

**PERIYARUNIVERSITY, SALEM – 636 011**

(Reaccredited with “A” Grade by the NAAC)

**DEPARTMENT OF ZOOLOGY**

**M.Sc. Zoology Course Scheme**

*(with effect from the AcademicYear2016-2017 onwards)*

Subject Code	Title of the Paper	Weekly Contact Hours	Credits	Internal marks	External Marks	Total Marks
<b>SEMESTER-I</b>						
16ZOOC01	Invertebrates and Chordates	5	4	25	75	100
16ZOOC02	The Cell	5	5	25	75	100
16ZOOC03	Biochemistry	5	5	25	75	100
16ZOOC04	Genetics	5	5	25	75	100
16ZOOP01	Lab Course-I (Covering core papers I-IV)	5	3	40	60	100
16ZOOE01	Elective-I 1. Microbiology 2. Tools and Techniques in Biology	5	4	25	75	100
	<b>Total</b>	<b>30</b>	<b>26</b>	<b>165</b>	<b>435</b>	<b>600</b>
<b>SEMESTER-II</b>						
16ZOOC05	Animal Physiology	5	5	25	75	100
16ZOOC06	Developmental Biology and Endocrinology	4	4	25	75	100
16ZOOC07	Evolution	4	4	25	75	100
16ZOOC08	Animal Behaviour	4	4	25	75	100
16ZOOP02	Lab Course-II (Covering core papers V-VIII)	5	3	40	60	100
16ZOOE02	Elective-II 1. Vermitechnology 2. Sericulture	4	4	25	75	100
16ZOOSO1	Supportive-I 1. Molecular Oncology 2. Vermiculture & Vermicomposting	4	4	25	75	100
	<b>Total</b>	<b>30</b>	<b>28</b>	<b>190</b>	<b>510</b>	<b>700</b>
<b>SEMESTER-III</b>						
16ZOOC09	Immunology	5	5	25	75	100
16ZOOC10	Nanobiotechnology	4	4	25	75	100
16ZOOC11	Environmental Biology	4	4	25	75	100
16ZOOC12	Aquaculture and Fishery Biology	4	4	25	75	100
16ZOOE03	1. Cancer Biology 2. Stem Cell Biology 3. Soft Skill Development	4	4	25	75	100
16ZOOP03	Lab Course-III (Covering core papers IX-XIII)	5	3	40	60	100
16ZOOSO2	1. Entrepreneur Zoology 2. Advances in Zoology	4	4	25	75	100
	<b>Total</b>	<b>30</b>	<b>28</b>	<b>190</b>	<b>510</b>	<b>700</b>
<b>SEMESTER-IV</b>						
	Project work and <i>viva voce</i>	26	8	100	100 (50+50)	200
	Field visit/Industrial Visit Report	--	-	50	Int+Ext -	50
16ZOOPR01						
16ZOOEC01	Soft Skill Development : <b>Statistical package for social sciences (Extra Credit Paper)</b>	4	4	25	75	100
	<b>Total</b>	<b>30</b>	<b>12</b>	<b>175</b>	<b>175</b>	<b>350</b>
<b>CUMULATIVE TOTAL</b>		<b>120</b>	<b>94</b>	<b>720</b>	<b>1630</b>	<b>2350</b>

- Only one Soft core /and one Elective paper should selected / semester.

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

Theory Papers Internal

Best two tests out of 3: 10 marks

Attendance : 5 marks

Seminar : 5 marks

Assignment : 5 marks

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25 marks

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Practical : 40 Internal Marks

Attendance : 5 marks

Practical Test Best 2

out of 3 : 30 marks

Record : 5 marks

Project

Internal Marks : 20 marks

Presentations Viva : 20 marks

Project Report : 60 marks

**Break-up Details for Attendance**

Below 60% : No Marks

60% to 75% : 3 Marks

76% to 90% : 4 Marks

91% to 100% : 5 Marks

**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, practicals, project and viva-voce) prescribed for the course in the First appearance.

## 9. GRADING SYSTEM

The term grading system indicates a Seven (7) Point Scale of evaluation of the performances of students in terms of marks obtained in the Internal and External Examination, grade points and letter grade.

### SEVEN POINT SCALE (As per UGC notification 1998)

GRADE	GRADE POINT	PERCENTAGE EQUIVALENT
`O' = Outstanding	5.50 – 6.00	75 – 100
`A' = Very Good	4.50 – 5.49	65 – 74
`B' = Good	3.50 – 4.49	55 – 64
`C' = Average	3.00 – 3.49	50 – 54
`D' = Below Average	1.50 – 2.99	35 – 49
`E' = Poor	0.50 – 1.49	25 – 34
`F' = Fail	0.00 – 0.49	0 - 24

## 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.

PERIYARUNIVERSITY, SALEM

Department of Zoology

M.Sc. Zoology Course - SEMESTER-I

(This syllabus is applicable to the students who are admitted on or after 2016-2017 academic year onwards)

INVERTEBRATES AND CHORDATES

UNIT I

General Classification of invertebrates upto order level. **Nutrition:** Nutrition in Protozoan, Sponges, Coelenterates and Platyhelminthes - Filter Feeding in Polychaetes and Mollusca. **Respiration:** Respiratory organs – Gills, gill book, book lungs, parapodia, trachea, water vascular system with reference to respiration. **Excretion:** Excretory organs and excretory products in invertebrates.

UNIT II

**Circulatory system** - Circulation in Invertebrates – open and closed system. **Receptors:** Mechano reception – Chemoreception – Photoreception. **Nervous System:** Primitive types - Coelenterates, Echinoderms and Hemichordates. Advanced types - Metameric nervous system-Giant nerve fibres- Molluscan nervous system-Nervous system and Learning in Cephalopods.

UNIT III

**Chemical Co-ordination:** Hormones and neurohormones -Endocrine regulation in annelids, crustaceans, insects, and Molluscs -Evolution of endocrine systems-Pheromones and Allelochemicals. **Reproduction:** Asexual reproduction in Protozoans and Polychaetes. Unity in the early development of Metazoa- Protostomia and Deuterostomia.Phylogeny of invertebrates.

UNIT IV

**Origin of Chordates and classification of Prochordates** Geological time scale, Origin of chordates, Vertebrate relationships and basic structure. Type study: *Amphioxus* Prochordates-Classification, characters and relationship. **Pisces** General characters and outline classification upto orders with suitable examples. Type study: Shark **Amphibia and Reptilia** General characters and outline classification up to orders with suitable examples of biological interest. Identification and study of Poisonous and non-poisonous snakes of India.

UNIT V

**Aves** General characters and outline classification up to orders with suitable examples of biological interest. Type study: Pigeon. Arachaeopteryx, Significance of *Archaeopteryx*, Migratory Birds. **Mammalia** General characters and outline classification up to orders with

suitable examples of biological interest. Prototheria, Metatheria and Eutheria- Type study: Rabbit. Importance of Marsupial Mammals.

### **TEXT BOOK REFERENCE BOOKS**

- Barrington, E.J.W. (1979): “Invertebrate Structure and Function”, II Edn. The English Language Book Society and Nelson.
- Barnes, R.D. (1982): “Invertebrate Zoology” IV Edn. Holt-Saunders International Edition.
- Kotpal , R.L. (2010)Modern Textbook of Zoology Chordates. Rastogi publications, Meerut.
- Jordan, E.L.and Verma, P.S.(2008) Chordate Zoology S. 14<sup>Th</sup> Edition Chand &Co. New Delhi
- Ayyar, M. and Anantha Kriashnan, T. N. (1994). A Manual of Zoology Part II. (Chordata). S.Viswanathan Pvt.Ltd.
- Miller, A.S. and John P. Harvley, (1996). Zoology. 2<sup>nd</sup> Edition. Wm. C.Brown Publishers.
- Cleveland P. Hickman (1973): “Biology of the Invertebrates”. II Edn. The C.V. Mosby Company, Saint Louis.

**Core Paper :02**

**Paper Code: 16ZOO02**

**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 2016-2017 academic year onwards)

**THE CELL**

**UNIT - I**

Discovery of cell: Cell theory, prokaryotic and eukaryotic cell differentiation, Cell Cycle and regulations. Cell division: mitosis- Stages and Significance of Mitotic spindle apparatus. Role of Kinetochores. Meiosis -Stages and their significance, Importance of Meiosis in evolution of sexual reproduction in animals and Nondisjunction. Cytoplasm: Physical and biological properties of cytoplasmic matrix.

**UNIT - II**

Ultra structure, types and functions of Plasma membrane – Fluid Mosaic model theory; Ribosome and Golgi bodies, Lysosome, Endoplasmic reticulum. Mitochondria: ultrastructure and functions. Micro bodies peroxisomes and glyoxisomes.

**UNIT – III**

Nucleus: ultrastructure of nuclear membrane. Nucleolus, Nucleoplasm and Chromatine fibres. Microtubules, microfilaments – Cilia and Flagella. Signal Transduction Pathways: organization of cell signals and their 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 based classification. C-value paradox. Significance of repetitive DNA and Junk DNA. Mutations: Mutagens-physical, chemical and biological agents – mutation types –molecular basis of spontaneous and induced mutation. mutagenesis testing: AMES test.

**UNIT - V**

DNA replication – semi conservative and rolling circle. Enzymes involved in DNA replications: types and their functions. Transcription and Translation in eukaryotes: RNA polymerase – types, properties and functions–Transcription process in Eukaryotes – RNA processing, capping, polyadenylation, splicing mechanism. Protein Synthesis: Translation and post translational modifications and their biological importance. Mechanism of cell aging and senescence. Comparison of Cell death: Necrotic and apoptotic cells.

## REFERENCE BOOKS:

1. Cooper, G.M.2013. The Cell – A Molecular Biological Approaches. ASM Press, Washington.
2. Alberts B, Johnson A, Lewis J, Raff M, Roberts K and Walter P (2012) Essential Cell Biology. Garland Science, New York
3. De Robertis EDP and De Robertis EMF(2011) Cell and Molecular Biology. Lippincott Williams and Wilkins, USA.
4. Gupta PK (2014) Cell and Molecular Biology. Rastogi Publications, Meerut.
5. Karp G (2014) Cell and Molecular Biology: Concepts and Experiments. 6<sup>th</sup> edition, John Wiley and Sons Ltd. New York.
6. Lewin B (2015) Genes XIII Oxford University Press, Oxford.
7. Walker JM and Gingold EB (2013) Molecular Biology and Biotechnology. Panima University Press, Oxford Publishing Co., New Delhi.
8. Thorpe NO (2000) Cell Biology, John Wiley and Sons, New York.
9. Turner PC McLennan AG Bates AD and White MRH (2007) Instant Notes Molecular Biology. Viva Books Pvt. Ltd., New Delhi.



Core Paper :03

Paper Code: 16ZOO03

**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 2016-2017 academic years onwards)

**BIOCHEMISTRY**

**UNIT – I**

Atoms: Atomic Theories and their applications. Chemical Composition of living matter. Biological importance of water. Buffers and its Physiological properties. Handerson and Hasselbach's Equation and pKa value determination. Classification, structure and function of carbohydrates. Carbohydrate metabolism and metabolic disorder: Diabetes and their biomedical significance.

**UNIT II**

**Amino acids:** Structure, classification and physicochemical properties of amino acids, essential amino acids, glycogenic and ketogenic amino acids. **Proteins:** Classification and properties of proteins. Levels of structure in protein architecture. **Enzymes:** Types of Enzymes. Structure of Lysozyme, mechanism of enzyme action, enzyme kinetics, enzyme inhibitors, coenzymes. Inborn Errors of Metabolism.

**UNIT III**

**Lipids:** Structure and Classification, fatty acid, triglycerides, compound lipids, phospholipids, sphingolipids, glycolipids, steroids and prostaglandin. Oxidation of fatty acids, ketosis, biosynthesis of fatty acids, triglycerides and cholesterol. **Integration of metabolism:** Beta oxidation of fatty acids and Cholesterol biosynthesis. Biomedical importance of: very-low-density lipoproteins (VLDL), intermediate-density lipoproteins (IDL), low-density lipoproteins (LDL), and high-density lipoproteins (HDL). Obesity: Causes and Preventive measures.

**UNIT IV**

**Porphyrins:** Haemoglobin synthesis and Sickle cell anemia. of nucleoside and nucleotide. **Nucleic acids:** Free nucleotides – structure, properties and functions of RNA and DNA. Synthesis and degradation of purine and pyrimidine (De novo and salvage pathways). Syndromes associated with nucleic acid metabolism: Aicardi-Goutières syndrome (AGS), Lesch-Nyhan syndrome and GOUT Disease.

**UNIT V**

**Signal transduction:** Hormones and their receptors, steroid hormone receptor and gene action. Peptide hormone receptor (cell surface receptors), signaling through G-protein coupled receptors, signal transduction pathways, cAMP, cGMP, phosphatidyl inositol and calcium as second messengers, regulation of signaling pathways.

## **REFERENCE BOOKS**

Murray, R. K., Granner, D. K., Mayes, P. A., Rodwell, V. W. (2014) Harper's Biochemistry. Prentice Hall International Inc.

Lehninger, A. L., Nelson, D. K., and Cox, M. M. (2015) Principles of Biochemistry. CBS Publishers and distributors, New Delhi.

Stryer, L. (2014) Biochemistry. W. H. Freeman and Company, New York.

Voet, D. Judith, G. Voet, Charlotte W. Pratt. (2008). Fundamentals of Biochemistry, John Wiley & Sons Inc. New York.

Satyanarayanan, U (2015). Essentials of Biochemistry, Uppala Author – Publisher Interlinks, Vijayawada

**Core Paper :04**

**Paper Code: 16ZOO04**

**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 2016-2017 academic years onwards)

**GENETICS**

**UNIT I**

Mendelian principles: Dominance, segregation, independent assortment, deviation from Mendelian inheritance. Concept of gene: Allele, multiple alleles, pseudoallele, complementation tests. Extensions of Mendelian principles: Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters. Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers.

**UNIT II**

Extra chromosomal inheritance: Inheritance of mitochondrial genes, maternal inheritance. Microbial genetics: Methods of genetic transfers – transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes. Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

**UNIT III**

Quantitative genetics: Polygenic inheritance, heritability and its measurements, QTL mapping. Mutation: Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis.

**UNIT IV**

Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their genetic implications. Recombination: Holiday Model, Homologous and non-homologous recombination, including transposition, site-specific recombination.

**UNIT V**

Principles and applications of Prenatal diagnosis – Chorionic villus sampling and Amniocentesis. Chromosomal karyotyping – Detection of Syndromes – Down Syndrome, Klinefelter's syndrome, 18 Trisomy. Methods and applications of Chromosomal micro-dissection, DNA Finger Printing and Fluorescent In Situ Hybridization (FISH). Importance of Genetic Counselling.

## REFERENCE BOOKS

- D. Peter Snustad and Michael J. Simmons. 2015. Principles of Genetics. John Wiley Inc.
- Sandy B. Primrose and Richard Twyman. 2006. Principles of Gene Manipulation and Genomics, Blackwell Publications
- Tamarin RH (2001) Principles of Genetics (2001) 7<sup>th</sup> edition, McGraw-Hill, New York.
- Snustad DP and Simmons MJ (2013) Principles of Genetics. 6<sup>th</sup> edition John Wiley and Sons.
- Strickberger MW (2010). Genetics, Prentice Hall of India Pvt. Limited.

**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 2016-2017 academic years onwards)

**Lab Course I**

**Core I Invertebrates and Chordates**

1. Structure and function of Major mammalian Organs (Rat-heart, pancreas, liver, kidney and gonads) – Voucher Specimen
2. Spotters and Slides (For *Plasmodium* sp., Sponges, *Hydra*, Liver fluke, Tape worm, *Peripatus*, *skeleton of Human*.)
3. Survey of Insects in Periyar University Campus (Field Study)
4. Survey of Birds in Periyar University Campus (Field Study)
5. Identification of Migratory Birds

**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)
4. Observation of Meiosis (Grasshopper – Voucher Specimen)
5. Cells of vital organs (Slides: Kidney, Liver, Spleen, Stomach, muscles, lung and colon)

**Core III Genetics**

1. Observation of Mendelian traits Among student Volunteers
2. Identification of Human Syndromes – Voucher Specimen
3. Study on polygenic inheritance – Voucher Specimen
4. Pedigree Analysis of Genetic Disorder (Hemophilia and Diabetes)
5. Genetic Counseling methods (Among Student Volunteers)

**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
5. Spotters: Diabetes, Lesch-Nyhan syndrome and GOUT Disease

**REFERENCE BOOKS**

1. Plumer HT (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

**Core Paper: 06**

**Paper Code: 16ZOOC05**

**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 2016-2017 academic years onwards)

## **ANIMAL PHYSIOLOGY**

### **UNIT I**

**General Physiology-** Functional organization of Human Body and control of the internal environment. **Thermoregulation:** Temperature compensation in poikilotherms, Temperature Regulation in homeotherms, Physical, chemical and neural regulation. Concept of acclimation and acclimatization. **Osmotic and ionic regulation:** Response to hyperosmotic and hyposmotic media with reference to fishes. **Stress and adaptations:** Adaptations to pressure - High altitude , buoyancy. **Respiration-** Comparative physiology of respiration in relation to different habitats, transport of gases, exchange of gases, neural and chemical regulation of respiration.

### **UNIT II**

**Circulation and Excretion:** Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume and its regulation, haemostasis - Comparative anatomy of heart structure, myogenic heart, cardiac cycle, heart as a pump, blood pressure, blood volume regulation, neural regulation, ECG - its principle and significance. Comparative physiology of excretion in relation to different habitats, kidney - urine formation, concentration, elimination and regulation of water balance.

### **UNIT III**

**Muscular co-ordination:** Chemistry and Molecular mechanism of muscular contraction. Nervous co-ordination: Gross anatomy of brain and spinal cord, Neuron- resting membrane potential, action potential, propagation of action potential, interneuron transmission, Central and peripheral nervous system - neural control of muscle tone and posture. **Receptor mechanism:** Chemoreception- Chemical senses , taste and smell, Phonoreception – Physiology of hearing, Photoreception - Photochemistry of vision.

### **UNIT IV**

**Endocrine system:** Basic mechanism of hormone action - Neuro endocrine mechanism in insect growth and reproduction. **Endocrine glands:** Hypothalamus, Pituitary axis, Pineal gland, Thyroid, Parathyroid, Pancreas and adrenal – Hormones secreted, functions and disorders.

## UNIT V

**Reproductive Systems:** Anatomy of Human reproductive systems – Hormones secreted, physiology and regulation. Hormone control of menstrual cycle, Pregnancy, Parturition and lactation. Disorders of ovary – amenorrhea, dysmenorrhea, polycystic ovary syndrome, menopause, Hormonal contraceptive agents, Hormonal replacement therapy. Assisted Reproductive technologies (ART) – Artificial insemination, surrogate motherhood, IVF, GIFT, ZIFT and ICSI ; Oocyte banking and donation. Outline of Chronobiology- Concepts of Circadian Rhythm, Biological clock, Neuro-Endocrine functions in regulation of photoperiods in mammals.

## REFERENCE BOOKS

J. E. Hall, 1998. Guyton and Hall Text Book of Medical Physiology. Thirteenth Edition, Elsevier Sander Publications, USA.

Richard W. Hill, 2016. Animal Physiology. 4<sup>th</sup> Edition, Sinauer Associates, Inc. USA.

Knut Schmidt-Nielsen, 2011. Animal Physiology: Adaptation and Environment, Sixth Edition, Cambridge University Press, UK.

Eckert, Roger, Randall, D.J., Burggren, Warren, French, Kathleen. 2011. Eckert's Animal Physiology, Fifth Edition. W.H. Freeman & Co Ltd. USA

Frederic H. Martini 2014. Fundamentals of Animal Physiology. Benjamin-Cummings Publications Ohio, USA

Gordon, M. S., Bartholomew, G. A., Grinnel, A. D., Jorgensen, C. B. White, F.N., (1971) Animal Function - Principles and Adaptations. Macmillan Co. London.

Marieb, E.N. (2007) Essentials of Human Anatomy and Physiology. Published by Dorling Kindersley (India) Pvt. Ltd.

Nelson, S, K. (1985) Animal Physiology - Adaptation and Environment. Cambridge University Press.

Prosser, C.L. and Brown (1985) Comparative Animal Physiology III Ed. W.B. Saunders Company, Philadelphia

Rastogi, S.C. (2005) Essentials of Animal Physiology IV Edn., Published by New Age International (P) Ltd. New Delhi.

Ian Kay, 2006. Animal Physiology Pear Tree Press Ltd., Singapore.



**Core Paper: 07**

**Paper Code: 16ZOOC06**

**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 2016-2017 academic years onwards)

**DEVELOPMENTAL BIOLOGY**

**UNIT I**

**Basic concepts of development:** Eggs and their types-Polarity, symmetry and chemo-differentiation of egg. Gamitogenesis: Spermatogenesis and Oogenesis. Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; Genes contributing to gonad development – Role of SF1, WT1, SRY, SOX 9 and other genes.

**UNIT II**

Role of maternal contribution in early embryogenesis – masked RNA. Molecular perspectives of fertilization: Recognition of egg and sperm, sperm attraction, acrosome reaction, species – specific recognition, cortical reaction, activation of egg metabolism, fusion of genetic material.

**UNIT III**

Totipotency and pluripotency of cleavage blastula and gastrula and morphogenetic movements. Nuclear transplantation experiments in amphibians – Embryonic stem cell and its application. Genes that pattern *Drosophila* body plan: morphogenetic gradients, cascades and signaling pathways in *Drosophila* development – Homeo box concept and its role.

**UNIT IV**

Cell-cell interaction, adhesion and communication – Organizer and induction: Spemann's classical experiment, molecules of Nieukoop center – activin, noggin, BMP4, Wnt, FGF and retinoic acid – chemistry and mechanism. Limb development in vertebrates. Post embryonic development – larval formation, metamorphosis, Environmental regulation of development.

**UNIT V**

Differentiation – definition, differentiation at tissue level - epithelio-mesenchymal interaction, differentiation at organ level – cyclopia and acephaly, role of Hox D gene, Hoxa gene. Concept of gene knock out, abnormal differentiation – teratoma and teratogens. Mechanism of Programmed cell death (Apoptosis).

**REFERENCE BOOKS**

- Scott F. Gilbert (2013) Developmental Biology, VIII Ed. Sinaur Associates Inc. Publishers, Sunderland, Massachusetts USA.

- B. I. Balinsky and B. C. Fabian. 1998. Introduction to Embryology. V Ed., Saunders,
- L. Wolpert, (2002). Principles of Developmental Biology. II Ed., Oxford University Press.
- Russo, V.E.A., Brody, S., Cove, D and Ottolenghi, S., (2002). Development. The Molecular Genetic Approach. Springer Verlag, Berlin.
- S. Soundian, 2011. Developmental Biology. Neha Publishers & Distributors, India
- Kevin Coward. 2013. Text Book of Clinical Embryology. Cambridge University Press.

**Core Paper: 08**

**Paper Code: 16ZOOC07**

**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 2016-2017 academic years onwards)

**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. Hall BK and Hallgrimsson B (2014) Strickberger's Evolution, Jones and Bartlett Publishers.
2. Scott, E.C. 2005. Evolution vs. Creation: An Introduction. University of California Press, Berkeley, CA.
3. Darwin, C. 1845. The Voyage of the Beagle. John Murray, London.
4. Darwin, C. 1958. The Autobiography of Charles Darwin 1809-882., The Norton Library, New York.
5. Futuyma DJ (2013) Evolution, Sinauer Associates, USA.
6. Minelli A (2009) Perspectives in Animal Phylogeny and Evolution, Oxford University Press, UK.
7. Dobzhansky, Th., F.J. Ayala, G.L. Stebbins & J.W. Valentine. 1977. *Evolution*. W.H. Freeman, San Francisco.
8. Dobzhansky T (1970) Genetics of the evolutionary process, Columbia University Press.
9. Jon C. Herron and Scott Freeman 2013. Evolutionary Analysis. 5<sup>th</sup> Edition. Pearson Publication.

**Core Paper: 09**

**Paper Code: 16ZOOC08**

**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 2016-2017 academic years onwards)

**ANIMAL BEHAVIOUR**

**Unit I**

**Introduction to animal behaviour-** Founding fathers of Animal behaviour- Tinbergen's four questions- Methods for studying animal behaviour- Proximate and ultimate causation of behaviour

**Unit II**

**Behavioural patterns-** Stereotyped behaviours- Orientation, animal navigation and migration- reflexes- Instinct Vs Learnt behaviour- Associative learning- Classical and Operant conditioning- Habituation, imprinting.

**Unit III**

**Social behaviour-** Altruism- Honey bee, Vampire bats- Hamilton's rule, Kin selection- Group foraging and its advantages- Dispersion- migration- territoriality- Pheromones and reproductive behaviour

**Unit IV**

**Mating system-** Sexual dimorphism- Male- Male competition- Female choice- Leks- Alternative mating tactics-satellite males- monogamy- Polyandry- Polygyny- Sperm competition- Parental care

**Unit V**

**Chronobiology-** Types and characteristics of biological rhythm- short term and long term rhythm- Circadian rhythm, tidal rhythm, lunar rhythm- photic and non photic zeitgebers- circannual rhythms- relevance of biological clocks- chronopharmacology

**REFERENCES**

- Alcock, J (2013) Animal Behavior: An evolutionary approach, Sinauer Associates, USA.
- Breed, M.D., and J. Moore (2011) Animal Behavior, Academic Press, USA

- Davis, N.B., Krebs, J.R and S.A. West (2012) An Introduction To Behavioural Ecology, Wiley-Blackwell.
- Manning, A and M. Dawkins (2012) An Introduction To Animal Behaviour, Cambridge University Press, London

**Core Paper: 10**

**Paper Code: 16ZOOP02**

**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 2016-2017 academic years onwards)

**LAB COURSE II**

1. Pregnancy testing for hcG in urine samples (from Volunteers)
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. Identification of Endocrine glands in mammals (Voucher Specimen)
8. Identification of Endocrine glands in insect (Voucher Specimen)
9. Identification of Secondary sexual characters in Peacock
10. Identification of Homology among Fauna of Periyar University
11. Identification of Vestigial organs of human by Student Volunteers (own)
12. Case Study Report: Ants and plant interaction (Convergent Evolution)

**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. Adaptive Radiation in Darwin Finches
7. Marine and freshwater prawns
8. Phylogenetic Tree

## **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.



**Core Paper: 11**

**Paper Code: 16ZOOC09**

**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 2016-2017 academic years 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:

- Fathimunisa Begum 2014. Immunology. PHI Learning Pvt. Ltd., Delhi
- Kuby, J. 2013. Immunology. W.H. Freeman & Company, New York.
- Lydyard, M., Whelan, A. and Fanger, M.V. 2004. Instant Notes in Immunology.
- Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt, 2006. XI edition, Roitt's
- Essential Immunology Wiley – Blackwell publications.
- Roitt, I., 2002. Essential Immunology, VI edition, Elsevier Science Publishing Company, New York.
- Tizard, I.R. 1995. Immunology-An introduction IV Ed. Saunders College Publications, Philadelphia.
- Janeway CA 2010. Immunobiology – The Immune System in Health and Disease, Churchill Livingstone, New York.

**Core Paper: 12**

**Paper Code: 16ZOOC10**

**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 2016-2017 academic years 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.

### **UNIT – II**

Gene transfer into animal cells, expression of foreign genes in animal cell lines. 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**

- Butler M (1997) Animal Cell Technology: Principles and Products, Open University Press, New York.
- Dubey RC (2012) A Text Book of Biotechnology, S. Chand Co., New Delhi.
- Gupta PK (2014) Biotechnology and Genomics, Rastogi Publications, Meerut, India.
- Mather JP and Barnes D (2003) Methods in Cell Biology, Vol 57 Animal Cell Culture Methods, Academic Press, New York.
- Potten CS (2010) Stem Cells, Academic Press, London.
- David J Lockwood (2004) FRSC: Introduction to Nanoscale Science and Technology, National Research Council of Canada Ottawa, Ontario, Canada.
- Kirkland AI and Hutchison JL (2007) Nanocharacterisation, Department of Materials, Oxford University, Oxford, UK.
- Yury Gogotsi (2006) Nanomaterials Handbook, Taylor and Francis Group, Boca Raton London, New York.

**Core Paper: 13**

**Paper Code: 16ZOOC11**

**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 2016-2017 academic years onwards)

## **ENVIRONMENTAL BIOLOGY**

### **UNIT I**

**The Environment:** Physical environment; biotic environment; biotic and abiotic interactions. Habitat and niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement. **Ecosystem:** Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).

### **UNIT II**

**Population Ecology:** Characteristics of a population; population growth curves; population regulation; life history strategies (*r* and *K* selection). **Air pollution:** Source, pollutants and effects of CFC, ozone, acid rain - global warming, emission standards, monitoring and control of pollution. **Water pollution :** Sources, effects - sewage and industrial wastes - BOD, COD. Waste water treatment - eutrophication. - biomagnifications. **Oil pollution:** Coastal pollution - Oil Slicks and Spills, Post gulf war effects. **Land pollution :** Solid waste accumulation, hospital waste and management.

### **UNIT III**

**Species interactions:** Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis. **Community ecology:** Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones. **Ecological succession:** Types; mechanisms; changes involved in succession; concept of climax.

### **UNIT IV**

**Biogeography:** Major terrestrial biomes; theory of island biogeography; biogeographical zones of India. **Applied ecology:** Environmental pollution; global environmental change; biodiversity-status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches.

### **UNIT V**

**Biodiversity and Conservation biology:** Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger,

Biosphere reserves). **Disaster Management:** Factors and Significance; Difference between Hazard and Disaster. Natural Disasters – Earthquakes, Volcanic Eruption, Landslides, Cyclones, Tsunamis and Droughts. Man Made Disasters- Fires and Forest Fires. Nuclear, Biological and Chemical disaster.

## REFERENCE BOOKS

Sharma, B.K. (2015). Environmental chemistry. Goel Publishing House, Meerut, 11<sup>th</sup> edition.

### REFERENCE BOOKS:

Asthana, D. K., and Meera, A. (2001) Environment – Problems and solution. S. Chand & Company LTD, New Delhi.

Cunningham, P. W. and Saigo, W.B. (1999) Environmental Science. V Ed. McGraw Hill, New York.

Dhawan, N.G. and Khan, A.S. (2014). Disaster Management and Preparedness. (Based on the syllabus prescribed by UGC for Disaster Management Education). CBS Publishers. New Delhi.

[Edward, I. N.](#) (1996). Applied Ecology & Environmental Management. Wiley-Blackwell Publication.

Goel, P.K. (1997). Water Pollution - Causes, Effects and Control. New Age International (P) Limited Publishers

Kudesia, V.P. (1986). Air Pollution. PragatiPrakashan, Meerut.

Nobel, J., Richard, T. Wright, S. (1996) Environmental Sciences. V Edition.

Shah, S.A. (1988) Forestry for People, Indian Council of Agricultural Research - KrishiAnusandhuBhavan, Pusa, New Delhi.

Sharma, B.K. and Kaur, H. (1997) An Introduction to Environmental Pollution. Goel Publishing House, Meerut.

Sinha, R.K. (1996) Biodiversity - Global Concerns. Common Wealth Publishers.

**Core Paper: 14**

**Paper Code: 16ZOOC12**

**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 2016-2017 academic years 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.



**Core Paper: 16 (Practical)**

**Paper Code: 16ZOOP03**

**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 2016-2017 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. Placoid and Tenoid scale
10. Synthesis of Silver Nanoparticle
11. Biosynthesis of Gold Nanoparticle
12. Characterization of Synthesized Nanoparticle using UV-Visible Spectrophotometer
13. Population Estimation of Soil organisms
14. Determination of Dissolved oxygen by Wrinkler's Method
15. Fauna of Pond and Grass land Ecosystems in Periyar University Campus.

**SPOTTERS**

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

8. DAPI Staining Picture
9. AO/EtBr Staining Picture
10. Apoptotic Cells
11. Silver Nanoparticle
12. Gold Nanoparticle
13. Mesoporous Silica Nanoparticle
14. Rocket Gel Immuno Electrophoresis
15. Octorlony

### **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, 2nd ed. Cold Spring Harbor, N.Y.: Cold Spring Harbor Laboratory Press.
5. Kannan S, Krishnan M, Thirumurugan R and Achiraman S(2012) Methods in Molecular Biology, UVN Publishers, India.

**Core Paper: 17 (Project viva Voce)**

**Paper Code: 16ZOOPR01**

**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 2016-2017 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 2nd / 3rd 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.

**Core Paper: 18 (Project viva Voce)**

**Paper Code: 16ZOOC14**

**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 2016-2017 academic year onwards)

**SOFT SKILL DEVELOPMENT (Extra Credit Paper)**

**STATISTICAL PACKAGE FOR SOCIAL SCIENCES (SPSS)**

**UNIT I**

Definition; Scope of Biostatistics, Variables in biology; Population and sampling, sampling distribution; Difference between parametric and non – parametric statistics; Data Collection, Classification, Tabulation. Introduction to Statistical Package for Social Sciences (SPSS) for windows. Variable naming on SPSS –data entry, Analysis of data – Formulation of frequency tables.

**UNIT II**

Measures of central tendency – Mean, Median, and Mode; Measures of dispersion – Range, quartile deviation, mean deviation and standard deviation; Skewness and kurtosis; Diagrammatic representation – Bar and pie chart , histogram, frequency polygon, Frequency Curve , Logarithmic curves, Scatter plot and line graphs.

**UNIT III**

Correlation – Types, methods – Graphic, mathematical- Pearson’s correlation co-efficient, Rank correlation co-efficient , Regression – Simple linear regression, regression equation and regression line.

**UNIT IV**

Elements of probability – Probability distribution – Binomial, Poisson, Normal, Tests of significance – hypothesis testing- Type I and Type II error, level of significance. Student ‘t’ test - One sample ‘t’ test, Independent sample and Paired ‘t’ test.

**UNIT V**

Chi – square; Application of chi – square test. Chi – square test for Goodness fit; Test for Independence of Attributes. F’ test – Analysis of Variance (ANOVA) – One way ANOVA – Two way analysis of variance - Introduction to Multivariate statistics.

**Note: Students will work out problems using SPSS package at the time of examination in on line.**

## **REFERENCE BOOKS**

Einspruch, E. L. (2004) Next steps with SPSS. Sage Publications, International educational and Professional Publisher, Thousand Oaks, London, New Delhi.

Mille , R. L. , Ciaran, A., Fullerton, D. A. and Maltby, J. (2002). SPSS for social scientists (Version 9, 10, 11). Consultant editor- Jo. Campling, publishers Palgrave MacMillon (UK.USA) Printed in China

**Elective Paper: 1**

**Paper Code: 16ZOOE01**

**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 2016-2017 academic year onwards)

**MICROBIOLOGY**

(This syllabus is applicable to the students who are admitted on or after 2016-2017 academic year onwards)

**UNIT I:** History and Scope of Microbiology- Wittaker's Five Kingdom concept- General features of prokaryotes. Morphology and ultra-structure of viruses. Mycology: Classification of biomedically important fungal species.

**UNIT II:** Culture and Characterization: Isolation and identification of bacteria. Techniques of pure culture methods. Phases of growth. Methods of sterilization and disinfection –. Staining: Simple and differential staining; Gram staining; acid fast staining; endospore staining; capsule staining and flagella staining.

**UNIT III**

Microbial genetics: Methods of genetic transfers – transformation, conjugation, transduction. Microbial Genomics: Genome project of *Escherichia coli* and *Yeast*. Metagenomics concepts and Significance. Microbial control – Physical and chemical agents

**UNIT IV:** Host parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into animal host cells, alteration of host cell behavior by pathogens.

**UNIT V:**

Industrial Microbiology: Microbial fermentation and production of small and macro molecules. Bioremediation Principles and application.

**REFERENCE BOOKS:**

1. Atlas RM (1997) Principles of Microbiology. 2<sup>nd</sup> edition, McGraw-Hill.
2. Dubey RC and Maheswari DK (2014) Textbook of Microbiology. S. Chand and Co.
3. Pelczar M J, Chan ECS and Kreig NR (2014) Microbiology. Tata-McGraw Hill.
4. Prescott LM (2013) Microbiology. 6<sup>th</sup> Edition. McGraw-Hill.
5. Stanier R, Ingraham J, Wheelis M and Painter P (2009) General Microbiology. 5<sup>th</sup> Edition, Macmillan Press.

**PERIYARUNIVERSITY, SALEM**

**Department of Zoology**

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

(This syllabus is applicable to the students who are admitted on or after 2016-2017 academic year onwards)

**TOOLS AND TECHNIQUES IN BIOLOGY**

**Unit I: Microbiological Techniques** - Media Preparation and sterilization - Inoculation and growth monitoring, Microbial identification. **Microscopy:** Principle & applications - Light microscope and phase contrast microscope - Fluorescence microscope - Electron microscope (SEM & TEM) - Confocal microscopy. Principle and applications of - Spectrophotometer - Ultra centrifuge.

**Unit II:** Cryotechniques - Cryopreservation of cells, tissues, organs and organisms, freeze drying. Separation techniques. -Chromatography, principle type and applicants. Electrophoresis, Principles, types and applications -PAGE and agarose gel electrophoresis.

**Unit III:** Radioisotope and main isotope techniques in biology. Sample preparation for radioactive counting, Autoradiography. Immunological techniques - Immunodiffusion (Single & Double) - Immuno electrophoresis Techniques immuno detection - Immunocyto / histochemistry - Immunoblotting, immunodetection, immunofluorescence.

**Unit IV:** Histological techniques - Principles of tissue fixation - Microtomy - Staining - Mounting – Histochemistry. Cell culture techniques. - Design and functioning of tissue culture laboratory - Culture media, essential components and Preparation - Cell viability testing.

**Unit V: Cytological techniques** – Working Principle and Applications of Flowcytometry, *in situ* hybridization (radio labelled and non-radio labelled methods) - FISH – Polymerase chain reaction (PCR), RFLP, RAPD, Blotting (Southern hybridization - Northern hybridization ) - DNA Sequencing types and applications

**REFERENCES**

1. Keith Wilson and John Wlaker (2014) Principles and techniques of Practical Biochemistry and molecular biology 10<sup>th</sup> Edition . Cambridge University Press.
2. Geofferoy M. Cooper (2013) The Cell- A Molecular Approach. ASM Press New York.
3. Frederick M. Ausubel, Roger Brent, Robert E. Kingston, David D. Moore, J. G. Seidman, John A. Smith, Kevin Struhl 2010 Short Protocols in Molecular Biology, 5th Edition, 2 Volume Set. Wiley publication.

4. R. Ian Freshney. 2011 Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, 6<sup>th</sup> Edition. Wiley publication.
5. Robert D Braun (1987) Introduction to instrumental analysis- -McGraw Hill.
6. B L Williams and K Wilson (1981) A biologist Guide to principles and Techniques of Practical Biochemistry. Edward Arnold, London. 1981.



**PERIYARUNIVERSITY, SALEM**

**Department of Zoology**

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

(This syllabus is applicable to the students who are admitted on or after 2016-2017 academic year onwards)

**VERMITECHNOLOGY**

**UNIT- I:** Earthworm – morphology and anatomy – Biology of *Perionyx excavatus*.– Ecological grouping – Epigeic, Anecic and Endogeic species; Ecological role and economic importance of earthworms.

**UNIT- II:** Vermiculture – definition, scope and importance; Common species for culture; Environmental requirements; Culture methods – indoor and outdoor cultures – monoculture and polyculture. Different methods for setting-up of vermicomposting units.

**UNIT- III:** Applications of vermiculture – Vermicomposting – different methods of vermicomposting; use of vermicastings in organic farming/horticulture, earthworms for management of municipal organic solid wastes. Nutrient value of worm cast/vermicompost – Effect of vermicompost on plants.

**UNIT- IV :** Advantages of Vermitechnology – Marketing the products of vermiculture – creating the demand by awareness and demonstration, advertisements, packaging and transport, direct marketing.

**UNIT- V:** Predators, Parasites, and Pathogens of Earthworms and their control. Future perspectives – Potentials and constraints for vermiculture in India.

**REFERENCES**

- Edwards, C.A., Arancon, N.Q. and Sherman, R. 2011. Vermiculture Technology: Earthworms, Organic Wastes, and Environmental Management. CRC Press, Boca Raton, FL.
- Ismail, S.A. 1997. *Vermicology: The Biology of Earthworms*. Orient Longman, India.
- Ismail, S.A. 2005. *The Earthworm Book*. Second Revised Edition, Other India Press, Apusa, Goa, India.
- Ranganathan, L.S. 2006. *Vermibiotechnology – From Soil Health to Human Health*. Agrobios, India.

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**PERIYARUNIVERSITY, SALEM**

**Department of Zoology**

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

(This syllabus is applicable to the students who are admitted on or after 2016-2017 academic year onwards)

**SERICULTURE**

**UNIT -I:**

**ECONOMIC IMPORTANCE AND SILKWORM BIOLOGY** :Prospects and status - Silk producing species - their distribution - Bombyxmori - life cycle - organization of larvae, pupae and moth - structure of the silk gland.

**UNIT-II:**

**MORICULTURE** :Mulberry - varieties - distribution - methods of cultivation and preparation - Harvest - Transport and preservation of leaves. Feeding and nutrition - specificity of diet - Factors of nutrition - Diet and growth. Pest and diseases.

**UNIT-III:**

**SILKWORM REPRODUCTION AND GENETICS:** Reproduction - Growth and Development of silkworms - Physiology of molting in different varieties (Uni, bi and multivoltine) - Endocrinology of reproduction and development. Genetics - mutation breeding and development of new strains.

**UNIT-IV:**

**PATHOGENIC DISEASES AND PEST:** Pathology - Viral, bacterial, fungi and protozoan diseases - control mechanisms. Uzifly menace.

**UNIT-V:**

**SILKWORM REARING AND SILK REELING:** Rearing operations - Selection and construction of rearing house Incubation - Hatching - brooding, Harvesting etc. Reeling techniques - lacing skinning. Re-reeling .

**REFERENCE BOOKS**

Eikichi, H. (1999). Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Ganga, G. (2003). Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

**Elective Paper: 3**

**Paper Code: 16ZOOE03**

**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 2016-2017 academic years onwards)

## **CANCER 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 a new perspective for cancer treatment.

### **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**

Cancer Stem cells– Properties , Types and Pros and cons of cancer stem cell technology. Primordial germ cell -Skin cell - Embryonic stem cell differentiation as a model to study haematopoietic and endothelial cell development, Reprogramming and induced pluripotency.

### **UNITV**

Cancer Prognosis, Diagnosis and Treatment: Principles and applications of Cyto toxicity assay (MTT and XTT Assasy), BrdU Assay, Flow Cytometry, TUNEL Assay, Staining Technique : Acredine Organge and Ethidium Bromide staining, DAPI Staining, Immunohistochemical staining, Hoechst staining, and Western Blotting. Treatment Strategies: Radio Therapy, Hormone therapy, Chemotherapy, Monoclonal Antibody Treatment, Combined Therapy, Nanomedicine and their merits and demerits. Current status of Drug development for Cancer.

## **REFERENCE BOOKS:**

- Turksen K (2002) Embryonic Stem Cells Method and Protocols. Humana press.
- Korobkin R and Munzer SR (2007) Stem Cell Century, Law and Policy for a Breakthrough Technology, Yale University Press.
- Lanza R (2005) Essential of Stem cell Biology. Elsevier press.
- Lanza R (2004) Hand Book of Stem Cells Volume 1and2, Elsevier press.
- Committee R (2004) Stem Cells and the Future of Regenerative Medicine by on the Biological and Biomedical Application of Stem Cell Research.
- Robertis EDP and De Robertis EMF (2005) Cell and Molecular Biology, (8th edn), De, B.I.Waverly Pvt. Ltd., New Delhi.
- 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.

**Elective Paper-03**

**Paper Code: 16ZOOE03**

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

(This syllabus is applicable to the students who are admitted on or after 2016-2017 academic year onwards)

### **SOFT SKILL DEVELOPMENT**

#### **UNIT I**

**Capacity Building :** Self awareness- building self-esteem- importance of having a strong self – esteem – developing positive attitude-. Anchoring on principles: Universal principles and values – forming & inculcating values.

#### **UNIT II**

**Interpersonal skills:** Trust-trustworthiness-interpersonal communication –art of listening, reading and writing –art of writing,e-mails and e-mail etiquettes –building relationship-networking.

#### **UNIT III**

**Corporate skills:** Vision, mission and goals: Concepts, vision setting, goal setting- goals for roles. Group goal –concept of synergy – team building – group skills.

#### **UNIT IV**

**Management skills:** Developing Body Language – Practicing etiquette and mannerism – Stress Management –Time Management: Important and urgent activities- time management to move towards life vision.

#### **UNIT: V**

**Employability Skills:** Writing Resume / CV –interview skills – Group Discussion –Mock Interview – Mock GD –Career Planning.

#### **REFERENCE BOOKS:**

Alex K.(2012) Soft Skills – Know Yourself & Know the World, S. Chand & Company Ltd.New Delhi

Meena K. Ayothi V. (2013). A Book on Development of Soft Skills (Soft Skills: A Road Map to Success), P.R. Publishers & Distributors, Trichy.

Francis Thamburaj S.J. (2009). Communication soft skills for Professional Excellence, 1<sup>st</sup> Ed., Grace Publishers.

Rathan Reddy B.(2005). Team Development and Leadership,Jaico Publishing House, Mumbai.

**Elective Paper-03**

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## **STEM CELL BIOLOGY**

### **UNIT I**

Stem Cell – Overview of Stem cell Biology, Fate mapping of Stem Cells. Cell cycle control, Checkpoints, Senescence of Dividing Somatic cells. Embryonic development - Generation and manipulation of Mouse and Human Embryonic Stem Cells.

### **UNIT II**

Primordial Germ cells and Germ cell development. Epigenetics and Reprogramming in Stem Cell Biology. Molecular mechanisms of self-renewal, Pluri/multipotency and lineage differentiation.

### **UNIT III**

Stem cell niche in Drosophila germ line. Hematopoietic stem cells: Repopulating Patterns of Primitive Hematopoietic Stem cells, Molecular Diversification and Developmental Interrelationships, Lymphopoiesis and Hemangioblast.

### **UNIT IV**

Stem cell bank-Aseptic techniques for cell culture room. Preparation of cell culture media, cell viability assays, Cytotoxicity assays. Signal transduction pathways in normal and diseased conditions.

### **UNIT V**

Skin Stem cells, Neural Stem cells, Liver stem cell, Pancreatic Stem cells and Cancer stem cells. Stem Cell treatment to diseases. Novel sources of multipotent stem cells. Ethical issues associates with Stem Cells.

## **REFERENCE BOOKS**

Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, James D. Watson.(1994). Molecular Biology of the Cell, 3<sup>rd</sup> Edition. CSH Publications USA.

Scott F. Gilbert (2000). *Developmental Biology*, 6<sup>th</sup> Edition. Sunderland (MA): Sinauer Associates New York.

Marshak, E. (2001) *Stem Cell Biology* by, Cold Spring Harbor Symposium Publication. USA

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(This syllabus is applicable to the students who are admitted on or after 2016-2017 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, CDKs, related pathways – Relationship between cancer and anti apoptotic proteins.

**UNIT - IV**

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

**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, New Jersey.



3. Depatin K and Fulda S (2008) Apoptosis and Cancer Therapy, WILEY-VCH Verlag 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.

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(This syllabus is applicable to the students who are admitted on or after 2016-2017 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. Ismail SA (1997) Vermicology: The Biology of Earthworms. Orient Longman, India.
2. Ismail SA (2005) The Earthworm Book. Second Revised Edition, Other India Press, Apusa, Goa, India.
3. Ranganathan LS (2006) Vermibiotechnology– From Soil Health to HumanHealth. Agrobios, India.

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

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**ENTREPRENEURIAL ZOOLOGY**

**Unit I:** Sericulture: History and present status - Sericulture in India - Types of silkworms and distribution. Silkworm rearing technology, Food plant cultivation, seed production, reeling, re-reeling, twisting, doubling and weaving. Diseases and pests of Silkworm: Protozoan, Viral, Bacterial and fungal diseases. Silkworm pests: —Indian Uzifly and Dermistid beetles

**Unit II:** Introduction to Aquaculture. Culture systems. Types of aquaculture. Pond Ecology - Preparation of ponds. Prevention and control of weeds. Parasitic, protozoan, bacterial, fungal and viral diseases and management. Culture of Prawns. Processing, preservation and commercialization of the products.

**Unit III:** Apiculture: Introduction and present status. Distribution and behavior of *Apis dorsata*, *Apis cerana indica*. Structure & Morphology, Life cycle, colony organization, division of labour and communication. Beekeeping equipments, beekeeping and its products. Diseases and pests of Bees: Bacterial, fungal and viral diseases. Bee pests: Mites, beetles and moths. Management of pests and diseases.

**Unit IV:** Introduction to Live feeds. Live feed species and their nutritional value. Rearing and maintenance of live feeds. Habitat maintenance for natural feed production. Mass culture techniques: Rearing and maintenance of phytoplankton and zooplanktons, Methods of collection, Different media used in culture, Application in hatcheries.

**Unit V:**

Oyster culture: History and present status. Seed production of oysters and collection methods. Habitat management – Preparation of nurseries, Feed and nutrition, Factors affecting nurseries and development. Edible oysters and Pear oysters. Predators, Diseases and Environmental factors that affect oysters.

**References:**

Eikichi, H. (1999). Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Ganga, G. (2003). Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Ganga, G. and SulochanaChetty, J. (1997).An Introduction to Sericulture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Hisao Aruga. (1994). Principles of Sericulture (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Mahadevappa, D., Halliyal, V.G., Shankar, D.G. and Bhandiwad, R., (2000). Mulberry Silk Reeling Technology Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Otsuki, R. and Sato, S.(1997). Silkworm Egg Production (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Soo-Ho Lim, Young-Taek Kim, Sang-Poong Lee. (1990). Sericulture Training Manual - Published by FAO - USA. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Veda, K., Nagai, I. and Horikomi, M. (1997). Silkworm Rearing (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Wu Pang-Chuan and Chen Da-Chuang.(1994). Silkworm Rearing - Published by FAO - USA. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

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**Department of Zoology**

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

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**ADVANCES IN ZOOLOGY**

**UNIT I**

**Recent Advances in Animal Biotechnology :** Tools and techniques in gene manipulation - antisense RNA technology, DNA and protein chip – Protein engineering – Gene knock out- RNAi and Gene silencing - Application of genetic engineering in medical, agriculture, animal husbandry – Transgenesis Bioethics and IPR.

**UNIT II**

**Current Scenario of Nanomedicine:** Nanoparticle as drug carriers- Nanoparticles as gene carrier- Nanoparticle as RNAi carriers. Development of nanomedicine to target cancer. Commercialized nanocarriers for cancer treatment. Impact of nano in cancer biology. Tumor immunology, immunodiagnosis and therapy with monoclonal antibodies.

**UNIT III**

**Behavioural Genetics:** Mendelian genetics, Beyond Mendal Laws, DNA basis of heredity, Pathways between genes and behaviour, Epigenesis, Genetic and Environmental influences of behaviour.

**UNIT IV**

**Immunity in Health Care:** Cell fusion methods. Hybridoma technology and its applications. Stem cell research; haemopoietic stem cells, embryonic stem cells in health care. Cell culture products. Production of interferons, interleukins and vaccines through mammalian cell cultures.

**UNIT V**

**Molecular Entomology :** Insect Molecular Physiology an Over view- Insect Pest Management, Role of Storage proteins in Insect Development (Embryo and Metamorphosis)- Vitellogenin in and receptor interaction in insect - Nanoparticles in Insect Pest Management. Pros and cons of Bacillus thuriengensis in Pest Management

## References

Eikichi, H. (1999). *Silkworm Breeding* (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Ganga, G. (2003). *Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, James D. Watson.(1994). *Molecular Biology of the Cell*, 3<sup>rd</sup> Edition, International Students Publication. USA

Primrose SB and R.M.Twyman (2006) *Principles of Gene Manipulation and Genomics* Blackwell Publishing, USA.

Salle AJ (1999) *Fundamental Principles of Bacteriology*. 7<sup>th</sup> edition, Tata- McGraw Hill.

Yury Gogotsi (2006) *Nanomaterials Handbook*, Taylor and Francis Group, Boca Raton London, New York.