

**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 2014-15**  
**onwards**

**PERIYAR UNIVERSITY, SALEM**  
**Department of Zoology**  
**M.Sc. Zoology Course Scheme**  
*(with effect from the Academic Year 2014-2015 onwards)*

Subject Code	Title of the Paper	Weekly Contact Hours	Credits	Internal marks	External Marks	Total Marks
<b>SEMESTER-I</b>						
14 ZOO C01	Animal Taxonomy and Diversity	4	4	25	75	100
14 ZOO C02	Cell and Molecular Biology	6	5	25	75	100
14 ZOO C03	Genetics	6	5	25	75	100
14 ZOO C04	Biochemistry	5	5	25	75	100
14 ZOO P01	Lab Course-I (Covering core I-IV)	5	4	40	60	100
14 ZOO E01	Elective -I	4	4	25	75	100
Total		30	27	165	435	600
<b>SEMESTER-II</b>						
14 ZOO C05	Animal Physiology and Behaviour	5	5	25	75	100
14 ZOO C06	Developmental Biology and Endocrinology	4	4	25	75	100
14 ZOO C07	Evolution	4	4	25	75	100
14 ZOO C08	Research Methodology	4	4	25	75	100
14 ZOO P02	Lab Course-II (Covering core V-VIII)	5	4	40	60	100
14 ZOO E02	Elective -II	4	4	25	75	100
14 ZOO SO1	Supportive-I	4	4	25	75	100
Total		30	29	190	510	700
<b>SEMESTER-III</b>						
14 ZOO C09	Immunology	4	4	25	75	100
14 ZOO C10	Nanobiotechnology	4	4	25	75	100
14 ZOO C11	Environmental Biology	4	4	25	75	100
14 ZOO C12	Aquaculture and Fishery Biology	4	4	25	75	100
14 ZOO C13	Cancer and Stem Cell Biology	5	4	25	75	100
14 ZOO P03	Lab Course-III (Covering core IX-XIII)	5	4	40	60	100
14 ZOO SO2	Supportive-II	4	4	25	75	100
Total		30	28	190	510	700
<b>SEMESTER-IV</b>						
14 ZOO PR01	Project work and <i>viva voce</i>	30	8	50	100 (50+50) Int+Ext	150
	Field visit/ Industrial Visit Report	--		50		50
Total		30	8	100	100	200
<b>CUMULATIVE TOTAL</b>		120	92	545	1555	2200

**Total weekly contact hours: 120**

**Total number of credits: 92**

## Elective Courses

1. Microbiology
2. Applied Entomology
3. Animal ethics and Biosafety
4. Wild life Biology

Subject Code	Title of the Paper	Weekly Contact Hours	Credits	Internal marks	External Marks	Total Marks
14ZOOEO1	Microbiology	4	4	25	75	100
14ZOOEO2	Applied Entomology	4	4	25	75	100
14ZOOEO3	Animal Ethics and Biosafety	4	4	25	75	100
14ZOOEO4	Wild Life Biology	4	4	25	75	100

## SUPPORTIVE PAPERS FOR OTHER PG COURSES:

Subject Code	Title of the Paper	Weekly Contact Hours	Credits	Internal marks	External Marks	Total Marks
14ZOOSO1	Molecular Oncology (Even Semester)	4	4	25	75	100
14ZOOSO2	Vermiculture and Vermicomposting (Odd Semester)	4	4	25	75	100
14ZOOSO3	Stem Cell Biology(Odd Semester)	4	4	25	75	100
14ZOOSO4	Bat Ecology (Even Semester)	4	4	25	75	100

## Details of the Course

1. No. of courses  
(Core papers + Practical's) : 17
2. Elective - Major : 2
3. Supportive course -Non Major : 2
4. Field/Industry visit : 1
5. Human Rights : 1

## SCHEME OF EXAMINATIONS

**The scheme of examinations for different semesters shall be as follows:**

Theory Paper External

Theory : 75 Marks

[Part A: 25 Marks (5 Questions with internal choice. Equal choice should be given to all the units) + Part B: 50 Marks (5 Questions with internal choice. Equal choice should be given to all the units)]

Internal : 25 Marks

Total : 100 Marks

Time : 3 hours.

**The following procedure will be followed for Internal Marks:**

**For Theory Paper**

Theory Papers Internal

Best two tests out of 3:	15 Marks
Seminar	: 5 Marks
Assignment	: 5 Marks
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	25 Marks
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**For Practical**

Practical Internal	: 40 Marks
Test Best 2 out of 3	: 30 Marks
Attendance	: 5 Marks
Record	: 5 Marks
Practical External	: 60 Marks
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Total	100 Marks
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**For Project and *viva voce***

Project	
Internal Marks	: 60 Marks
Project work and <i>viva voce</i>	: 90 Marks
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Total	150 Marks
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**6. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTERS:**

(i) Candidates shall register their names for the First semester examination after the admission in the PG courses.

(ii) Candidates shall be permitted to proceed from the First Semester upto the Final Semester irrespective of their failure in any of the Semester Examination subject to the condition that the candidates should register for all the arrear subjects of earlier semesters along with current (subject) Semester subjects.

(iii) Candidates shall be eligible to proceed to the subsequent semester, only if they earn sufficient attendance as prescribed therefore by the Syndicate from time to time.

Provided in case of candidate earning less than 50% of attendance in any one of the semester due to any extraordinary circumstance such as medical grounds, such candidates who shall produce Medical Certificate issued by the Authorized Medical Attendant (AMA), duly certified by the Principal of the College, shall be permitted to proceed to the next semester and to complete the course of study. Such candidate shall have to repeat the missed semester

by rejoining after completion of final semester of the course, after paying the fee for the break of study as prescribed by the University from time to time.

## 7. PASSING MINIMUM

- a) There shall be no Passing Minimum for Internal.
- b) For External Examination, Passing Minimum shall be of 50% (Fifty Percentage) of the maximum marks prescribed for the paper.
- c) In the aggregate (External + Internal) the passing minimum shall be of 50% for each Paper/Practical/Project and Viva-voce.
- d) Grading shall be based on overall marks obtained (internal + external).

## 8. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Candidates who secured not less than 60% of aggregate marks (Internal + External) in the whole examination shall be declared to have passed the examination in the First Class. All other successful candidates shall be declared to have passed in Second Class. Candidates who obtain 75% of the marks in the aggregate (Internal + External) shall be deemed to have passed the examination in First Class with Distinction, provided they pass all the examinations (theory papers, practical, project and *viva-voce*) prescribed for the course in the First appearance.

## 9. MARKS AND GRADES:

The following table gives the marks, grade points and classification to indicate the performance of the candidate

RANGE OF MARKS	GRADE POINTS	LETTER GRADE	DESCRIPTION
90 – 100	9.0 – 10.0	O	OUTSTANDING
80 – 89	8.0 – 8.9	D+	EXCELLENT
75 – 79	7.5 – 7.9	D	DISTINCTIN
70 – 74	7.0 – 7.4	A+	VERY GOOD
60 – 69	6.0 – 6.9	A	GOOD
50 – 59	5.0 – 5.9	B	AVERAGE
00 – 49	0.0	U	RE-APPEAR
ABSENT	0.0	AAA	ABSENT

## 10. RANKING

Candidates who pass all the examinations prescribed for the course in the first appearance itself alone are eligible for Ranking / Distinction.

Provided in the case of candidates who pass all the examinations prescribed for the course with a break in the First Appearance due to the reasons as furnished in the Regulations under “Requirements for Proceeding to subsequent Semester” are only eligible for Classification.

### **11. PATTERN OF QUESTION PAPER:**

PART – A (200 words): Answer All 5 Questions either or type 5 x 5 = 25 Marks

PART – B (500 words): Answer All 5 Questions either or type 5 x 10 = 50 Marks

### **12. APPEARANCE FOR IMPROVEMENT:**

Candidates who have passed in a theory paper / papers are allowed to appear again for theory paper / papers only once in order to improve his / her marks, by paying the fee prescribed from time to time. Such candidates are allowed to improve within a maximum period of 10 semesters counting from his / her first semester of his / her admission. If candidate improve his marks, then his improved marks will be taken into consideration for the award of Classification only. Such improved marks will not be counted for the award of Prizes / Medals, Rank and Distinction. If the candidate does not show improvement in the marks, his previous marks will be taken into consideration. Candidate will be allowed to improve marks in the Practicals, Project, Viva-voce, Field work.

### **13. TRANSITORY PROVISION:**

Candidates who have undergone the course of study prior to the academic year 2008 -2009 will be permitted to appear for the examinations under those Regulations for a period of three years i.e., up to and inclusive of April / May 2012 Examinations. Thereafter, they will be permitted to appear for the examination only under the Regulations then in force.

**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 2014-2015 academic year onwards)

**ANIMAL TAXONOMY AND DIVERSITY**

**UNIT - I**

Basic concepts of biosystematics, Animal taxonomy and classification - History of Classification Binomial nomenclature – Trends in systematic and molecular taxonomy - Dimensions of speciation and taxonomic characters. Species concepts: species category and subspecies - Theories of biological classification: hierarchy of categories. International Code of Zoological Nomenclature (ICZN).

**UNIT - II**

Origin of metazoan, Classification of Invertebrates upto Order level - Organization of Coelom: Acoelomates, Pseudo coelomates, Coelomates. Organization: Symmetry in animal organization – Asymmetry, radial, biradial and bilateral symmetry– Metamerism – corm theory, Embryological theory

**UNIT - III**

Locomotion: Amoeboid, Flageller and Ciliary movement in protozoa, movements in Annelida and Echinodermata. Respiration: Organs of respiration: Gills, lungs and trachea. - Respiratory pigments, Excretion in invertebrates. Reproduction: Pattern of sexual and asexual reproduction – Invertebrate larval forms and their phylogenetic significance.

**UNIT- IV**

Chordates: Classification upto order level, Special features: Retrogressive metamorphosis in *Ascidia* sp, Paedomorphosis with special reference to Axolotl larva, Unique characters: Swim bladder in teleost, Poison apparatus and biting mechanism of snake, Exoskeleton structures of birds and mammals, Dentition in Mammals, Ruminant stomach in mammals and Echolocation in bats. Vertebrate Fossils: Archaeopteryx and Mesozoic mammals.

**UNIT - V**

Biodiversity - Concept and principle of biodiversity - Causes for the loss of biodiversity - Measuring biodiversity: Shannon and Wiener Index, Similarity and Dominance index, Wildlife of India, - Values of wildlife, positive and negative - Wildlife protection Act - Conservation of wildlife in India - Endangered, endemic and threatened species.

## REFERENCE BOOKS:

1. Barnes RD (1982) Invertebrate Zoology.4<sup>th</sup> Edition, Holt Saunders International Edition.
2. Barrington EJW (1979) Invertebrate Structure and Functions.2<sup>nd</sup> Edition, ELBS and Nelson.
3. Colbert H and Edwin (1989) Evolution of the Vertebrates. 2<sup>nd</sup> Edition, Wiley Eastern Limited, New Delhi.
4. Pough H, Heisher JB and McFarland WN (1990) Vertebrate Life. Macmillan Publishing Co., New York.
5. HymanGH (1955) The Invertebrates, Vol. I to VII, McGraw Hill Book Co., Inc., New York.
6. Anne EM (2003) Measuring Biological Diversity, Blackwell Publications, UK.
7. Hickman CP, Roberts LS and Larson A. (2003) Animal Diversity.Granite Hill Publishers.
8. Hosetti BB (2002) Biodiversity, Daya Books, New Delhi.
9. Young JZ (1981) Life of Vertebrates, Clarendon Press.
10. Kashyap V (1997) Life of Invertebrates.Vikas Publishing House Pvt.Ltd., New Delhi.
11. Waterman AJ (1971) Chordate Structure and Function. The Macmillan Company.



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**Department of Zoology**

**M.Sc. Zoology Course - SEMESTER-I**

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**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 membrane: Chemical composition, structure and functions.

**UNIT - II**

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

**UNIT - III**

Nucleus: ultra-structure of nuclear membrane. Nucleolus, Nucleoplasm and Chromatic fibers. Microtubules, 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 (2013) Essential Cell Biology. Garland Science, New York.
2. Cooper, GM (2013) The Cell – A Molecular Biological Approaches. ASM Press, Washington.
3. De Robertis EDP and De Robertis EMF (2011) Cell and Molecular Biology. Lippincott Williams and Wilkins, USA.
4. Gupta PK (2013) Cell and Molecular Biology. Rastogi Publications, Meerut.
5. Karp G (2012) Cell and Molecular Biology: Concepts and Experiments. 9<sup>th</sup> edition, John Wiley and Sons Ltd. New York.
6. Lewin B (2013) Genes XII. Oxford University Press, Oxford.
7. Turner PC McLennan AG Bates AD and White MRH (2010) Instant Notes Molecular Biology. Viva Books Pvt. Ltd., New Delhi.
8. Walker JM and Gingold EB (2013) Molecular Biology and Biotechnology. Panima University Press, Oxford Publishing Co., New Delhi.

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**Department of Zoology**

**M.Sc. Zoology Course - SEMESTER-I**

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**GENETICS**

**UNIT - I**

Definition and scope of Genetics – Pre-Mendelian 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 and B Chromosomes.

**UNIT - III**

Linkage and crossing over: Coupling and repulsion hypothesis. Linkage in *Drosophila*. Sex Linkage, Crossing over – Mechanism of crossing over. Cytological theories of crossing over. Construction of genetic maps in *Drosophila*.

**UNIT - IV**

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

**UNIT - V**

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

## REFERENCE BOOKS:

1. Snustad DP and Simmons MJ (2011) Principles of Genetics. 6<sup>th</sup> Edition John Wiley and Sons.
2. Dale JW and Park SF (2004) Molecular Genetics of Bacteria. 4<sup>th</sup> Edition, John Wiley and Sons Ltd. New York.
3. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments. 6<sup>th</sup> Edition, John Wiley and Sons Ltd. New York.
4. Tamarin RH (2012) Principles of Genetics 9<sup>th</sup> Edition, McGraw-Hill, New York.
5. Strickberger MW and Strickberger MW (2010) Genetics, Prentice Hall of India Pvt. Limited.
6. Lewin B (2013) Genes XII. Oxford University Press, Oxford.
7. Cooper, GM (2013) The Cell – A Molecular Biological Approaches. ASM Press, Washington.

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**Department of Zoology**

**M.Sc. Zoology Course - SEMESTER-I**

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**BIOCHEMISTRY**

**UNIT - I**

Biomacromolecules and their physiological significance. Properties of water. Classification, structure and function of mono, di, oligo and polysaccharides. Biochemical disorder of carbohydrate metabolism.

**UNIT - II**

Classification, structure and function of proteins. Enzymology: enzymes – factors affecting enzyme action, mechanism of action. Types of inhibition: feedback and allosteric, competitive, uncompetitive and non-competitive. Michaelis and Menten's equation.

**UNIT - III**

Classification, structure and function of lipids. Lipids: Fatty acids – biosynthesis, oxidation-ketogenesis. Cholesterol – biosynthesis, transport and excretion. Bioenergetics oxidation and reduction reactions

**UNIT - IV**

Carbohydrates: Metabolism of carbohydrates – glycolysis, glycogen metabolism, glycogenolysis, gluconeogenesis, pentose phosphate pathway, pyruvate oxidation, citric acid cycle, Electron transport system, Oxidative phosphorylation, Stoichiometry of ATP cycle.

**UNIT - V**

Nucleic acids: Synthesis and degradation of purines and pyrimidines – *de nova* and salvage pathway. Applications of secondary metabolites. Vitamins: water soluble and fat soluble. Minerals and hormones: types, structure and their functions.

## **REFERENCE BOOKS:**

1. Lehninger AL, Nelson DL and Cox MM (2013) The Principles of Biochemistry. CBS Publishers, New Delhi.
2. Moat AG and Foster JE (2008) Microbial Physiology. John Wiley and Sons, New York.
3. Stryer L (2012) Biochemistry.4<sup>th</sup> edition, W. H. Freeman and Company, New York.
4. Voet D and Voet JG (2012) Biochemistry.4<sup>th</sup> edition, John Wiley and Sons, New York.
5. Ambika Shanmugam (2012) Fundamentals of Biochemistry for medical students, 7<sup>th</sup> Edition, Lippincott Williams and Wilkins.

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**Department of Zoology**

**M.Sc. Zoology Course - SEMESTER-I**

(This syllabus is applicable to the students who are admitted on or after 2014-2015 academic year onwards)

**LAB COURSE I**

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

1. Structure and function of Major mammalian Organs (Rat-heart, pancreas, liver, kidney and gonads) – Voucher Specimen
2. Spotters and Slide

**Core II Cell and Molecular Biology**

1. Micrometry for cell measurement
2. Identification of different types of cells in blood
3. Observation of Mitosis (onion root tip) and Meiosis (Grasshopper – Voucher Specimen)

**Core III Genetics**

1. Observation of Mendelian traits in student population
2. Study on human syndromes – Voucher Specimen
3. Study on polygenic inheritance – Voucher Specimen

**Core IV Biochemistry**

1. Estimation of Protein
2. Determination of glucose level in Blood
3. Effect of Temperature on salivary amylase activity
4. Identification of amino acids by paper chromatography

**REFERENCE BOOKS**

1. Plumer HD (2012) Practical : Biochemistry , Wiley Publication, India
2. Borah D (2012) Biotechnology Lab Practices, Global Academic Publisher, India
3. Kannan S, Krishnan M, Thirumurugan R and Achiraman S (2012) Methods in Molecular Biology, UVN Publishers, India.
4. Lal SS (2009) Practical Zoology, Rastogi Publications, New Delhi.

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**M.Sc. Zoology Course - SEMESTER-II**

(This syllabus is applicable to the students who are admitted on or after 2014-2015 academic year onwards)

**ANIMAL PHYSIOLOGY AND 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:** Learning memory and Imprinting, Conditioned reflex – Pheromones and Behavior – Allelochemicals in plant-insect interaction – Chemotaxis. Role of mammalian pheromones in reproduction. Circadian rhythms – Migration of birds and fishes.



## REFERENCE BOOKS:

1. Guyton Mc. and Hall, R.T. 2011. Textbook of Medical Physiology. 12<sup>th</sup> Edition Saunders Publisher, USA
2. Schmidt-Nielsen K (2010) Animal Physiology, Cambridge University Press.
3. Randall D, Burggren W and French K (2002) Eckrett Animal Physiology, W. H. Freeman Publications.
4. Sherwood L, Klandorf H and Yancey P (2012) Animal Physiology: From genes to organisms, Cengage Learning.
5. Prosser CL (1991) Comparative Animal Physiology, Environmental and Metabolic Animal Physiology, John Wiley and Sons.
6. Manning A and Dawkins MS (2012) An Introduction to Animal Behaviour, Cambridge University Press.
7. Breed, MD and Moore J (2011) Animal Behavior, Academic Press, New York.
8. Goodenough J, McGuire B and Jakob E (2009) Perspectives on Animal Behavior, John Wiley and Sons.
9. Halliday T (1994) Animal Behavior, University of Oklahoma press, USA
10. E.O.Wilson, 2000 Sociobiology A New Synthesis.25<sup>th</sup> Edition. The Harvard College Publisher, USA

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**DEVELOPMENTAL BIOLOGY AND ENDOCRINOLOGY**

**UNIT - I**

Concept of Embryology – Gametes – Types of sperm and eggs. Fertilization - Biochemistry of fertilization. Early development – Cleavage – Patterns of cleavage, Chemical changes during cleavage, formation of blastula, types of blastula. Gastrulation – Fate map, construction of fate map. Morphogenetic movements – Epiboly, Emboly – types of embolic movements. Neurulation – mechanism of neural tube formation.

**UNIT - II**

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

**UNIT - III**

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

**UNIT - IV**

Pineal organ - Structure and functions. The gonads: Structure of testis and ovary - Steroid hormones and their functions - Endocrine control of osmoregulation in fish. Chemical nature of hormones: Hormone Secretions (apocrine, holocrine, and merocrine) - Hormone Delivery - Hormonal feedback in homeostasis. Thyroid Gland - Biosynthesis of thyroid hormones, Control of secretion and Physiological roles. Parathyroid Gland.

**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. Adrenal gland: Structure and functions. 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. Gilbert, S.F. (2011). *Developmental Biology*, Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
2. Balinsky, B.I. (2012). *Introduction to Embryology*, Holt Saunders International, 5<sup>th</sup> Edition, 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.
6. Nussey SS and Whitehead SA (2013) *Endocrinology: an integrated approach*, CRC Press.
7. Hadley, ME and Levine JE (2010) *Endocrinology*, Prentice Hall.

**PERIYAR UNIVERSITY, SALEM**

**Department of Zoology**

**M.Sc. Zoology Course - SEMESTER-II**

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**EVOLUTION**

**UNIT - I**

Introduction: Origins of evolutionary thought- Early ideas of evolution- Charles Darwin: The voyage on 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. Wilson EO (2000) *Sociobiology: The new synthesis*, Harvard University.
2. Hall BK and Hallgrímsson B (2013) *Strickberger's Evolution*, Jones and Bartlett Publishers.
3. Futuyma DJ (2013) *Evolution*, Sinauer Associates, USA.
4. Minelli A (2009) *Perspectives in Animal Phylogeny and Evolution*, Oxford University Press, UK
5. Dobzhansky T (2010) *Genetics of the evolutionary process*, Columbia University Press.

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**M.Sc. Zoology Course - SEMESTER-II**

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**RESEARCH METHODOLOGY**

**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. Composite databases – MIPS.

**UNIT - II**

FASTA: types, Interpretation of results. BLAST – types, parameters, Interpretation of results, Multiple alignment – CLUSTALW. DNA Bar coding and its applications. Human Genome Project – SNP analysis. DNA Microarray Technology. Phylogenetic Analysis. Applications of molecular phylogenetics.

**UNIT - III**

Biostatistics: Definition and applications of mean, median, mode, variance, standard deviation. Probability. Testing of significance. Analysis of variance: ANOVA and MANOVA. Simple correlation and regression analysis; Chi-square test, students' t-test.

**UNIT - IV**

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 - 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. Duncary P (2003) *Authoring a Ph.D., thesis: How to plan, draft, write and finish a doctoral dissertation*. Palgrave Macmillan.
2. Daniel WW (2006) *Biostatistics: A Foundation for Analysis in the Health Sciences (7<sup>th</sup>Edn)*. JohnWiley and Sons, New York.
3. Zar, Jerrold H (2008) *Biostatistical Analysis (3<sup>rd</sup> Edn.)*. Pearson Education Inc., New Delhi.
4. Attwood, TK and Parry Smith DJ (2011) *Introduction to Bioinformatics*, Longman Publications, Pearson Education Ltd., New Delhi.
5. Baxevanis AD and Francis Ouellette BP (2011) *Bioinformatics, A Practical Guide to the Analysis of Genes and Proteins*, Wiley – Interscience Publication, New York.
6. Brown TA (2013) *Genomes*. John Wiley and Sons Inc., New York.
7. Zhang WEI and Shmulevich IYA (2005) *Computational and Statistical Approaches to Genomics*, Kluwer Academic Publishers, London.

**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 2014-2015 academic year onwards)

**LAB COURSE II**

1. Pregnancy testing using 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. Online Observations of impact of climate change on Biodiversity in India
6. Cultivation of Silkworm to assess the Larval and Pupal stages of silkworm
7. BLAST search for identification of Protein sequence
8. BLAST search for conversion of DNA sequence into Protein sequence
9. Protein structure prediction using RasMol
10. Identification of Endocrine glands in mammals (Voucher Specimen)
11. Identification of Endocrine glands in insect (Voucher Specimen)

**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



## **REFERENCE BOOKS**

1. Laura R. Keller, John H. Evans, Thomas C. S. Keller (1999) *Experimental Developmental Biology: A Laboratory Manual*, Academic Press.
2. Yolanda P. Cruz (1993) *Laboratory Exercises in Developmental Biology*, Academic Press.
3. Nigam SC, Nigam SC and Omkar (2006) *Experimental Animal Physiology and Biochemistry*, New Age International.
4. Seidman and Moore (2009) *Basic Laboratory Methods for Biotechnology: Textbook and Laboratory Reference*, 2<sup>nd</sup> Edition. Prentice Hall.

**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 2014-2015 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. Freund's adjuvants and its significance. Cytokines, interleukins, complement system; Immunostimulation, Immunosuppression and its clinical significance.

**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. 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; Abzymes.

**UNIT - V**

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

## REFERENCE BOOKS:

1. Owen J, Punt, J and Stanford S (2013) Kuby Immunology, W.H. Freeman Publishers.
2. Delves PJ, Martin SJ, Burton DR and Roitt, IM (2011) Roitt's Essential Immunology, Wiley-Blackwell Publishers, UK.
3. Paul WE (2012) Fundamental Immunology, Wolters Kluwer Publishers.
4. Sompayrac LM (2012) How the Immune System Works, Wiley-Blackwell Publishers, UK.
5. Janeway CA (2010) Immunobiology – The Immune System in Health and Disease, Churchill Livingstone, New York.
6. Lydyard P, Whelan A and Fanger M (2011) Immunology, BIOS Scientific Publishers, London.
7. Roit IN Brostaff JJ and Male DK (2008) Immunology, C. Mosby, St.Louis.

**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 2014-2015 academic year onwards)

**NANOBIOTECHNOLOGY**

**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. Stem cells – Definition, functions and origin, types, stem cell therapy, stem cell culture. Cloned genes and production of recombinant proteins and vaccines. Insulin, somatotrophin, Human interferons. Hepatitis B virus vaccine; 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: MTT Assay, XTT Assay.

**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 RC (2009) *A Text Book of Biotechnology*, S. Chand Co., New Delhi.
3. Gupta PK (2010) *Biotechnology and Genomics*, Rastogi Publications, Meerut, India.
4. Mather JP and Barnes D (1998) *Methods in Cell Biology, Vol 57 Animal Cell Culture Methods*, Academic Press, New York.
5. Potten CS (2006) *Stem Cells*, Academic Press, London.
6. David J Lockwood (2004) *FRSC: Introduction to Nanoscale Science and Technology*, National Research Council of Canada Ottawa, Ontario, Canada.
7. Kirkland AI and Hutchison JL (2007) *Nanocharacterisation*, Department of Materials, Oxford University, Oxford, UK.
8. Yury Gogotsi (2006) *Nanomaterials Handbook*, Taylor and Francis Group, Boca Raton London, New York.

**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 2014-2015 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 and 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. Molles MC (2013) Ecology: Concepts and Applications, McGraw-Hill Publishers, UK
2. Stiling P (2014) Ecology, McGraw-Hill Publishers, UK
3. Cain ML, Bowman WD and Hacker SD (2011) Ecology, Sinauer Associates Publishers.
4. Odum EP (2008) Fundamentals of Ecology, Cengage Learning (Thompson), USA.
5. Henry M and Stevens H (2009) A Primer of Ecology with R, Springer.
6. Smith TM and Smith RL (2008) Elements of Ecology (7<sup>th</sup> Edition), Benjamin Cummings.
7. Krebs CJ (2008) Ecology: The Experimental Analysis of Distribution and Abundance (6<sup>th</sup> Edition), Benjamin Cummings.
8. Clark RS (2001) Marine Pollution, Clarendon Press Oxford, New York.

**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 2014-2015 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**

Inland fisheries: 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 VG (1991) Fish and fisheries of India. Hindustan Publishing Corporation, New Delhi.
2. Pillai TVR (1993) Aquaculture Principles and Practices. Fishing News Agency, London.
3. Biswas SP (1993) Manual of Methods in Fish Biology, International Book Co., Absecon Highlands, New Jersey.
4. Bose AN, Yang CT and Misra A (1991) Coastal Aquaculture Engineering. Oxford and IBH Publishing Co., Pvt. Ltd., New Delhi.
5. MPEDA Hand book of Aquafarming (1992) Freshwater Fishes, Marine Products Export Development Agency, Kochi.

**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 2014-2015 academic year onwards)

**CANCER AND STEM CELL BIOLOGY**

**UNIT - I**

Regulation of the Eukaryotic cell cycle, Cell birth, Lineage and cell death. 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 and A549. 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 process; Primordial germ cell -Skin cell - Embryonic stem cell differentiation as a model to study haematopoietic and endothelial cell development, Reprogramming and induced pluripotency.

**UNIT-V**

Stem cell localisation 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. Turksen K (2002) Embryonic Stem Cells Method and Protocols. Humana press.
2. Korobkin R and Munzer SR (2007) Stem Cell Century, Law and Policy for a Breakthrough Technology, Yale University Press.
3. Lanza R (2005) Essential of Stem cell Biology. Elsevier press.
4. Lanza R (2004) Hand Book of Stem Cells. Volume 1 and 2, Elsevier press.
5. Committee R (2004) Stem Cells and the Future of Regenerative Medicine by on the Biological and Biomedical Application of Stem Cell Research.
6. Robertis EDP and De Robertis EMF (2005) Cell and Molecular Biology, (8<sup>th</sup> Edn), De, B.I. Waverly Pvt. Ltd., New Delhi.
7. Lodish H, Kaiser CA, Bretscher A, Amon A, Berk A, Kneger M, Ploegh H and Scott MP (2012) Molecular Cell Biology, 7<sup>th</sup> Edition, Garland Publishing, Inc. New York.

**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 2014-2015 academic year onwards)

**LAB COURSE-III**

1. Radial immunodiffusion
2. Double immunodiffusion
3. Blood Group Testing
4. Immuno electrophoresis
5. Widal Test – Quantitative and Qualitative Method
6. Isolation of plasmid DNA and Agarose gel Electrophoresis
7. Isolation of chromosomal DNA from human blood
8. SDS PAGE to determine protein Molecular Weight
9. Proof Readings and symbols
10. Placoid and Tenoid scale

**SPOTTERS**

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

## **REFERENCE BOOKS**

1. Hay FC and Westwood OMR (2008) Practical Immunology, John Wiley and Sons.
2. Wilson K and Walker JM (2010) Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press.
3. Yadav B (2012) Bioinformatics: A practical guide for Molecular Biologists LAP Lambert Academic Publishing.
4. Green MR and Sambrook J (2012) Molecular cloning: a laboratory manual, 2<sup>nd</sup> Ed. Cold Spring Harbor, N.Y.: Cold Spring Harbor Laboratory Press.

**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 2014-2015 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 any 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 2<sup>nd</sup> / 3<sup>rd</sup> semester and shall be completed by the end of the 4<sup>th</sup> 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.

**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 2014-2015 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. Mycology: Classification of biomedically important fungal species. Virology: classification of virus based on structure and nucleic acid.

**UNIT - II**

Culture and Characterization: Methods of collection of sample – methods of estimation of microorganism– Isolation and identification of bacteria. Techniques of pure culture – Method of cultivation of bacteria – Phases of growth. Methods of sterilization and disinfection – Microbial control – Physical and chemical agents. Stain: Simple and differential staining; Gram staining; acid fast staining; endospore staining; negative staining; capsule staining; flagella staining.

**UNIT - III**

Microbial Ecology: Distribution of microorganism in soil, water and air –Role of microorganisms in the cycling of nutrients – carbon, nitrogen, phosphorous and sulphur cycle.

**UNIT - IV**

Food Microbiology: Sources, types, incidence of microorganism in vegetables, meats, poultry, seafood and dairy products. Spoilage of food, fruits, vegetables, meat, seafood and 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 acetic acid and ethanol, Antibiotics – Fermentation of lactic acid.

## **REFERENCE BOOKS:**

1. Atlas RM (1997) Principles of Microbiology. 2<sup>nd</sup> Edition, McGraw-Hill.
2. Dubey RC and Maheswari DK (2011) Textbook of Microbiology. S. Chand and Co.
3. Pelczar M J, Chan ECS and Kreig NR (2010) Microbiology. Tata-McGraw Hill.
4. Prescott LM (2010) Microbiology. 6<sup>th</sup> Edition. McGraw-Hill.
5. Salle AJ (1999) Fundamental Principles of Bacteriology. 7<sup>th</sup> Edition, Tata- McGraw Hill.
6. Stanier R, Ingraham J, Wheelis M and Painter P (2009) General Microbiology. 5<sup>th</sup> Edition, Macmillan Press.



**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 2014-2015 academic year onwards)

**APPLIED ENTOMOLOGY**

**UNIT - I**

An overview of class Insecta. Classification of Insects. External morphology of Insects – Types of mouthparts, Antennae, wings and legs. Life cycle of insects – Types of metamorphosis.

**UNIT - II**

Insect Physiology: Digestive system, respiratory system, circulatory system, excretory and reproductive systems. Insect Endocrinology: Hormones and pheromones.

**UNIT - III**

Beneficial And Harmful Insects: Insects pest of agriculture (Rice, cotton and groundnut), Sericulture, Apiculture and Lac culture. Introduction to Mosquitoes. Mosquito life cycle. Mosquito feeding behavior. Anopheles, Aedes and Culex. Sand flies, Bugs – Human bugs and lice.

**UNIT - IV**

Vector borne diseases – Insect transmitted diseases. Malaria – Parasites, causes, symptoms, diagnostics and treatment. Plasmodium life cycle. Dengue and Filariasis - causes, symptoms, diagnostics and treatment. Blue tongue virus, sleeping sickness.

**UNIT - V**

Integrated Pest Management (IPM) - Chemical, Physical and Biological control. Synthesis of Metal Nanoparticles for Pest Management.

## **REFERENCE BOOKS:**

1. Fernald H.T. (2014) Applied Entomology: An Introductory Text-Book of Insects in Their Relations to Man. Publisher: Nabu Press.
2. Shukla A (2013) Introduction to General and Applied Entomology, Daya Publishing House
3. Isaac Ishaaya, Subba Reddy Palli, A. Rami Horowitz (2012). Advanced Technologies for Managing Insect Pests. Springer.
4. Gillot C (2012) Entomology, Springer Publishers.
5. Neal J (2012) Entomology: Living With Insects. Kendall Hunt Publishers.
6. Mike Service (2008) Medical Entomology for Students. Cambridge University Press.
7. B.F. Eldridge, J.D. Edman (2003). Medical Entomology: A Textbook on Public Health and Veterinary Problems Caused by Arthropods. Springer.
8. Fenemore P.G., Alka Prakash A (2009) Applied Entomology, New age publishers.

**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 2014-2015 academic year onwards)

**ANIMAL WELFARE AND ANIMAL ETHICS**

**UNIT- I**

Introduction to Need of Animal protection and its significance. Concepts of Animal Welfare and its significance in Animal Science Research. Sentience, Suffering, Anthropomorphism Death and animal welfare Role of World Society for the Protection of Animals (WSPA).

**UNIT -II**

Outline of CPCSEA guidelines: Goal, Veterinary Care, Animal procurement, Quarantine, Stabilization and separation. Survivaence, Diagnosis, treatment and control of animal diseases in Primates and Sub primates. Animal Experimentations with hazardous material. Personal hygiene, physical restraints- Physical relationship to animal facilities to laboratories.

**Unit -III**

Animal Husbandry: Caging of Animal systems, Outdoor housing, Social environment. Activity, Food, Bedding and water. Sanitation and Cleanliness of animal house. Assessing the cleanliness of sanitation. Method of Waste disposal. Pest control, Emergency and week end / holiday animal care.

**UNIT -IV**

Standard Operating Procedures (SOP) - Guidelines, Components of SOP, Personal and training, Transport of Laboratory Animals and safety procedures. Anaesthesia and euthanasia. Laboratory animal ethics. Maintenance of transgenic animals. Breeding and Genetics. Record Preparation and maintenance for Animal house.

**UNIT- V**

Institutional Animal Ethical Committee: Components, Prevention of Cruelty to Animal Act, 1960. Breeding of and Experiments on Animals (Control and Supervision) Rules, 1998. Breeding of and Experiments on Animals (Control and Supervision) Rules, 2001, Breeding of and Experiments on Animals (Control and Supervision) Rules, 2006. Inspection Performa for Animal House Facility. Recommendations of the Sub-Committee on Rehabilitation of Animals.

## **REFERENCE BOOKS**

1. Thomas J.A., Fush R.L., (2002), Biotechnology and safety Assessment (3<sup>rd</sup> Edn.), Academic press.
2. Fleming D.A., Hunt D.L., (2002), Biological safety Principles and practices (3<sup>rd</sup> Edn.) ASM Press, Washington.
3. Biotechnology- A Comprehensive treatise (Vol. 12), Legal economic and ethical Dimensions VCH.
4. Sasson A, Biotechnologies and Development, UNESCO Publications.
5. Singh K, Intellectual Property Rights on Biotechnology, BCIL, New Delhi.

**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 2014-2015 academic year onwards)

**WILDLIFE BIOLOGY**

**UNIT-I**

**Foraging and Reproductive Ecology:** Feeding ecology of herbivores-carnivores, insectivores and omnivores food selection, quantity, quality (nutritional value), seasonal variations . Predator-prey interactions. Avoidance of competition for food and shelter. Reproductive ecology, ispersion, patterns of growth and development. Eco-physiology- water and temperature physiology and its ecological implications. Effects of day length and temperature on reproduction, and migration. Importance of minerals in animal health, growth and reproduction

**UNIT-II**

**Animal Adaptations;** Origin of adaptive and non adaptive characters, Kind of Adaptation in animals; Structural adaptation: Cursorial adaptations, fossorial adaptations, arboreal adaptations, digging mechanism, Volant adaptations, Cave adaptations, Aquatic adaptations, Desert adaptations, Deep sea adaptations ethological adaptation, parasitic adaptation,; Physiological adaptation; Protective adaptation: mimicry and protective coloration.

**UNIT-III**

**Wildlife management:** Principles and practices of wildlife management. Management of special habitats; riparian zones. Grasslands etc. Analysis of wildlife management, problems in plantations and exploited forests; Indian scenario. Species conservation projects; tiger, lion, rhino, crocodile etc.

**UNIT – IV**

**Man animal Interactions** Anthrozoology: Relation between human and animals. Man animal conflicts: causes and remedial measures to curb the conflicts. Human wildlife conflict: crop damage, livestock depredation, injuries to people, loss of human life, damage to property, injuries to wildlife, animal death and destruction of habitat.

**UNIT – V**

**Insitu and Exsitu conservation of wild life:** captive breeding and in-situ, ex-situ conservations. Latest techniques used in Biotechnology for ecological and wildlife preservation. Captive breeding and Propagation: Founder population, rehabilitation, education, utilization, gene banks, Ex-situ and in-situ linkages, conservation breeding Management Plans, wildlife conservation in India, sanctuaries, various protected wild animals of India.

## **REFERENCE BOOKS**

1. Raymond F. Dasmann, (1981). *Wildlife Biology*, 2 edition, Wiley Publications.
2. Eric G. Bolen, William Robinson, (2002). *Wildlife Ecology and Management*. 5<sup>th</sup> Edition, Publisher: Benjamin Cummings.
3. Odum EP (2008) *Fundamentals of Ecology*, Cengage Learning (Thompson ), USA.
4. Anthony R. E. Sinclair, Graeme Caughley, John M. Fryxell, (2006). *Wildlife Ecology, Conservation and Management*, 2nd Edition. Wiley-Blackwell Publication.
5. Guy R. McPherson, Stephen De Stefano, (2003). *Applied Ecology and Natural Resource Management*. Cambridge University Press.

**PERIYAR UNIVERSITY, SALEM**  
**Department of Zoology**  
**SEMESTER-II SUPPORTIVE PAPER**

(This syllabus is applicable to the students who are admitted on or after 2014-2015 academic year onwards)

**MOLECULAR ONCOLOGY**

**UNIT - I**

History, scope and current scenario of cancer research. Cancer – Types and their prevalence – Carcinoma, Lymphoma and Malignancy - Classification based on origin/organ: breast, colon, lung, prostate, cervical and oral cancers.

**UNIT-II**

Molecular mechanism of oncogenesis – Proto oncogenes, oncogene, oncoproteins, other tumour suppressor proteins and receptors proteins involved in cancer.

**UNIT-III**

Apoptosis and cancer : Mechanism of apoptosis - proteins involved in apoptosis-Signaling pathways : types and their impact on apoptosis and oncogenesis - Significance of –RB, Cyclins, RTK, CDKs, related pathways – Relationship between cancer and antiapoptotic proteins.

**UNIT - IV**

Principle and methods of cancer diagnosis: – Biochemical, Genetic, Cytotoxic and cell growth and viability tests. Current status of cancer proteomics.

**UNIT - V**

Cancer therapy – at cellular level- at gene level- at protein level. Principles of cancer biomarker and their applications – chemotherapeutics for cancer, Phytotherapy for cancer.

## **REFERENCE BOOKS:**

1. Tannock IF and Hill RP (1998) The Basic Science of Oncology, Third Edition, McGraw- Hill, New York.
2. Bronchud MH, Foote M, Giaccone G, olopade O and Workman P (2008) Principles of Molecular Oncology, Third Edition, Humana Press, NewJersey.
3. Depatin KM and Fulda S (2008) Apoptosis and Cancer Therapy, WILEY-VCHVerlag GmbH and Co., New York.
4. Hayat MA (2010) Methods of Cancer Diagnosis, Therapy, and Prognosis, Vol-7; Springer, Netherland.
5. Missailidis S (2008) Anticancer Therapeutics, John Wiley and Sons, Ltd., USA.



**PERIYAR UNIVERSITY, SALEM**  
**Department of Zoology**  
**SEMESTER-III SUPPORTIVE PAPER**

(This syllabus is applicable to the students who are admitted on or after 2014-2015 academic year onwards)

**VERMICULTURE AND VERMICOMPOSTING**

**UNIT - I**

Earthworms – Taxonomic position and diversity; types – morphological and ecological grouping – Epigeic, Anecic and Endogeic species; Ecological role and economic importance of earthworms.

**UNIT - II**

Vermiculture – definition, scope and importance; Local and exotic species for culture; Environmental requirements; Culture methods – wormery – breeding techniques; indoor and outdoor cultures – monoculture and polyculture.

**UNIT - III**

Applications of vermiculture – Vermicomposting – use of vermicastings in organic farming, Earthworms for management of municipal organic solid wastes. Nutrient value of worm cast/vermicompost – Effect of vermicompost on plants.

**UNIT - IV**

Marketing the products of vermiculture – quality control, market research, marketing techniques – creating the demand by awareness and demonstration, advertisements, packaging and transport.

**UNIT - V**

Future perspectives – Predator/pathogen control in wormeries; Potentials and constraints for vermiculture in India.

## **REFERENCE BOOKS:**

1. Edwards CA, Hendrix P and Arancon N (2014) *Biology and Ecology of Earthworms*, Springer Publishers.
2. Karaca A (2011) *Soil Biology: Biology of Earthworms*. Springer Publishers.
3. Edwards CA, Arancon NQ and Sherman RL (2011) *Vermiculture Technology: Earthworms, Organic Wastes, and Environmental Management*, CRC Press, USA.
4. Ranganathan LS (2006) *Vermibiotechnology– From Soil Health to Human Health*. Agrobios, India.
5. Ismail SA (2005) *The Earthworm Book*. Edition, Other India Press, Apusa, Goa, India.
6. Ismail SA (1997) *Vermicology: The Biology of Earthworms*. Orient Longman, India.

**PERIYAR UNIVERSITY, SALEM**  
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**SEMESTER-II SUPPORTIVE PAPER**

(This syllabus is applicable to the students who are admitted on or after 2014-2015 academic year onwards)

**STEM CELL BIOLOGY**

**UNIT-I**

Basic biology of stem cells; Types and sources of stem cell with characteristics: embryonic, adult, haematopoietic, fetal, cord blood, placenta, bone marrow, primordial germ cells, cancer stem cells, induced pluripotent stem cells.

**UNIT-II**

Stem cell characterizations: isolation and characterizations, markers and their identification, growth factor requirements and their maintenance in culture. Feeder and feeder free cultures. Cell cycle regulators in stem cells

**UNIT-III**

Epigenetic mechanisms Role in development and cell remembrance, histone modifications, acetylation, methylation, reprogramming, cellular response, DNA methylation and development, functional role of epigenetic in development

**UNIT-IV**

Molecular Basis of stem cell renewal and differentiation, Metaplasia and transdifferentiation. Molecular basis of pluripotency and stem cell niche.

**UNIT-V**

Applications of stem cells: neurodegenerative diseases, spinal cord injury, heart disease, diabetes, burns and skin ulcers, muscular dystrophy, orthopaedic applications, eye diseases, stem cells and gene therapy.

## **REFERENCE BOOKS:**

1. Lanza, R. Weissman, I. Thomson, J. and Pedersen, R. (2012) Handbook of Stem Cells, Two-Volume, Volume 1-2: Volume 1-Embryonic Stem Cells; Volume 2-Adult and Fetal Stem Cells, Academic Press.
2. Lanza, R. Gearhart J. (2009) Essential of Stem Cell Biology, (*Ed.*), Elsevier Academic press.
3. Mao, J.J. Vunjak-Novakovic G. (2008). Translational Approaches in Tissue Engineering and Regenerative Medicine. Artech House, INC Publications.
4. Naggy A. Habib, N. Levicar, M.Y. Jiao L.G. and Fisk N. (2007). Stem Cell Repair and Regeneration. Volume-2, Imperial College Press.
5. Lodish, H. Berk, A. (2008) Molecular Cell Biology, 6th Edition, W.H. Freeman and company.
6. Alberts B. Johnson, A. Lewis, J. Raff M., Roberts, K. and Walter P. (2008) Molecular biology of cell,. Garland Science, Taylor and Francis Group.

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**BAT ECOLOGY**

**UNIT - I**

**INTRODUCTION TO ANIMAL BEHAVIOUR:** Introduction- Founding fathers of animal behaviour - Innate and acquired behaviour - Proximate and ultimate causation of behaviour - Animal learning – Trial and error learning - Classical and operant conditioning.

**UNIT - II**

**CLASSIFICATION AND IDENTIFICATION OF BATS** Classification of bats and their identification – Collection methods of bats - Mist netting - hoop netting - Tuttle traps – Methods of marking bats - Non invasive methods of identification of bats - Methods to study the abundance of bats. Echolocation and its uses- Classification based on echolocation- Classification based on food types - Bat roosting areas - Beneficial role of bats – Pollination - seed dispersal - insect control - Diseases spread by bats

**UNIT- III**

**ROOSTING AND FORAGING BEHAVIOR OF BATS** Advantages of roosting together - Parental care-Foraging behaviour – Types of foraging – Group and solitary foraging – Factors affecting foraging - Resource sharing - Partitioning of resources – Eavesdropping

**UNIT- IV**

**BREEDING ECOLOGY OF BATS** Breeding behaviour – Monogamy - Polygamy - Polyandry – Resource defence polygyny - Female defence polygyny -

**UNIT-V**

**CHRONOBIOLOGY:** Introduction- Different types of biological rhythm- Ultradian, Circadian and Infradian rhythms- Zeitgebers, Free running and entrainment of rhythms- Animals with varying circadian rhythms- Role of Pineal gland and Melatonin in Circadian rhythm

**UNIT-VI**

**MOLECULAR ECOLOGY** Molecular ecology and phylogeography – DNA markers – DNA fingerprinting - Minisatellites - Microsatellite - Mitochondrial DNA - PCR – RAPD – RFLP

## REFERENCE BOOKS

1. Alcock, J. (2013) *Animal Behavior: An evolutionary approach*. Sinauer Associates, Inc.
2. Chandrashekar, M.K. (2006) *Time in the living world*. University Press (India) Ltd.
3. Dytham, C. (1999) *Choosing and Using Statistics: A Biologist's Guide*. Oxford: Blackwell Scientific.
4. Kunz, T.H. and B. Fenton. (2000) *Bat ecology*. Pp.798, University of Chicago Press.
5. Martin, P. and Bateson, P. (1999) *Measuring Behaviour: An Introductory Guide*. 2<sup>nd</sup> Edn. Cambridge: Cambridge University Press.
6. Rowe, G., Beebe, T (2008). *An introduction to molecular ecology*. Oxford University Press.