differentiation, Cell Cycle and regulations. Cell division: mitosis, meiosis and their significance. Cytoplasm: Physical and biological properties of cytoplasmic matrix. Plasma memberane:Chemical composition, structure and functions.

### UNIT II

Ribosome and Golgi bodies: ultrastructure, types and function. Lysosome: Chemical composition, Polymorphism and Functions. Endoplasmic reticulum and plastids. Ultrastructure, types and functions, Mitochodira: ultrastructure and functions. Micro bodies peroxisomes and glyoxisomes.

### UNIT III

Nucleus: ultra-structure of nuclear membrane. Nucleolus, Nucleoplasm and Chromatic fibres. Microtubes, microfilaments – Cilia and Flagella. Signal Transduction Pathways: organisation signals, receptors. Ion channel coupled receptors – secondary messengers. Amplifiers, Integrators and signal hypothesis.

### UNIT IV

Nucleic Acid: DNA as genetic material (direct and indirect evidences) – Structure and types of DNA and RNA. Eukaryotic Chromosome: Chromosome structure and organisation-C-value paradox DNA – repetitive DNA – Junk DNA. Mutations and DNA damage: physical, chemical and biological agents – mutation types –molecular basis of spontaneous and induced mutations. Environmental mutagenesis and toxicity testing: AMES test. DNA repair mechanisms.

**UNIT V**

**DNA** replication – semi conservative and rolling circle. Enzymes involved in replications: types and their functions. Transcription and Translation: RNA polymerase – types, properties and functions – Transcription process in prokaryotes and Eukaryotes – RNA processing, capping, polyadenylation, splicing, introns and exons.

**REFERENCE BOOKS:**


1. Alberts B, Johnson A, Lewis J, Raff M, Roberts K and Walter P (2009) Essential Cell Biology. Garland Science, New York.

2. Cooper, GM (2005) The Cell – A Molecular Biological Approaches. ASM Press, Washington.

3. De Robertis EDP and De Robertis EMF (2001) Cell and Molecular Biology. Lippincott Williams and Wilkins, USA.

4. Gupta PK (2009) Cell and Molecular Biology. Rastogi Publications, Meerut.

5. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition, John Wiley & Sons Ltd. New York.

6. Lewin B (2010) Genes XI. Oxford University Press, Oxford.

7. Pavlella P (1998) Introduction to Molecular Biology, McGraw-Hill Companies Inc., New York.

8. Roy SC and De KK (2010) Cell Biology, New Central Book Agency, Calcutta.

9. Thorpe NO (2000) Cell Biology, John Wiley and Sons, New York.

10. Turner PC McLennan AG Bates AD and White MRH (2007) Instant Notes Molecular Biology. Viva Books Pvt. Ltd., New Delhi.

11. Walker JM and Gingold EB (2010) Molecular Biology and Biotechnology. Panima Press, Oxford Publishing Co., New Delhi.

*Core Paper III* *Paper Code: 12 ZOO C03*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-I
**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## GENETICS

### UNIT I

Definition and scope of Genetics – Premendelian genetic concepts – Preformation, Epigenesis, Inheritance of acquired characters, Germplasm theory. Heredity and Environment, Genotype and Phenotype – Heredity and Variation.

### UNIT II

Physical basis of inheritance – Chromosome theory of inheritance. Chromosome types – Heterochromatin and Euchromatin and its significance. Ultrastructure of Chromosome – Karyotype and Idiogram. Special types of chromosomes – Polytene chromosomes – Salivary gland chromosomes in *Drosophila*, Lampbrush Chromosomes in amphibian Oocytes & B Chromosomes.

### UNIT III

Linkage and Sex Linkage – Coupling and repulsion hypothesis. Linkage in maize and Drosophila, Linkage groups, Complete linkage, incomplete linkage, factors affecting linkage. Crossing over – Mechanism of crossing over. Cytological theories of crossing over. Germinal and Somatic crossing over. Interference and Coincidence. Construction of genetic maps (*Drosophila* and Maize).

### UNIT IV

Chromosomal aberrations – Numerical – Euploidy (Monoploidy, Haploidy and Polyploidy) Polyploidy – Autopolyploidy and allopolyploidy. Aneuploidy – Monosomes, Nullisomes & Trisomes. Structural aberrations: Deletions, Duplications, Translocations and Inversions. Evolutionary significance of chromosomal aberrations.

**UNIT V**

Extra Chromosomal Inheritance / Cytoplasmic Inheritance – Mitochondrial DNA, Chloroplast, DNA, Kappa particles in Paramecium, Sigma factor in Drosophila. Mitochondrial diseases in Human.

**REFERENCE BOOKS:**


1. Dale JW and Park SF (2004) Molecular Genetics of Bacteria. 4th edition, John Wiley & Sons Ltd. New York.

2. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition, John Wiley & Sons Ltd. New York.

3. Snustad DP and Simmons MJ (2008) Principles of Genetics. John Wiley & Sons Ltd. New York.

4. Tamarin RH (2001) Principles of Genetics (2001) 7th edition, McGraw-Hill,New York.

*Core Paper IV* *Paper Code: 12 ZOO C04*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-I
**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## BIOCHEMISTRY

### UNIT I

General concept of Biomolecules and water. Water – unique properties, pH and buffer, chemistry of living matter. Vitamins: water soluble and fat soluble; minerals and their function. Biomolecules: proteins, carbohydrates, lipids,aminoacids and nucleic acids – structure, classification and function

### UNIT II

Enzymology and Enzyme kinetics:Enzymology: enzymes – classification, factors affecting enzyme action, mechanism of action, types of inhibition: feedback and allosteric, competitive and uncompetitive, Michaelis and Menten's equation, $V_{max}$

### UNIT III

Bioenergetics oxidation and reduction reactions: The role of ATP; Formation of ATP; Respiratory chain and oxidative phosphorylation, energy coupling reactions. Process of photosynthesis – light and dark reactions.

### UNIT IV

Carbohydrates and Lipids: Metabolism of carbohydrates – glycolysis, pyruvate oxidation, citric acid cycle, glycogen metabolism, gluconeogenesis, pentose phosphate pathway;
Lipids: Fatty acids – biosynthesis, oxidation-ketogenesis. Metabolism of Acylglycerols and sphingolipids. Cholesterol – biosynthesis, transport and excretion.

**UNIT V**

Proteins and Nucleic acids: biosynthesis of amino acids; catabolism of proteins and aminoacid nitrogen – urea biosynthesis; catabolism of carbonskeletons of amino acids. Porphyrine and Bile pigments; Nucleic acids: synthesis and degradation of purines and pyrimidines – *de nova* and salvage pathway.

**REFERENCE BOOKS:**


1. David L, Nelson M and Cox M (2005) Lehninger Principles of Biochemistry. 4th edition, W. H. Freeman and Company, New York.

2. Lehninger AL, Nelson DL and Cox MM (2009) The Principles of Biochemistry. CBS Publishers, New Delhi.

3. Moat AG and Foster JE (2008) Microbial Physiology. John Wiley & Sons, New York.

4. Stryer L (2007) Biochemistry. 4th edition, W. H. Freeman and Company, New York.

5. Voet D and Voet JG (2010) Biochemistry. 4th edition, John Wiley & Sons, New York.

*Core Paper V* *Paper Code: 12 ZOO P01*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-I

**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## LAB COURSE I

**Core I Functional Morphology of Invertebrates and Chordates**

1. Nervous system of Cockroach, Crab, Prawn
2. Nervous system of Bivalve /*Pila globosa* / Mytilus
3. General Nervous System of Rat (Neck Nerves), Fresh Water Cat Fish
4. Functional Organisation of Major Organs (Rat-heart, pancreas, liver, kidney and gonads
5. Spotters and Slide

**Core II Cell and Molecular Biology**

1. Micrometry for cell measurement
2. Identification of different types of cells in blood
3. Isolation of DNA and RNA
4. Observation of Mitosis and Meiosis (onion root tip/grasshopper testis)

**Core III Genetics**

1. Verification of Mendelian ratio using beads
2. Observation of Mendelian traits in student population
3. Blood grouping and demonstration of karyotyping
4. Study on human syndromes
5. Study on polygenic inheritance
6. Study on polytene chromosomes (Drosophila / Chironomous)

**Core IV Biochemistry**

1. Estimation of Protein
2. Determination of glucose level in blood& urine
3. Determination of amylase activity
4. Identification of amino acids by paper chromatography
5. Estimation of Vitamin C
6. Estimation of DNA and RNA

**Reference Book**


1. H.T.Plumer, 2009 Practical; Biochemistry, Wiley Publications, Inida
2. Debajit Borah, 2012. Biotechnology Lab Practices, Global Academic Publisher, India
3. S.Kannan, M.Krishnan, R.Thirumurugan, S.Achiraman. 2012. Methods in Molecular Biology, UVN Publishers, India

*Elective Paper I* *Paper Code: 12 ZOO E01*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-I

**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## MICROBIOLOGY

### UNIT I

**History and Scope of Microbiology** – Contributions of Louis Pasteur, Robert Koch, Alexander Fleming, Antony van Leewenhoek. **Bacteriology:**outline classification of bacteria;Structure andfunctions of bacterial cell organelles: cell wall, flagella and pili. Mechanism of sporulation in bacteria.**Mycology**: classification and characterization of biomedically important fungal species: *Candida, Asperigillus, Fusarium*and yeast**. Virology**: classification of virus based on structure and nucleic acid. Current scenario of Dengue, Chikungunya viruses and their biomedical importance.

### UNIT II

**Culture and Characterization:** Methods of collection of sample – methods of estimation of microorganism in soil, water and air – Isolation and identification of bacteria. Methods of sterilization and disinfection – Microbial control – Physical and chemical agents – techniques of pure culture – Method of cultivation of bacteria – Phases of growth. Acidic and Basic dyes; Classification of stains:simple and differential staining; theories of staining, mordant and its function; Gram staining; acid fast staining; endospore staining; negative staining; capsule staining; flagella staining; mechanism of Gram's staining.

### UNIT III

**Microbial Ecology:** Distribution of microorganism in soil, water and air – Environmental factors influencing the distribution of microorganism – Role of microorganisms in the cycling of nutrients – carbon, nitrogen, phosphorous and sulphur cycle. Whittaker's Five-kingdom and three-kingdom concept of living organisms (General characteristics of those groups); General features of Eubacteria and Archaebacteria (major difference within Eubacteria).

**UNIT IV**

**Food Microbiology:** Sources, types, incidence of microorganism in vegetables, meats, poultry, seafood, milk and dairy products – spoilage of food, fruits, vegetables, cereals, meat, poultry egg, seafood, caned products – Factors influencing spoilage – Methods of detection of spoilage, principles of food preservation and prevention of food spoilage

**UNIT V**

**Microbial Technology:** Genetic engineering of food and additives – Single Cell Protein (SCP) production – Production of organic acids (acetic acid), ethanol – Antibiotics – Microbial toxins – methanogenesis — Fermentation products.

**REFERENCE BOOKS:**


1. Atlas RM (2007) Principles of Microbiology. 2nd edition, McGraw-Hill.
2. Dubey RC and Maheswari DK (2011) Textbook of Microbiology. S. Chand & Co.
3. Pelczar M *et al.* (2010) Microbiology. Tata-McGraw Hill.
4. Prescott LM (2010) Microbiology. 6th edition. McGraw-Hill.
5. Salle AJ (1999) Fundamental Principles of Bacteriology. 7th edition, Tata- McGraw Hill.
6. Stanier RY *et al.* (2009) General Microbiology. 5th edition, Macmillan Press.
7. Subba Rao NS (2000) Soil Microbiology. 4th edition, Oxford & IBH Publ Co. Pvt. Ltd.

*Core Paper VI* *Paper Code: 12 ZOO C05*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-II

**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## ANIMAL PHYSIOLOGY & ANIMAL BEHAVIOUR

### UNIT I

**Nutrition and Digestion:** Metabolism: Types – anabolism and catabolism. Basal metabolic rate (BMR); Nutritive Requirements – carbohydrates, proteins, lipids, vitamins and minerals; Physiology of Digestion – role of salivary glands, liver, pancreas and intestinal glands in digestion.Symbiotic digestion – Cellulose digestion.Absorption and Assimilation – Hormonal control of digestion.

### UNIT II

**Respiration and Circulation:** Respiratory pigments: Types, Haemoglobin: structure and function. Transport of gases – Oxygen equilibrium curve, Bohr Effect, Chloride Shift. Respiratory adjustments: Hypoxia and oxygen therapy, Dyspnea, Periodic breathing. High altitude: Respiratory physiology. Structure of mammalian heart. Heart beat – mechanism of circulation – origin and conduction of heart beat – Blood coagulation. Lymph: composition and dynamics.

### UNIT III

**Excretion, Osmoregulation and Thermoregulation:** Structure of mammalian kidney – Urine formation: Glomerular filtration – Tubular reabsorption and secretion – Counter current mechanism. Role of hormones in excretion. Osmotic and ionic regulation in freshwater, marine and terrestrial animals. Thermoregulation in homeotherms and poikilotherms.

### UNIT IV

**Muscle and Nerve Physiology:** Ultra structure of skeletal muscle. Mechanism of muscle contraction – theories. Physico-chemical changes during muscle contraction. Structure of neuron – origin and conduction of nerve impulse.Synaptic transmission – neuromuscular junction.

**UNIT V**

**Behavioural Physiology:** Conditioned reflex – Pheromones in colonial interactions, foraging and mating – Allelo chemicals in plant-insect interaction – Chemotaxis. Role of mammalian pheromones in reproduction.Circadian rhythms – Migration of birds and fishes.

**REFERENCE BOOKS:**


1. Hoar, W.S. Comparative Animal Physiology.

2. Schmidt-Nielson. Animal Physiology.

3. Manning, A and M.S. Dawkins (1998), An Introduction to Animal Behaviour. Cambridge University Press.

4. Brown, M.E. (1957), Physiology of Fishes, Vols. 1 & 2, Academic Press.

*Core Paper VII* *Paper Code: 12 ZOO C06*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-II

**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## DEVELOPMENTAL BIOLOGY

### UNIT I

Concept of Embryology – Gametes – Types of sperm and eggs. Fertilization – Recognition of gametes, Contact of gametes, Acrosomal reaction, Cortical reaction, entry of sperm, fusion of gametes. Biochemistry of fertilization. Early development – Cleavage – Patterns of cleavage, Chemical changes during cleavage, formation of blastula, types of blastula.

### UNIT II

Gastrulation – Fate map, construction of fate map. Morphogenetic movements – Epiboly, Emboly – types of embolic movements. Mechanism of gastrulation in amphibian, chick. Gene action during gastrulation. Neurulation – mechanism of neural tube formation.

### UNIT III

Organizer – Types and properties. Induction – primary embryonic induction, regional specificity of induction, mechanism of primary embryonic induction. Gradient – single and double gradient theories. Animal, vegetal gradient in sea urchin development.

### UNIT IV

Organogenesis in vertebrates – Derivatives of ectoderm, mesoderm and endoderm. Development of Brain, Eye, Heart, Reproductive system, Alimentary canal.

### UNIT V

Regeneration – Regenerative ability in animals – Types – Autotomy, reparative and physiological regeneration – Mechanism of regeneration in Salamander limb, factors affecting regeneration. Metamorphosis in amphibians, Insects, Hormonal regulation of metamorphosis.

**REFERENCE BOOKS:**


1. Gilbert, S.F. (2009). Developmental Biology, Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.

2. Balinsky, B.I. (1981). Introduction to Embryology, Holt Saunders International, Edn., Philadelphia.

3. Wolpert, L. (2007). Principles of Development, Oxford Publication.

4. Kalthoff, K. (1996). Analysis of Biological Development, McGraw-Hill Publishers, New York.

5. Berril, N.J. (1986). Developmental Biology, Tata McGraw-Hill Publication Co. Ltd., New Delhi.

*Core Paper VIII* *Paper Code: 12 ZOO C07*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-II

**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## IMPACT OF CLIMATE CHANGE ON BIODIVERSITY

**UNIT I**

Introduction: Biodiversity, Ecosystem Services, and Climate Change – Green House Effect – Green House Gases – Climate Change and its significance and Causes (Acid rain, Ozone depletion, Green house effect, Forest fire) – Impact of Climate Change on Ecosystem – Fossil Fuel in Climate Change – Present and Future Trends.

**UNIT II**

Impact on Climate on Biodiversity: Behavioural Adaptation – Threats to Biodiversity – Migration of species – Climate Change: A threat to Biodiversity – Higher Sea Surface Temperatures – Biodiversity of land, aquatic and Polar Ecosystem – Climate Change on Human Health. Transgenic plants and Behaviour of Animals.

**UNIT III**

Climate Change and its Interference on Genetics, Species and Ecosystem Diversity. Future Climate Scenarios and Coral Reef Decline – Climate Change on Reef Bleaching – Diversity indices: Shannon-Wiener, dominance – Adopting Indigenous Knowledge to Adapt to Climate Change.

**UNIT IV**

Climate Change on the Conservation of biodiversity: *In-situ* and *Ex-situ* conservation of biodiversity – Global Information System (GIS) and Remote Sensing (RS) on Biodiversity Measurements. Impact of Climate on the Ecological degradation – Protecting Food Security through Adaptation to Climate Change. Climate Change on Drought – Reducing agricultural and Forestry Emissions – Carbon Foot Printing.

**UNIT V**

Human impact on Biological Diversity, Adaptation and Mitigation – Climate Change on the Forest Fragmentation – Climate Change on Animal Migration. Role of Intergovernmental Panel

on Climate Change (IPPC), United Nations Framework Convention on Climate Change, Kyoto Protocol and the Nairobi Work Programme.The UNFCCC Climate Change Funds and the Global Environment Facility.

**REFERENCE BOOKS:**


1. Odum, E.P. 1971. Fundamentals of Ecology, W.B. Saunders Co., USA. Pp.574.

2. V.H. Heywood and R.T. Watson. 1995. Global Biodiversity Assessment. Cambridge University Press.

3. IPCC. Climate Change. The Scientific Basis. Report of Working Group I of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2001.

4. IPCC., 2001. In: Houghton, J.T., Ding, Y., Griggs, D.J., Noguer, M., van der Linden, P.J., Xiaosu, D. (Eds.), Climate Change 18 *J. Fuhrer / Agriculture, Ecosystems and Environment 97 (2003) 1-20* 2001: The Scientific Basis. Cambridge University Press, UK (*http://www.ipcc.ch*).

5. CCSP (2009). *Thresholds of Climate Change in Ecosystems.* A report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. Fagre, D.B., Charles, C.W., Allen, C.D., Birkeland, C., Chapin, F.S. III, Groffman, P.M., Guntenspergen, G.R., Knapp, A.K., McGuire, A.D., Mulholland, P.J., Peters, D.P.C., Roby, D.D., and Sugihara, G. U.S. Geological Survey, Department of the Interior, Washington DC, USA.

6. NRC (2008). *Ecological impacts of Climate Change.* National Research Council. The National Academy Press, Washington, DC, USA.

7. Major Impacts: Climate Change – Prepared by: Compass Resource Management for the Biodiversity BC Technical subcommittee for the report on the status of biodiversity in BC May 2007 – Technical Subcommittee Component Report.

8. Biodiversity and Climate Change: Reports and Guidance Developed Under the Bern Convention – Volume I (Nature and Environment N°156) (2010).

*Core Paper IX* *Paper Code: 12 ZOO P02*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course -SEMESTER-II

**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

### LAB COURSE II

1. Pregnancy test using ELISA kit
2. Identification of thyroidism among the students
3. Effect of pH on opercular movement in fish
4. Effect of temperature on opercular movement in fish
5. Determination of embryonic stages in growing Chick embryo
6. Monitoring the metamorphic changes in tadpole larvae
7. Online Observations of impact of climate change on Biodiversity in India
8. Cultivation of Silkworm to assess the Larval and Pupal stages of silkworm
9. BLAST search for identification of Protein sequence
10. BLAST search for conversion of DNA sequence into Protein sequence
11. Protein structure prediction using RasMol

**SPOTTERS:**

1. Typical structure of Neuron
2. Ultra structure of Skeletal Muscles
3. Observation of 24, 48 and 72 Hour stages of Chick embryo
4. Blastula and Gastrula stages in Embryo
5. Photographs for tsunami effects in Tamil Nadu
6. Marine and freshwater prawns
7. Phylogenetic Tree
8. DNA Microarray Slide
9. 3D Structure of Haemoglobin

*Elective Paper II* *Paper Code: 12 ZOO E02*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course -SEMESTER-II
**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## ECONOMIC ZOOLOGY

### UNIT I

Introduction – Definition – Economical Importance of Protozoa – Nematodes and Helminths – Annelids. Role in House Hold Insects – Effecting Human Health – Damaging Food Products – Goods. Insect pests of sugarcane – paddy – pulse crops – vegetables – fruits – cotton – oil seed crops. Coconut palm – tea and coffee – insect pest management (IPM) – natural control – applied control – integrated pest management.

### UNIT II

Economics of aquaculture: **Pisciculture** – Techniques of induced breeding. Commercial culture of catla & cat fish. By-products of fishing and its commercial values. **Prawn culture** – Culture techniques of fresh water (*Macrobrachium malcolmsonii*) & Marine water (*Penaeus monodon*) preservation – Processing and export techniques adopted in Prawn fishery. **Pearl Culture:** Formation and nature of Pearls – Commercial importance of Pearl Culture in India.

### UNIT III

**Sericulture:** Origin and history of Sericulture, silk route – Silk industry in India and Tamil Nadu (Mulberry and Non-Mulberry Sericulture). Silk production, Number of reeling units and Silkworm races. Classification of Mulberry silkworm on the basis of its origin and voltinism. **Apiculture:** Contemporary situation in bee-keeping and its important for the human community – Biology of the honey bee (*Apis mellifera*) – Bee products: honey, beeswax, propolis (resin), royal jelly, pollen, bee venom – Beekeeping in the past and today. **Lac Culture:** Biology of lac insects, distribution, products of lac industry and their economic value.

**UNIT IV**

IntegratedPest Management – pest management using. Juvenile hormone analogues.Pheromones in genetic manipulations – Biotechnology of silk worms.Baculo viruses in biocontrol and foreign gene expression – Biotechnology in aquaculture – transgenic fishes.Animal bioreactor and molecular farming.Selected traits and their breeding into livestock.Applications of molecular genetics in improvement of livestock.

**UNIT V**

Transgenic animals – mice, cattle, Gene Knockout mice.Use of nucleic acid probes and antibodies in clinical diagnosis.DNA fingerprinting.Current trends in Gene therapy.Ethical issues in Animal Biotechnology.**Vermiculture** and its importance, useful species for vermiculture, methods of vermiculture.

**REFERENCE BOOKS:**


1. Sukla, G.S. and Upadhyay, V.B. (2005) Economic Zoology. Rastogi Publications, Meerut, India.

2. JawaidAhsan and Subhas Prasad Sinha (2007) A Handbook on Economic Zoology. S. Chand & Co., Ltd., New Delhi.

3. Ashok Kumar and Prem Mohan Nigam (1991) Economic and Applied Entomology. Emkay Publications, New Delhi.

4. Shammi, Q.J. and Bhatnagar, S. (2002) Applied Fisheries. Agrobios (India), Jodhpur, India.

*Elective Paper III* *Paper Code: 12 ZOO E03*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-II

**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## BIOINFORMATICS

### UNIT I

Bioinformatics: Definition, Scope and current status. Biological database – Primary databases – NCBI, EMBL and DDBJ, PIR., SWISS – PROT. Secondary databases – PRINTS, PROFILE, PFAM and BLOCKS, Computer databases.

### UNIT II

Structural databases – PDB. Sequence retrieval system – ENTREZ, EXPASY and Ensembl. Medical databases and its applications. Database searching – Identity, similarity and homology. Sequence alignment: local and global alignment. Applications of computers in Biology. Proteomic microarray and its applications.

### UNIT III

Algorithms – Needleman – Wunch Algorithm – Hash coding – Smith Watermann - algorithm, dot plot. FASTA: types, Interpretation of results. BLAST – types, parameters, Interpretation of results, Multiple alignment – CLUSTALW. DNA Bar coding and its applications.

### UNIT IV

Expressed sequence tags: EST Clustering, ESTs and gene discovery, ESTs and sequence polymorphism. Comparative genomics Analysis. Applications of comparative genomics. Human Genome Project – Pharmacogenomics – High throughput screening for discovery and identification of drugs – Drug targets and development – SNP analysis. DNA Microarray Technology.

**UNIT V**

Metabolomics and Networks – Phylogenetic Analysis – Fundamental elements of Phylogenetic models. Phylogenetic tree – tree types, true building models: paralogs, orthologs and homologs. DNA-based phylogenetic trees. Applications of molecular phylogenetics.

**REFERENCE BOOKS:**


1. Attwood, T.K. and Parry Smith, D.J. 2009, *Introduction to Bioinformatics*, Longman Publications, Pearson Education Ltd., New Delhi.

2. Baxevanis, A.D. and Francis Ouelletle, B.P., 2008, Bioinformatics, *A Practical Guide to the Analysis of Genes and Proteins*, Wiley – Interscience Publication, New York.

3. Bishop, M.J. and Ramlings, C.J., 2007, *Nucleic Acid and Protein Sequence Analysis. A practical Approach*, IRL Press, Oxford.

4. Brown, T.A., *Genomes*, 2009, John Wiley and Sons Inc., New York.

5. Zhang, W.E.I. and Shmulevich, I.Y.A. 2005, *Computational and Statistical Approaches to Genomics*, Kluwer Academic Publishers, London.

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-III
**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## IMMUNOLOGY

### UNIT I

Historical perspective, lymphoid organs and cells. Cells of immune system, T and B cell activation and maturation, Haematopoiesis, Haematopoietic stem cells, Class switching, Antigens. The molecular basis of antigen and antibody interactions. Types of immunity and immune responses.

### UNIT II

Immunoglobulins: Structure and properties of immunoglobulin classes. Hybridoma technology for monoclonal antibodies and designer monoclonal antibodies. Multiple myelomas and structural basis of antibody diversity. Freund's adjuvants and its significance. Cytokines, interleukins, complement system – The classical pathway, alternate pathway and the membrane attack pathway. Immunostimulation, Immunosuppression and its clinical significance, Immunopotentiation - adjuvants.

### UNIT III

MHC gene in man and mouse, Genomic map, gene expression, antigen presentation and processing by MHC class I and class II molecules. Autoimmune diseases. Transplantation Immunology- Tissue typing and organ transplantation. Tumour Immunology. Immunobiology of HIV infection.

### UNIT IV

Immunization – active and passive. Vaccines – whole organism vaccine, synthetic peptide vaccine, multivalent subunit vaccine, anti idotype vaccine, designer vaccine, edible vaccine, DNA vaccine, recombinant vector vaccine. Production and applications of monoclonal antibodies genetically engineered monoclonal antibodies, Abzymes,

**UNIT V**

Radio Immuno Assay, ELISA, Immunofluorescence technique, immunohistochemistry. Karyotyping and molecular basis of cancer therapy. Microarray as a tool for detection of human genetic disorders. Immunodiagnostics and immunotherapy in virology – Serological methods for detection and quantitation of viruses: Hepatitis and Influenza viruses. Western Blotting,

**REFERENCE BOOKS:**


1. Fernandaz, N. and Butcher, G., 1998, MHC Vol.2, A Practical Approach, Oxford University Press, New York.

2. Janeway, C.A., 2010, Immunobiology – The Immune System in Health and Disease, Churchill Livingstone, New York.

3. Kuby, J., 2003, Immunology, W.H. Freeman & Co., New York.

4. Roit, I.N., Brostaff, J.J. and Male, D.K., 2008, Immunology, C. Mosby, St.Louis.

5. Van Dam – Mieras, M.C.E., de Jeu, W.H., de Vries, J., Currell, B.R., James, J.W., Leach, C.K. and Patmore, R.A., 1994, Technological Applications of Immunochemicals, Butterworth – Heineman Ltd., Oxford.

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course -SEMESTER-III
**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## CONCEPTS OF ANIMAL BIOTECHNOLOGY & NANOTECHNOLOGY

### UNIT I

**Animal cell culture**: Stages of culturing - cell culture media, cell lines, large scale culture, bioreactor models for animal cell culture, characterization and maintenance of cell lines – telomerase and cellular aging. Cryopreservation, cell bank. Applications of cell line. Gene transfer into animal cells, expression of foreign genes in animal cell lines.

### UNIT II

**Viral vectors** – Biology, adenovirus, adeno associated virus, retroviral vectors, Herpes virus, vaccinia virus. Stem cells – Definition, functions and origin, types, stem cell therapy, stem cell culture. Cloned genes and production of recombinant proteins and vaccines. Insulin, somatotrophin, somatostatin, β-endorphin, Human interferons. Hepatitis B virus vaccine, vaccine for foot and mouth disease virus – DNA vaccine.

### UNIT III

**Scope of Nanobiotechnology**– Landmarks in Nanobiotechnology – Current Scenario of Nano Science and Technology. Synthesis of Nano materials – Biological Methods and Chemical Methods – Chemical Vapor condensation and Sol gel methods. Synthesis of Gold, Silver, Ormosil and Iron oxide.

### UNIT IV

**Characterization of Nano materials**: Physical Method – Zeta potential, Monodispersion of Nanoparticles, SEM, TEM and AFM. Chemical Method – Principle and Applications of UVvisible Spectrophotometer, FT-IR spectroscopy, NMR and XRD. Biological Methods: MTTAssay, XTT Assay and ELISA.

### UNIT V

**Development of Drug delivery system**: Use of polymers and co-polymers in drug delivery.Methods of drug loading. Evaluation of cytotoxicity, druggability for the drug loaded nano materials. Nanomaterial as gene delivering agent Uses of Nanomaterials in controlling of microbial diseases, biochemical disorders and genetic disorders. Development of Nanomedicine for diabetes and cancer.

**REFERENCE BOOKS:**


1. Butler, M., 1997, Animal Cell Technology: Principles and Products, Open University Press, New York.

2. Dubey, R. C., 2009, A Text Book of Biotechnology, S. Chand Co., New Delhi.

3. Gupta, P.K, 2010, Biotechnology and Genomics, Rastogi Publications, Meerut, India.

4. S.Kannan, M.Krishnan, R.Thirumurugan, S.Achiraman 2012. Methods in Molecular Biology, UVP Press, India.

5. Marx, J.L., 1999, A Revolution in Biotechnology, Cambridge University Press, Cambridge.

6. Mather, J.P. and Barnes, D., 1998., Methods in Cell Biology, Vol 57 Animal Cell Culture Methods, Academic Press, New York.

7. Potten, C.S, 2006, Stem Cells, Academic Press, London.

8. David J. Lockwood, FRSC: Introduction to Nanoscale Science and Technology, 2004. National Research Council of Canada Ottawa, Ontario, Canada.

9. Augus I Kirkland and John L Hutchison: Nanocharacterisation, 2007. Department of Materials, Oxford Un iversity, Oxford, UK.

10. YuryGogotsi: Nanomaterials Handbook, 2006. Taylor & Francis Group, Boca Raton London, New York.


***Core Paper XII*** ***Paper Code: 12 ZOO C10***

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-III
**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## RESEARCH METHODOLOGY

**UNIT I:**

**Instrumentation and its applications:** Spectroscopy, microscopy (light, compound, SEM, TEM), Chromatography (paper, TLC. HPLC, GC-MS, FPLC, LC-MS), electrophoresis (AGE, PAGE), sedimentation and centrifugation.

**UNIT II:**

**Research formulations:** Basic concepts of research: meaning, objectives, motivation and approaches. Defining and formulation of research problem- literature review- importance. Hypothesis- null and alternate hypothesis and testing of hypothesis- theory, principles, law and Canon.Data collection technique.Selection of problem- stages in execution of research; preparation of Manuscript- thesis format.

**UNIT III:**

**Descriptive Statistics:** Variables and observations, empirical distribution, bar chart, stem and leaf, histogram. Location: mean, median, mode; Dispersion: range, variance, standard variance, standard deviation, inter-quartile range; Shape: modality, skewness. Probability: probability distributions- Bernoulli, binomial, Poisson, normal.

**UNIT IV:**

**Comparison of Means and Multivariate Analysis:** Testing significance: confidence interval-sample mean. Use of statistical tables and levels of significance.Analysis of variance: ANOVA and MANOVA. Tukey's, Dunnets, SNK. Simple correlation and regression analysis; Chi-square test, students' t-test. Multivariate analysis: basic principles and application. Use of correlation and regression, regression and correlation coefficients. Multivariate Analysis: Basic principles and applications of Multiple regression analysis, Principal Component Analysis (PCA), Discriminant Function Analysis (DFA), Cluster Analysis

**UNIT V:**

**Scientific Documentation and Communication:** Project proposal writing, research report writing: thesis and dissertation; preparation of manuscript. Standard of Research journals: peer review- impact factor- citation index. Choice of journals for publication. Information retrieval: archives, databases and search engines: Google, PubMed, online database library: Genbank. Research paper: oral and poster presentation. Synopsis- facing *viva-voce* using LCD. Latex and Science direct. Planning of research: Research proposals, time scheduling of research, available sources and generation of funds and facilities.

**REFERENCE BOOKS:**


1. Davis, GB and CA Parker. 1997. Writing the doctoral dissertation. Barrons Educational series, 2nd Edition.
2. S.Kannan, M.Krishnan, R.Thirumurugan and S.Achiraman. 2012. Methods in Molecular Biology – From Cell to Molecules. First Edition, UVN- Press. India
3. Duncary P. 2003. Authoring a Ph.D thesis: How to plan, draft, write and finish a doctoral dissertation. Palgrave Macmillan.
4. Snedecor GW and WG Cochran. 1978. Statistical methods. Oxford and IBH publishing Co PVt. Ltd.
5. Daniel WW. 2006. Biostatistics: A Foundation for Analysis in the Health Sciences (7thedn). JohnWiley& Sons, New York.
6. Zar, Jerrold H. 2008. Biostatistical Analysis (3rdedn.). Pearson Education Inc., New Delhi.

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-III

**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## ENDOCRINOLOGY

### UNIT I

**Vertebrate endocrine system**: Hypothalamo-hypophyseal system- Concept of neurosecretion - **Hypothalamic neurosecretorycentres** - Median eminence: Structure and function - **Neurohypophysis**: General organization – Neurohypophysial octapeptide hormones - **Adenohypophysis:** General organization - Distribution of pituitary cell types and functions (teleost pituitary model).

### UNIT II

**Pineal organ:** Structure and functions - Comparative anatomy of thyroid gland and its role in amphibian metamorphosis - **Comparative anatomy of adrenocortical and medullary** homologues - The gonads : Structure of testis and ovary - Steroidogenic sites - Steroidogenic sites - Steroid hormones and their functions - Endocrine control of colour change in amphibians with emphasis to pars intermedia function - Endocrine control of osmoregulation in fish.

### UNIT III

**Chemical nature of hormones** :Hormone Secretions (apocrine, holocrine, and merocrine) - Hormone Delivery - Hormonal feedback in homeostasis - **Mechanism of hormone action** - Protein Hormones - Membrane receptors - G-proteins and control of adenylatecyclase - Cyclic AMP cascade - Other signal Transduction systems (PLC and PLA pathways) - **Steroid** hormones.

### UNIT IV

**Hypothalamo-hypophysial System**: General organization, Neurohypophysialoctapeptides (Oxytocin and Vasopressin) - Hypophysiotropic **hormones**: Chemistry localization and actions - Chemistry and physiological roles of Somatotropin, Prolacin, FSH, LH and TSH. Neural control of adenohypophysis -**Thyroid Gland** - Biosynthesis of thyroid hormones, Control of secretion and Physiological roles.

### UNIT V

**Steroid hormone biosynthesis and pathways**:**Testis**: Organization, Physiological roles of androgens and Inhibin. **Ovary**: Organization, Physiological roles of Estrogen, Progesterone and Relaxin and Inhibin. Structure and functions of **Adrenal Cortex**. Endocrine **Pancreas**: Biosynthesis and physiological actions of Insulin and Glucagon. Role of **parathormone**: Calcitonin and vitamin D in calcium homeostasis. Current scenario of endocrine disorders and human health

**REFERENCE BOOKS:**


1. Turner and Bagnara: General Endocrinology, W. B. Saunders Company Philadelphia. 1984.

2. Hadley: Endocrinology, Prentice hall. International Edition. 2007.

3. Larson: Williams Text Book of Endocrinology, 10th edition. W. B. Saunders Company, Philadelphia. 2010.

4. Bentley: Comparative Vertebrate Endocrinology, Cambridge University Press, 1998.

5. Norris: Vertebrate Endocrinology, (4th ed.), Lea & Febiger, 2000.

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-III

**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

### LAB COURSE-III

1. Radial immunodiffusion
2. Double immunodiffusion
3. Raising Antibody in mice
4. Immune electrophoresis
5. hCG Testing Kit
6. Identification of Endocrine glands in mammals
7. Identification of Endocrine glands in insect
8. Isolation of plasmid DNA &Agarose gel Electrophoresis
9. Isolation of chromosomal DNA from human blood
10. SDS Page to determine protein Molecular Weight
11. Proof Readings and symbols

**SPOTTERS:**

1. MCF-7 cells
2. A549 Cells
3. ZR751Cells
4. HepG2 Cells
5. Electrophoresis unit
6. Autoimmune disease

***Elective Paper IV*** ***Paper Code: 12 ZOO E04***

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-III
**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## CANCER AND STEM CELL BIOLOGY

**UNIT I**

Regulation of the Eukaryotic cell cycle, Cell birth, Lineage and cell death. Cancer/ oncogenes, Cancer biomarkers, Cellular morphology, Primary and established cell lines, Kinetics of Cancer cell growth, Genetics of cancer cells. Cancer stem cell culture and their applications. Cell culture based vaccines. Cancer proteomics.

**UNIT II**

Cell Signalling in Cancer Cell lines: Cancer cell lines : MCF-7, HeLa, HepG2, A549 and ZR771.Signaling at the cell surface, Types of signaling pathways that control gene activity, Integration of signals and gene controls. Moving proteins into membranes and organelles, Vascular traffic, secretion and endocytosis, Metabolism and movement of lipids.

**UNIT III**

Etiology, epidemiology, diagnosis and treatment of Breast, Lung, colo-rectal, blood, endocrine cancers. Current scenario of RNAi technology in cancer medicine. Role of gene therapy in cancer treatment.

**UNIT IV**

Stem cell concept – Properties of stem cell – Types of stem cell embryonic stem cell – Adult stem cells – Problem of differentiation.Differentiation status of cells – Primordial germ cell - Skin cell - Gastrointestinal cells – Embryonic stem cell differentiation as a model to study haematopoietic and endothelial cell development.

**UNIT V**

Stem cell location and Classification – Neural stem cells – Stem cell niches – Germ line Epithelial and Epidermal and neural niches. Uses of Stem cells - Human stem cells – Renewal of stem cells- Stem cells and Tissue engineering – Embryonic stem cells and Gene therapy - Therapeutic cloning. Ethical and Social consideration of Stem cell research.

**REFERENCE BOOKS:**


1. Kursad Turksen 2002. Embryonic Stem Cells Method and Protocols. Humana press.

2. Russell Korobkin and Stephen R. Munzer 2007. Stem Cell Century, Law and Policy for a Breakthrough Technology, Yale University Press.

3. Robert Lanza 2005. Essential of Stem cell Biology. Elsevier press.

4. Robert Lanza, 2004. Hand Book of Stem Cells Volume 1&2, Elsevier press.

5. Committee, R. 2004. Stem Cells and the Future of Regenerative Medicine by on the Biological andBiomedical Application of Stem Cell Research.

6. Robertis, E.D.P. and De Robertis, E. M.F. 2005. Cell and Molecular Biology, (8th edn)., De, B.I.Waverly Pvt. Ltd., New Delhi.

7. B. Albert et al., 2008. Essential Cell Biology, Garland Publishing, Inc. New York.

*Core Paper XV* *Paper Code: 12 ZOO C13*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-IV

**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## ENVIRONMENTAL BIOLOGY

### UNIT I

**Ecosystem**: Ecosystem concepts- Energy flow in ecosystem - Trophic structures. Ecological pyramids - Food chain, food web and their significance. Concept of limiting factors- Shelford's law of tolerance-ecotypes. Ecosystem services by animals.

### UNIT II

**Population and Community Ecology**: The population concept- Natality, mortality, growth rate, population density & age distribution, carrying capacity, fluctuation and regulation. Community structure - influence of competition - influence of predation and disturbance. Community succession and climax stage.

### UNIT III

**Habitat Ecology and Resource Ecology**: Physical and biotic features of terrestrial, freshwater, estuarine, marine habitats. Unique features of Coral Reefs, Seaweeds, Seagrasses and Mangroves. Natural resources and their conservation.

### UNIT IV

**Environmental Pollution**: Types of environmental pollution and their biological effects. Air pollution, soil and water pollution- causes, effects and control. Environmental awareness. Organizations involved in environmental protection - Principles of conservation: Application of ecological principles - germplasm conservation. Environmental laws.

### UNIT V

**Environmental Disaster and Management:**Effect of climate change, global warming and its effect on living organisms – Tsunami, Cyclone Earth Quake, Flood: Causes, consequences,

control and management. War and its impact on environment. Remediation and reclamation of the Environment - Role of microbes in bioremediation.

**REFERENCE BOOKS:**


1. Henry, M., and H. Stevens, 2009. A Primer of Ecology with R (Use R), Springer

2. Odum EP, 2008. Fundamentals of Ecology, Cengage Learning ( Thompson ), USA.

3. Smith, T. M., and R. L. Smith, 2008. Elements of Ecology (7th Edition), Benjamin Cummings.

4. Krebs, C. J. 2008. Ecology: The Experimental Analysis of Distribution and Abundance (6th Edition), Benjamin Cummings.

5. Clark R.S. 2001. Marine Pollution, Clanderson Press Oxford, New York.

*Core Paper XVI* *Paper Code: 12 ZOO C14*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-IV

**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## EVOLUTION

### UNIT I

Introduction: Origins of evolutionary thought- Early ideas of evolution- Charles Darwin: The voyage of the Beagle-The nature of evolutionary units; Species concepts- The Biological Species concept and Theories of Evolution. A general theory of speciation and its impacts.

### UNIT II

The causes of evolution; Hardy-Weinberg equilibrium: - Mutation and Gene flow with reference to Rates of evolutionary change; Genetic drift and Non-random breeding-Reproductive isolating mechanisms: Models of population growth- Variation in natural populations. Phenotypic variation: Polygenic traits; Heritability and Variation over geography: The "niche" concept.

### UNIT III

Natural selection I: Stabilizing, directional, and disruptive selection- Natural selection II: The general selection model- Group selection, kin selection, and sociobiology- Ecogeographic rules: Subspecies concepts- Clines and hybrid zones

### UNIT IV

Phenetics and cladistics- Tracing ancestor-descendant relationships- The molecular clock- Phyletic patterns and biogeography- Evolutionary trends and laws: Gradualism and punctuated equilibria- Adaptation and adaptive radiation with reference to convergent and divergent evolution.

### UNIT V

Ontogeny and phylogeny: Historical perspective; allometry and Species selection. Evolutionary innovations and the origin of higher taxa- Evolution of *Homo sapiens* and molecular biological and immunological evidences for evolution. Impact of DNA bar coding in modern Evolutionary studies.

**REFERENCE BOOKS:**


1. Hafner, M.S. 1994. *Evolution laboratory: Laboratory exercises and discussions in evolutionary biology.* Baton Rouge, LA: Louisiana State University.

2. Minkoff, E. C. 1983. *Evolutionary biology.* Reading, MA: Addison-Wesley Publishing Company.

3. Sober, E. 1994. *Conceptual issues in evolutionary biology.* Cambridge, MA: MIT Press.

4. Himanshu Arora and Mohan P. Arora 2013. *A Text Book of Organic Evolution*, third edition. Himalaya Publications, New Delhi.

5. Veer Bala Rastogi, 2012. *Organic Evolution*. Knrn publications, Meerut.

*Core Paper XVII* *Paper Code: 12 ZOO P04*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-IV
**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

### PROJECT WORK and *Viva voce*

Aim: (a) Application of knowledge to real life situation (b) to introduce research methodology. Topic of dissertation may be chosen from the broad area of Zoology and may be laboratory based, field based or both or computational, with emphasis on originality of approach. It may be started during 2nd / 3rd semester and shall be completed by the end of the 4$^{th}$ semester. The Dissertation to be submitted should include (a) background information in the form of introduction (b) objectives of the study (c) materials and methods employed for the study (d) results and discussion thereon (e) summary and conclusions and (f) bibliography. Apart from these sections, importance of the results, originality and general presentation also may be taken into consideration for evaluation.

RULES GOVERNING THE EVALUATION OF PROJECT AND *VIVA VOCE*

1. Each student shall select a topic for his/her project work in consultation with his/her guide and Head of the Department.
2. The project report should be submitted to the Controller of Examinations Periyar university through the Head of the Department on or before 30$^{th}$ April of every year or the date prescribed by the Controller of Examinations with the approval of the Head of the Institution. If a candidate fails to submit project report on the date prescribed by the Controller of Examinations, he/she may be permitted to submit the same one day prior to the date of *viva voce* examination with a fine prescribed by the Controller of Examinations in consultation with the Head of the Institution at that time.
3. Each student shall submit 3 copies of his/her project report for valuation.

4. The project report shall contain atleast 30 pages excluding bibliography and appendices. This condition may be relaxed in the case of the students who have chosen a research problem for their dissertation on the recommendation of the guide.
5. The project shall be valued for a total of 200 marks out of which the external examiner and the guide share 50 marks each at the time of *viva voce* and project submission mark is allotted as 100. The sum of marks awarded by both the examiners shall be considered to be the final mark. For a pass in the project work, the student should secure a minimum of 50%. If the student fails to get the minimum pass marks in the project report, he/she shall be permitted to resubmit his/her project report once again within a period of 6 months after the publication of the result.
6. The student should secure a minimum of 50 marks for the pass in the *viva voce* examination failing which he/she shall be required to reappear for the *viva voce* same after a month but within a period of three months for which he/she will have to pay a fee as prescribed by the Head of the institution.

Further for a pass in this paper as a whole, a student should secure at least 50 marks in Project report and *viva voce* put together.

*Elective Paper V* *Paper Code: 12 ZOO E05*

# PERIYAR UNIVERSITY, SALEM
## Department of Zoology
## M.Sc. Zoology Course - SEMESTER-IV
**(This syllabus is applicable to the students who are admitted on or after 2012-2013 academic year onwards)**

## AQUACULTURE AND FISHERY BIOLOGY

**UNIT I**

Historical background and present status of aquaculture: purpose and importance of aquaculture. Types of culture systems: Traditional, extensive, semi-intensive, intensive, super-intensive. Characteristic features of cultivable species (Indian major carps, murrels, catfish and tilapia). Selection criteria of cultivable species.

**UNIT II**

Types of aquaculture: Freshwater aquaculture, brackishwater aquaculture and mariculture, merits and demerits, Design, construction and management of ponds, types of ponds. Control of aquatic weeds and predators.

**UNIT III**

Composite fish culture: Mono sex culture, culture of air-breathing fishes, sewage fed fish culture, Fish-cum duck culture: induced breeding of carps: Broodstock management.

**UNIT IV**

Fish diseases: Parasitic, protozoan, bacterial, fungal and viral diseases and their control measures. Fish processing and preservation, fishery by-products.

**UNIT V**

Inlandfisheries: Freshwater, riverine, reservoir, pond and cold water fisheries. Estuarine and brackishwater fisheries and their economics. Fish gears and crafts used in South Indian Fisheries. Marine Fisheries : Sardine, Mackaeral, Bombay duck, Sciaenids, Ribbonfish, Silver bellies, Pomfrets, Carangids, Sharks, Shrimps, Prawns, Crabs, Lobsters and Molluscs (Mussels, clams and scallops).

**REFERENCE BOOKS:**


1. Jhingran, V. G. (1991). Fish and fisheries of India. Hindustan Publishing Corporation, New Delhi.

2. Pillai, T. V. R. (1993). Aquaculture Principles and Practices. Fishing News Agency, London.

3. Biswas, S.P., (1993) Manual of Methods in Fish Biology, International Book Co., Absecon Highlands, New Jersey.

4. Bose, A.N., Yang, C.T., and Misra, A. (1991). Coastal Aquaculture Engineering. Oxford and IBH Publishing Co., Pvt. Ltd., New Delhi.

5. MPEDA Hand book of Aqua farming (1992). Freshwater Fishes, Marine Products Export Development Agency, Kochi.