



**THIRUVALLUVAR UNIVERSITY**  
**SERKKADU, VELLORE – 632 115**  
**Department of Zoology**  
**M.Sc., Zoology (University Department)**

**UNDER CBCS (With effect from 2022-2023 onwards)**

**The course of study and scheme of examinations**

**1. TITLE:** M.Sc., Zoology.

**2. YEAR OF IMPLEMENTATION:** July 2022 onwards

**3. COURSE DETAILS:**

Total No. of Semesters	– 04 (Two semesters per year)
Total No. of theory papers	– 09
Total No. of Practicals	– 06
Project	– 4 <sup>th</sup> semester only

**Total Marks for M.Sc. Degree**

Theory	- 1900 marks
Practicals	- 600 marks
Project	- 100 marks
<b>Total</b>	<b>- 2700 marks/94 credits</b>

**4. PREAMBLE OF THE SYLLABUS:**

Master of Science (M.Sc.) in Zoology is a post graduation course of Thiruvalluvar University. The curriculum is prepared by following the prospectus of various national and international universities. The syllabi are all set to meet the standard of UGC-CSIR (NET) and SLET examinations. The credit system to be implemented through this curriculum would allow students to develop a strong footing in the fundamentals and specialize in the disciplines of his/her liking and abilities. The students pursuing this course would have to develop in-depth understanding of various aspects of Zoology. The conceptual understanding, development of experimental skills, designing and implementation of novel synthetic methods, developing the aptitude for academic and professional skills, acquiring basic concepts for structural elucidation with hyphenated techniques, understanding the fundamental biological processes and rationale towards computer. The project introduced in the curriculum will motivate the students to pursue the research and find a job in reputed pharmaceutical and other industries including abroad.

## **1. ELIGIBILITY FOR ADMISSION**

A candidate who has passed the B.Sc., degree examination with Zoology as the main subject of study of this university or an examination of any other university accepted by the syndicate as equivalent there to shall be eligible for admission to the M.Sc., degree in Zoology.

## **2. DURATION OF THE COURSE**

The course shall extend over a period of two years comprising of four semesters with two semesters in one academic year. There shall not be less than 90 working days for each semester. Examination shall be conducted at the end of every semester for the respective subjects. Each semester has 90 working days consists of 5 teaching hours per working day. Thus, each semester has 450 teaching hours and the whole programme has 1800 teaching hours.

## **3. MEDIUM OF INSTRUCTION AND EXAMINATIONS**

The medium of instruction for the courses is English only.

## **4. RESTRICTIONS TO APPEAR FOR THE EXAMINATIONS**

Any candidate having arrear paper(s) shall have the option to appear in any arrear paper along with the regular semester papers, in theory as well as in practical's, as long as the transitory provision is applicable.

## **5. INSTRUCTION OF THE STUDENTS**

The students admitted to M.Sc. Zoology course that suppose to adhere the following rules:

1. A minimum of 75% attendance for lectures / practicals is the pre-requisite.
2. There shall be tutorial / practical / surprise test / home assignment / referencing of research papers / seminar / industrial visits / training course as part of internal assessment in each semester. The students are

supposed to attend all the tests. The students should note that retest will not be given to the students absent for the test/s.

## **6. PATTERN OF EXAMINATION**

Evaluation of Students:

1. The Odd-Semester and even semester examinations will be of 100 marks each.
2. Student has to obtain 50% marks in all the examinations (both theory and laboratory course)

**7. FEE STRUCTURE:** As per Thiruvalluvar University norms

## **8. SCHEME OF EXAMINATION**

The semester examination will be conducted at the end of each semester (Both theory & practical examination), for odd semesters in the month of November/December; for even semester in April/May. All theory examination is conducted for 3 hours irrespective of total marks. However, duration of practical examinations is 4 hours.

**Each theory paper** will be of 75 marks each and 25 marks will be awarded for internal evaluation for University examination.

**Theory****examinations****75 marks**Section-A  $10 \times 2$  = 20 marksSection-B  $5 \times 5$  = 25 marksSection-C  $3 \times 10$  = 30 marks**Total = 75 marks****Internal Assessment****25 marks**

Test : 10 marks (best 2 out of 3)

Assignment : 05 Marks

Seminar : 10 Marks

**Total : 25 marks**

**Each practical examination** will be of 75 marks for the university examination and 25 marks will be awarded for internal evaluation.

**9. Distribution of marks for practical examinations****A) University Practical Examination****: 75 Marks**

Procedure : 05 marks

Experiment : 30 marks

Interpretation : 10 marks

Result : 10marks)

viva-voce : 10 marks

Record : 10 Marks

**Total :75 marks****B)Practical Internal Assessment : 25 marks**

Number of Experiments : 10 marks

Performance : 10 Marks

Test : 05 Marks

**Total:25 marks**

## 10. Passing Minimum in Practical examinations

Internal assessment (Lab. course) : 12 Marks (50 %)

University examination : 38Marks (50 %)

**Total : 50 Marks**

**Project (dissertation) : 100 marks**

Dissertation : 150 marks

Viva-voce : 50 marks

**Total : 200 Marks**

## 11. Distribution of marks for Dissertation/ project

Project will be evaluated by the concerned project guide along with departmental project committee. Assessment will be done by the committee every month. Evaluation will be on the basis of monthly progress of project work, progress report, referencing. Oral, results and documentation.

Dissertation format : 15 marks

Scope of the research problem : 15 marks

Methodology : 15marks

Analysis : 15 marks

Results and findings : 15 marks

**Total : 75 marks**

Project committee will have to conduct the seminar, regular review meetings collection of dissertation and conduct final viva-voce examination.

**viva-voce examination**

**25 marks**

Presentation : 10 marks

Subject knowledge : 10 marks

Interaction : 5 marks

**Total : 25 marks**

## 12. QUESTION PAPER SETTINGS

Question papers will be set in the view of the entire syllabus and preferably covering each unit of the syllabus by our University faculties.

## 13. STANDARD OF PASSING

A candidate should get not less than 50% in the university examination, compulsorily, in all papers, including lab. Course. Also, the candidate who secures not less than 50% marks in the University Examination (UE) and Internal Assessment (IA) examinations put together in any theory paper/practical shall be declared to have successfully passed the examination.

- Internal marks will not change. Student cannot repeat internal assessment. If student misses internal assessment examination, she/he will have to score passing minimum in the external examinations only.

**Illustration:** Theory – Internal Assessment -12 marks

University Examination - 38 marks

**OR**

Internal Assessment - 0 marks

University Examination - 50 marks

There shall be revaluation of answer script of end semester examination, but not of internal assessment papers.

Internal assessment answer scripts may be shown to the concerned student but not end semester answer script.

## 13. REVISION OF REGULATIONS AND CURRICULAM

The above regulation and scheme in examinations will be in vogue without any for a minimum period of three years from the date of approval of the regulations. The university may revise/amend/change the regulations and scheme of examinations, if found necessary.



**திருவள்ளூர் பல்கலைக்கழகம்**  
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## M.Sc. ZOOLOGY

UNDER CBCS

(With effect from 2020 – 21 onwards)

The Course of Study and the Scheme of Examinations

Year / Semester	Subject Core/elective	Paper	Title of the Paper	Credit	Ins. Hrs/ week	Max. Marks		
						IA	Uni. Exam.	Total
I Semester	Core	Paper I	Comparative and functional anatomy of Invertebrates	4	5	25	75	100
	Core	Paper II	Comparative and functional anatomy of Chordates	4	5	25	75	100
	Core	Paper III	Cell and Molecular Biology	4	5	25	75	100
	Core	Practical -I	Comparative and functional anatomy of invertebrates, and Chordates	4	4	25	75	100
	Core	Practical -II	Cell and Molecular Biology	4	4	25	75	100
	Value Added course		Medical Lab Technology	2	2	25	75	100
Internal Elective for same major students (Choose any one)								
	Core Elective		A.Fisheries and Auqa Culture B.Basic concepts in Bio Informatics C.Stem Cell Biology	3	5	25	75	100
				25	30	175	525	700
II Semester	Core	Paper IV	Genetics	4	5	25	75	100
	Core	Paper V	Environmental Biology and Evolution	4	5	25	75	100
	Core	Paper VI	Comparative animal Physiology	4	5	25	75	100
	Core	Practical -III	Genetics	4	4	25	75	100
	Core	Practical -IV	Environmental Biology and Comparative animal Physiology	4	4	25	75	100
Internal Elective for same major students (Choose any one)								
Core Elective			A. Entomology B. Reproductive Physiology C. Endocrinology	3	3	25	75	100
External Elective for same major students (Choose any one)								
Open Elective			A. Environmental Sciences B. Pest Management C. Biodiversity	2	2	25	75	100
Compulsory Paper MDHR20			Human Rights	2	2	25	75	100
				27	30	200	600	800

Year / Semester	Subject Core/elective	Paper	Title of the Paper	Credit	Ins. Hrs/ week	Max. Marks		
						IA	Uni. Exam.	Total
Semester III	Core	Paper VII	Developmental Biology	4	5	25	75	100
	Core	Paper VIII	Micro Biology and Immunology	4	5	25	75	100
	Core	Paper IX	Biochemistry, Biophysics and Biostatistics	4	5	25	75	100
	Core	Practical -V	Developmental Biology Micro Biology and Immunology	4	4	25	75	100
	Core	Practical -VI	Biochemistry, Biophysics and Biostatistics	4	4	25	75	100
Internal Elective for same major students (Choose any one)								
	Core Elective		A. Basic concepts in Biotechnology B. Nano Biotechnology C. Research Methodology	3	5	25	75	100
External Elective for same major students (Choose any one)								
	Open Elective		A. Sericulture B. Ethnopharmacology C. Genetic Disorder	2	2	25	75	100
	MOOC Courses			2				100
	USRR			2				100
				<b>29</b>	<b>30</b>	<b>175</b>	<b>525</b>	<b>900</b>
Semester IV	Core	Paper X	Bioinstrumentation	5	5	25	75	100
	Core Elective	Paper XI	Aqua Culture and Farm Management	3	5	25	75	100
	Core	Project	Project with viva voce (75 project+25 viva)	5	20	25	75	100
				<b>13</b>	<b>30</b>	<b>75</b>	<b>225</b>	<b>300</b>
			<b>Grand Total</b>	<b>94</b>	<b>120</b>			<b>2700</b>



## **CORE PAPER: I**

### **COMPARATIVE AND FUNCTIONAL ANATOMY OF INVERTEBRATES**

#### **OBJECTIVES**

To enlighten the students with adequate scientific details on origin, functional anatomy, mode of life and adaptive radiations with the relationships of invertebrates

#### **UNIT I Organization of symmetry, Coelom and metamerism**

Organization- Organization of asymmetry, radial, biradial and bilateral symmetry – Significance. Evolution of coelom. Acoelomate, pseudocoelomate, coelomate groups (Schizocoel, Enterocoel, mesenchyme) – Evolution of metamerism – Pseudometamerism, cyclo metamerism, corm theory, embryological theory – Significance.

#### **UNIT II Locomotion and Nutrition**

Locomotion- Amoeboid, Flagellar and Ciliary movement in protozoa, Hydrostatic movements in Coelenterata, Annelida, Mollusca and Echinoderms Nutrition and Digestion, - Patterns of Feeding and digestion in lower metazoa, Mollusca, - Echinodermata, Filter feeding in polychaeta.

#### **UNIT III Respiration and excretion**

Respiration - Organs of respiration : Gills, lungs and trachea. – Respiratory pigments. - Mechanism of respiration. Excretion in lower invertebrates, Excretion in higher invertebrates. Mechanism of Osmoregulation.

#### **UNIT IV Nervous System and Chemical Co-ordination**

Primitive Nervous systems:-Coelenterata and Echinodermata. Advanced nervous system: - Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda) Endocrine glands in Mollusc and insects.

#### **UNIT V Reproductive system**

Pattern of sexual and asexual reproduction – Invertebrate larval forms and their phylogenetic significance.

#### **REFERENCES**

1. Barrington, E.J.W. (1979)- II edition. Invertebrate structure and function. Thomas Nelson Sons Ltd., London.
2. Hyman, L.H. (1940-1959)-Vol I- Vol-VIII. The Invertebrates, McGraw Hill Co., New York and London.
3. Barnes, R.D. (1982). Invertebrates Zoology, VI edition. W.B. Saunders Co. Philadelphia.
4. Parker, T.J., Haswell W.A. (1991). Text book of Zoology, Macmillan Co., London.
5. Gardinar, M.S. (1972). Biology of invertebrates, MC.Graw Hill Book & Co, New Delhi.
6. Kotpal, R.L. (1997). Modern text Book of Zoology: Invertebrates 7<sup>th</sup> edit. Rastogi publications.
7. Jordan, E.L., Verma P.S. (1997). Invertebrate Zoology, 14<sup>th</sup> edit.-S.Chand & Co, New Delhi.

## **CORE PAPER: II**

### **COMPARATIVE AND FUNCTIONAL ANATOMY OF CHORDATES**

#### **OBJECTIVES**

To comprehend the systematic position, functional anatomy, mode of life, adaptive radiation of chordates.

#### **UNIT I: PHYLOGENY**

Sailent features of Prochordates, -Amphioxus- Ascidian-Balanoglossus.

#### **UNIT II: STRUCTURAL**

Peculiarities- Elasmobranch & Bony fish-External characters, Digestive, Respiratory, Circulatory, Nervous System, Sense Organs, Nervous system, Sense organs & Reproductive systems.

#### **UNIT III: ADAPTIVE RADIATION OF CHORDATES**

Adaptive radiation of fishes, Amphibians, reptiles, birds and mammals.

Structural peculiarities of Prototheria, Metatheria and Eutheria.

#### **UNIT IV: PARENTAL CARE & MIGRATION**

Parental care in fishes and Amphibia. Migration of fishes. Migration of birds.

#### **UNIT V: COMPARATIVE ANATOMY**

Comparative anatomy of Paired fins, limbs, heart, kidney, aortic arches and brain of vertebrates.

#### **REFERENCES**

1. Waterman, A.J. (1971). VIIth edition. Chordate Structure and Function. Macmillan Co. London.
2. Young, J.Z. (1981) Life of Vertebrates. 3rd edition ELBS, Oxford.
3. E.L.Jordan & P.S. Verma. 1998. Chordate Zoology. S.Chand & Company (Pvt) Ltd. New Delhi – 110055.
4. Colbert (1981)-Evolution of the vertebrates. 7<sup>th</sup> edition. John Wiley & Sons Company, New York.
5. Kapoor V.C. (1991). Theory and practical of animal taxonomy Oxford & IBH Publishing company, New Delhi.
6. Iyer E.K, & T.N. Anathakrishnan (2000). Manual of Zoology-Vol-II-Chordata. Viswanathan printers & Publishers pvt.Ltd.Chennai.

## **CORE PAPER III**

### **CELL AND MOLECULAR BIOLOGY**

#### **OBJECTIVES**

To understand the structure and molecular basis of cellular interactions, energy transformation, regulation and control of genes, cell cycle and information transfer.

#### **UNIT I: ULTRA STRUCTURE OF CELL**

Prokaryotic Cell, Eukaryotic Cell, Structure, Comparison, Plasma membrane – Structure – Passive and active transport - Cellular communication

#### **UNIT II: STRUCTURE AND FUNCTIONS OF CELL ORGANELLES**

Ultra structure and function of Endoplasmic reticulum, Ribosome, Golgi bodies, Mitochondria, Lysosome. Nucleo cytoplasmic interactions, nuclear receptors

#### **UNIT III: MOLECULAR STRUCTURE OF DNA**

DNA – Chemical composition -Watson Crick model of DNA, Types of DNA, DNA Replication, types, enzymology and mechanism of semi conservative mode of replication – DNA damage and repair.

#### **UNIT IV: MOLECULAR STRUCTURE OF RNA**

RNA-Chemical composition-Types-Transcription-Enzyme-Synthesis of RNA-RNA polymerase structure, Basic features of RNA synthesis –Template recognition –Core promoters (-10 and 35 box), UP element, Initiation, elongation and termination.

#### **UNIT V: SYNTHESIS OF PROTEIN**

Mechanism of protein synthesis, components of protein synthesis-Transcription, Translation, Post translation modification.

#### **REFERENCE/BOOKS**

1. De Robertis, E. D.P. and De Robertis. E. M. F., (2001) Cell and molecular Biology. Lippincott Williams & Wilkinson Ltd., USA.
2. Howland, J. L. (1973) Cell Physiology. Mac Millan Publishing Co.
3. Avers, C. J., (1976). Cell Biology. D. Can Nostrand Company. New York.
4. Korenberg, A., (1974). DNA replication. W. H. Freeman and Company. San Francisco.
5. Albert. B and Watson. J. D., (1990) Molecular Biology of the Cell. Garland Publishing. London. Darrtell. J., Lodish, H. and Baltimore, D., 1992. Molecular Cell Biology. Scientific American Books.
6. Nelson D.L, Cox, M.M.(2005). Lehninger principles of Biochemistry, 4<sup>th</sup> edition, W.H. Freeman & Co.
7. Gupta, P.K. (1999). Cell & molecular Biology, Rastogi Publications, Meerut.

## **Practical – I**

### **A. Comparative and functional anatomy of Invertebrates**

1. Identification of selected protozoans, Helminthes, Larval forms of major phyla of invertebrates and their medicinal importance.
2. Dissection of digestive system, nervous system of insect and crustacean.
3. Identification and study of invertebrate fossils.
4. Mounting:
  - a) Appendages of prawn
  - b) Sting apparatus of honey bee.
  - c) Mouth parts of House fly & Mosquito - structure and function.

### **B. Comparative and functional anatomy of chordates**

1. Study of the following with reference to their adaptive features.
  1. Balanoglossus
  2. Amphioxus
  3. Ascidian
  4. Petromyzon
  5. Echeneis
  6. Hyla
  7. Draco
  8. Pigeon
  9. Bat
  10. Chameleon
2. Dissect and display the weberian ossicle in cat fish.
3. Aortic arches in teleost fish.
4. IX and X the cranial nerve of shark.

## **CORE PAPER : IV**

### **GENETICS**

#### **OBJECTIVES**

To understand the basic concept of genetic, Material, Mendelians rule, sex determination in human beings, and the mechanism of multiple in skin colour formation. To know the various genetic disorders and understand about the statistical population, variables, primary, secondary data, different kind of data

presentation in the form of diagrams and various types of statistical applications.

#### **UNIT I Microbial Genetics**

Conjugation, Transformation, transduction and sexduction. Chromosome mapping in prokaryotes (Virus & Bacteria) and eukaryotes (Drosophila and man).

#### **UNIT-II Enzyme regulation of gene action**

Gene regulation-Gene action-Operon concept- GAL & LAC operon system. Evidences of regulation of gene action. Inborn errors of metabolism, with reference to protein lipid, carbohydrate & nucleic acid.

#### **UNIT-III**

Human genetics- karyotype and nomenclature of metaphase chromosome bands; chromosome anomalies and diseases- chromosomal anomalies in malignancy (chronic myeloid leukemia, Burkitt's lymphoma, retinoblastoma and Wilms' tumor); genetic analysis of complex traits - complex pattern of inheritance, quantitative traits, threshold traits; human genome and mapping.

#### **UnitIV : Chromatin organization**

Components of chromatin - Chromosome structure, Euchromatin and Heterochromatin.

Chromatin organization - Structure and organization of nucleosome in chromatin, solenoids, loops and scaffolds, nucleosome phasing, active and inactive states of chromatin..

Chromatin Modifications – Histone modifications and their effect.

Dosage compensation, X - chromosome inactivation. Evolutionary significance, Chromosome Abnormalities.

#### **UnitV**

Structural chromosomal abnormalities- Origin of breaks and gaps, ring chromosomes, Isochromosomes, centric fusion, centric fission- Mechanisms involved. Deletions, duplications, inversions, translocations

Numerical chromosomal abnormalities- Aneuploidy, Polyploidy. Non-Disjunction and Anaphase lag. Chromosome instability and associated syndromes. Sister chromatid exchanges and its significance.

## REFERENCES

1. Robert P. Wagner. (1980). Introduction to modern Genetics-John Wiley& Sons, USA.
2. Snustad Y, and Simmons W.E, (2005), Principles of Genetics, John Wiley & Sons, USA.
3. Anothony, J.F. Griffiths (2000). An introduction to Genetic analysis- 7<sup>th</sup> edition W.H Freeman & Co, USA.
4. Gardner. (1984) 7th edition.Principles of Genetics, W.H Freeman & Co, USA.
5. Snedecor, Gm, Wand Cochran, W.G.(1967). 3rd edition, Statistical methods in Biology- Oxford publications, New Delhi.
6. Gupta, S.P. (1988). An easy approach to statistics-S.Chand & Co, New Delhi.
7. Pillai, R.S.N, Bagawathi, V. (2005). Statistics - S.Chand & Co, New Delhi.

## **CORE PAPER: V**

### **ENVIRONMENTAL BIOLOGY AND EVOLUTION**

#### **OBJECTIVES**

To generate up-to-date knowledge on environmental conservation and management through a comprehensive understanding of the components of ecosystem, biological cycles, habitat ecology, resource ecology, pollution and its management and To comprehend the scientific concepts of animal evolution through an understanding of its evidences, its mechanics, process and products.

#### **UNIT-I: ECOSYSTEM AND COMMUNITY**

Ecosystem and Community - Review of concept of ecosystem - Natural and Man-made ecosystem, with examples. Energy flow - Trophic structure and levels - Pyramids, food chain and web - ecological efficiencies, and productivity and its measurement.

#### **UNIT-II: POPULATION ECOLOGY**

Structure and distribution - Growth curves - Groups, natality, Mortality – Density indices, Life study tables - factors affecting population growth – Carrying capacity. Population regulation and human population control.

#### **UNIT-III: RESOURCES ECOLOGY AND BIOLOGICAL CYCLES**

Renewable and non - renewable resources - animal resources. Conventional and non - conventional energy sources. Review of Biogeochemical cycles : Nitrogen, Phosphorous and sulphur.

#### **UNIT-IV: ENVIRONMENTAL CONSERVATION, POLLUTION AND MANAGEMENT**

Principles of conservation – ethics and values of wild life, National parks, Rain water harvesting. Bioremediation - Need & Scope of Bioremediation - Environmental applications – Phytoremediation – Biomagnification -Bioavailability.

#### **UNIT V: EVOLUTION**

Adaptation - Nature and types of adaptation - Adaptive trends quantifying adaptation - Batesian and Mullerian mimicry Polymorphism and Evolutions. Speciation - Structure of species - clones, peripheral population and peripheral isolates. Human evolution - Sociobiology: Definition and scope - selfish gene, altruism and kin selection - bioethics.

## REFERENCE BOOKS

1. Odum. E.P. (1996) 2nd Edition. Fundamentals of Ecology. Nataraj Publishers, Dehra Dun.
2. Trivedi, P.R.and Gurdeepraj, K. 1992. Environmental Biology. Akashdeep Publishing House New Delhi.
3. Sharma, P.D. (1995). Ecology and environment. Rastogi Publications.
4. Smith, R.L.1986. Elements of Ecology. Harpet and Row Publishers, New York.
5. D. S. Bendall (ed) 1983). Evolution from Molecules to Men. Cambridge University Press.
6. E.C. Minkoff (1984). Evolutionary Biology. Addison-Wesley. London.
7. A.P. Kamalakara rao, Ittasambasivah, & T.S. Gopala Krishnan (1983) 4<sup>th</sup> edition .Principles of organic evolution- Pearl Publications.



**CORE PAPER VI:**  
**COMPARATIVE ANIMAL PHYSIOLOGY**

**OBJECTIVES**

To derive an unified knowledge of the functions of animals, their parts, organs and their behaviour, through and understanding of their nutrition, respiration, circulation, excretion and physico-chemical coordination with a phylogenetic tinge.

**UNIT-I: NUTRITION**

Nutritive requirements – Digestion and adsorption of proteins, carbohydrates and lipids. Role of gastrointestinal hormones in digestion.

**UNIT-II: RESPIRATION & CIRCULATION**

**Respiration:** The exchange of gases- integumentary respiration, branchial respiration and gill respiration - physiology of respiration in Man. Respiratory Pigments, BMR. **Circulation:** Types of hearts - physiology of cardiac muscle - heart beat and its regulation – Composition of blood coagulation.

**UNIT-III: EXCRETION & OSMOREGULATION**

**Excretion:** Nitrogenous waste- Ammoniotelism, Ureotelism, Uricotelism – Structure of mammalian kidney – Nephron - formation of urine - physiology of excretion in Man.

**Osmoregulation:** Osmo – iono regulation in crustaceans, fishes, birds and mammals - hormonal control.

**UNIT-IV: COORDINATION**

Neuro muscular co-ordination - types of neurons, transmissions of nerve impulse and reflex action. Chemical composition of muscle fiber and physiology of muscle contraction. Endocrine glands with special reference to man - Hormones and Functions. Receptors – Classification & function – Mechanism of hearing – Physiology of vision in man.

**UNIT-V: CHRONOBIOLOGY**

Chronobiology - (types - trophism, taxis, kinesis, reflex, learning). Temperature regulation: Poikilotherms, homeotherms and heterotherms - hibernation, aestivation - diapause.

## REFERENCE BOOKS

1. Hoar, W.S.1991, General and Comparative Physiology. Prentice Hall of India, New Delhi.
2. Prosser, C.L. 1973, (III Edition) Comparative Animal Physiology, W.B. Saunders & Co., Philadelphia.
3. Welson, A. 1979. Principles of Animal Physiology, McMillan Publishing Co. Inc. New York.
4. Schmidt Nelssen, K.1985. Animal Physiology, Adaptation and Environment Club, London.
5. Verma PS, Tyagi and Agarwal, V.K. 2010 Animal Physiology. S Chand & company (P) Ltd, New Delhi
6. Goel, K.A and Sastry, K.V, 1998 (IV Edition) A text book of Animal Physiology, Rastogi Publication, Meerut 250 002.
7. A.P. Kamalakara rao, Ittasambasivaiah, & T.S. Gopalakrishnan. (1983) 4<sup>th</sup> edition. Animal Physiology, Pearl Publications.

## **Practical – II**

### **A. MOLECULAR CELL BIOLOGY**

1. Preparation of Buccal smears to show squamous epithelial cells.
2. Onion root tip squash preparation- Study of Mitosis.
3. Measurement of cell by using stage and ocular micrometer.
4. Slides (With reference to cell organelles).

### **B. MOLECULAR GENETICS**

1. Culture of *Drosophila* method of maintenance, sex identification.
2. Mounting of salivary gland of *Drosophilla* and *Chironomous* larva.
3. Karyotyping, identification of syndromes (Down, Klineflelter and Turner).
4. Identification of blood groups A, B, AB, O and Rh factors with reasons.

### **C. BIOSTATISTICS**

1. Data collection and frequency
2. Measurements of central tendency-Mean, Median & Mode.
3. Simple Correlation.
4. Test of Significance- Chi square test.

### **Practical – III**

#### **A. ENVIRONMENTAL BIOLOGY**

1. Estimation of dissolved Oxygen – River, Pond and Industrial effluents.
2. Estimation of salinity, Nitrites, Phosphates, Calcium and Alkalinity in water samples.
3. Analysis of industrial effluents- TDS, TSS, BOD, COD.
4. Study of sandy, Muddy and rocky shore fauna with reference to adaptation to the environment
5. Animal association parasitism, Mutualism and Commensalism.
6. Field visit – To visit various industries & Processing Centres
  - i. Tanneries
  - ii. Dyeing industry.
  - iii. Sugar mill.
  - iv. Dairy farm.
  - v. Food Processing Industries.

#### **B. COMPARATIVE ANIMAL PHYSIOLOGY**

1. Estimation of RQ in fish reference to light and temperature.
2. Estimation of salt loss and salt gain in fish.
3. Estimation of protein, carbohydrate and lipid in tissue of fish.
4. Estimation of bleeding, clotting time and haemoglobin concentration
5. Estimation of ESR and PCV.
6. Principle and Application of Sphygmomanometer, Hemocytometer, Kymograph, Electrophoresis.

## **COMPULSORY PAPER**

### **HUMAN RIGHTS**

#### **UNIT-I : HISTORICAL DEVELOPMENT AND THEORIES**

Definition of Human Rights - Nature, Content, Legitimacy and Priority - Theories on Human Rights - Historical Development of Human Rights.

#### **UNIT-II INTERNATIONAL HUMAN RIGHTS**

Prescription and Enforcement up to World War II - Human Rights and the U.N .O. - Universal Declaration of Human Rights - International Covenant on Civil and Political Rights - International Covenant on Economic, Social and Cultural Rights and Optional Protocol.

#### **UNIT-III HUMAN RIGHTS DECLARATIONS**

U.N. Human Rights Declarations - U.N. Human Commissioner.

#### **UNIT-IV INTERNATIONAL HUMAN RIGHTS**

Amnesty International - Human Rights and Helsinki Process – Regional Developments - European Human Rights System - African Human Rights System - International Human Rights in Domestic courts.

#### **UNIT-V : HUMAN RIGHTS IN CHILDREN AND WOMEN**

Contemporary Issues on Human Rights: Children's Rights - Women's Rights - Dalit's Rights - Bonded Labour and Wages - Refugees - Capital Punishment. Fundamental Rights in the Indian Constitution - Directive Principles of State Policy - Fundamental Duties - National Human Rights Commission.

#### **Books for Reference:**

1. International Bill of Human Rights, Amnesty International Publication, 1988.
2. Human Rights, Questions and Answers, UNESCO, 1982
3. Mausice Cranston - What is Human Rights
4. Desai, A.R. - Violation of Democratic Rights in India
5. Pandey - Constitutional Law.
6. Timm. R.W. - Working for Justice and Human Rights.
7. Human Rights, A Selected Bibliography, USIS.
8. J.C.Johari - Human Rights and New World Order.
9. G.S. Bajwa - Human Rights in India.
10. Amnesty International, - Human Rights in India.
11. P.C.Sinha & - International Encyclopedia of Peace, Security

- 12.K. Cheous (Ed)                      Social Justice and Human Rights (Vols 1-7).  
13.Devasia, V.V.                      - Human Rights and Victimology.

**Magazines:**

1. The Lawyer, Bombay
2. Human Rights Today, Columbia University
3. International Instruments of Human Rights, UN Publication
4. Human Rights Quarterly, John Hopkins University, U.S.A.

## **CORE PAPER :VII**

### **DEVELOPMENTAL BIOLOGY**

#### **OBJECTIVES**

To imbibe the current knowledge pertaining to the development of animal embryos of diverse taxonomic groups through experimental analyses based on modern biological tools.

#### **UNIT I: GAMETOGENESIS**

History of Embryology - Ovists Vs Animalculist Preformation and Epigenesis - Descriptive and Experimental Embryology - Molecular Embryology gametogenesis: Spermatogenesis – Structure, motility of sperm-Egg activation – Acrosomal reaction - Growth of Oocytes - Synthesis and storage of macromolecules in the oocytes - Nuclear activities during oocytes growth. Hormonal control of ovulation.

#### **UNIT II: FERTILIZATION**

Fertilization: polyspermy - Androgenesis - Egg activation - Electron microscopic and biochemical aspects - Fertility of sperm and its in vitro fertilization - artificial fertilization Chemodifferentiation.

#### **UNIT III: DEVELOPMENT**

Gastrulation movements: role of egg cortex - Cell surface in morphogenesis - Cell adhesion and cell communication. Chemotactic induced aggregation - Aggregation in sponges. Experimental analysis in the early development of Echinoderms, Amphibians and Birds.

#### **UNIT IV: ORGANOGENESIS AND REGULATION**

Organogenesis - formation of organ. Rudiments: Differentiation and development of limb, thymus, spleen, salivary glands, heart and kidney in a mammal. Organiser: Inductive tissue interactions in developments. Metamorphosis - morphological and biochemical changes during amphibian metamorphosis - Hormonal control of metamorphosis in amphibians - Neuro - endocrine control of insect metamorphosis - Biochemistry and mechanism of action of hormones during metamorphosis

#### **UNIT V: GENES AND DEVELOPMENT**

Nuclear transplantation. Cellular differentiation. Differential activation. Developmental genetic defects. Role of cell death in development. Teratogenesis - Ageing, transgenics.

#### **REFERENCE/BOOKS**

1. Balinsky, B. L., 1981. An introduction to embryology, Saunders, Philadelphia.
2. Karp. G. and Berrill, N.J. 1981. Development, McGraw Hill, New York.

3. Grant, P., 1978. Biology of developing systems, Hoit Rein chart and Winston, Inc. New York and Chicago.
4. Saunders, J. W. 1982. Developmental Biology. Macmillan Co., London.
5. Gilbert, Scott. F. 1985. Developmental Biology. Sinauer Association, Inc., Publishers.
6. Raven, P. (1997). An outline of developmental physiology, Pergamon Press, New York.
7. Browder, W. (1984). Developmental Biology. Saunder college Publishing Company. India.



## **CORE PAPER: VIII**

### **MICROBIOLOGY AND IMMUNOLOGY**

#### **OBJECTIVES**

To acquire a basic knowledge of the microbes in general and of the environmental, medical and industrial important microbes in particular in order to have an integrated approach in biology and functional basis of immunoglobulin's, the mechanism, mediators, detection and application of antigen-reaction in the immune system.

#### **UNIT I: STERILIZATION AND CULTURE TECHNIQUES**

Sterilization: Principles - dry heat, moist heat, filtration, Tyndilization, pasteurization, Radiation - disinfection - Antimicrobial chemotherapy - Antibiotics source - Tests for sensitivity to antimicrobial agents and its quality control. Culture techniques - media preparation - preservation of cultures - Aerobic and anaerobic culture techniques- pure and mixed cultures.

#### **UNIT II: ENVIRONMENTAL MICROBIOLOGY**

Microbial ecology, role of microorganisms in the productivity of ecosystems - Interactions between microorganisms and plants and animal- Microbiology of soil, water and air.

#### **UNIT III: INDUSTRIAL MICROBIOLOGY**

Industrial microbiology - Industrial uses of microbes - fermentation products, bioconversions - bioremediation. Products of industrial microbiology - Penicillin, fuel ethanol, vinegar, vitamin B12, citric acid, glutamic acid, protease. Food and Dairy microbiology - Microbes in food - Role of microbes in food production. Dairy and non-dairy products - fermented foods and alcoholic beverages. Pharmaceuticals (antibiotics, vaccines etc.)

#### **UNIT IV: ANTIGENS & ANTIBODIES**

Antigens-Immunogenicity Vs Antigenicity, Haptens. Factors influencing Immunogenicity. Epitopes - B cell epitope and T cell epitope.

Antigen - Antibody interaction and immunodiagnostics. MHC - Restriction, Organization and inheritance of MHC, Antigen processing and presentation.

#### **UNIT V: MECHANISM OF IMMUNE SYSTEMS**

Immunoglobulin - structure, isotypes and biological function. Immune response & theories. Antigenic determinant on immunoglobulin - isotype, allotype and idiotype. B-cell receptor, immunoglobulin super family, Monoclonal antibody, Polyclonal antibody. T cell receptor, cytokine, adhesion molecules.

Complement, Hypersensitive reaction, Transplantation immunology. Vaccines - Principles and types of Vaccines - DNA Recombinant Vaccine, Serum therapy.

## REFERENCE

1. Richard, A Golds, Thomas J. Kindt & Barbara A. Osborne. 2000. Kuby - Immunology. Freeman and Co. New York.
2. D.P. Stites, A.I. Terr and T.G. Parsloio. 1997. Medical Immunology. Prentice Hall, New Jersey.
3. Janeway, C.A. and P. Travers. 1997. Immunobiology. Current Biology Ltd. London.
4. Prescott L.M. Harley J.O. Klein D.A. 1990. Microbiology. WCB Publishers, Sydney.
5. Ananthanaryanan, T. and Paniker, J.C.K. 2000. Text Book of Microbiology Oriental Longman Ltd., Madras.
6. Ahmed, M. and Basumatary. S.K. 2006. Applied Microbiology. MJP Publishers, Chennai.
7. Alcas, R.M. (1995). Principles of Microbiology. Mosby-Year Book.

## **CORE PAPER: IX**

### **BIOCHEMISTRY, BIOPHYSICS AND BIOSTATISTICS**

#### **OBJECTIVES**

To comprehend the chemical constituents of living matter, chemistry of food substances and their transformation in animal system. The energy changes associated with hormonal regulation. The structure of biomolecules energy transformation in living system and modern physical instruments for the exploration of knowledge in biology.

#### **UNIT I: WATER, HORMONES, ENZYMES, VITAMINS & Aminoacids**

Water – Biological importance – pH, Acid and base balance – Henderson, Hasselbach equation – Buffers – Biological importance. Acidosis, Alkalosis.

Chemistry and functions of steroid Hormones. Enzymes, Vitamins and amino acids Structure, Classification and Properties. Bioenergetics – High energy phosphates, Role of ATP, Biological Oxidation, Reductions – Mechanism of oxidative phosphorylation

#### **UNIT II: BIO-KINETICS**

Classification, Structure and properties of mono, di and poly saccharides. Defects in carbohydrate metabolism. Glycolysis, Krebs's cycle. Structure and chemistry of simple and compound lipids. Defects in lipid metabolism.

#### **UNIT III: STRUCTURE OF BIOMOLECULES**

Electron configuration of atom – Bonds forces between molecules – Electrostatic force, Vander Waal's forces – Hydrophobic and Hydrophilic – Biological importance. Law of thermodynamics- concept of free energy and entropy. Effects of sunlight and temperature on reaction. Energy of activation. Diffusion, Oxidation and reduction reaction. Bioluminescence.

#### **UNIT IV: PHOTO BIO PHYSICS**

Effects of UV in biological system. Delayed effects of radiation – Ageing, reduction in life span, cancer. Radioactive Isotopes and their importance. Measurements, Auto radiography. Effects of radiation.

Population, Sample, variable, parameter, primary and secondary data, screening and representation of data. Frequency distribution, tabulation, bar diagram, histograms, per diagram, and cumulative frequency curves. Mean median, mode, quartiles and percentiles, measures of dispersion : range, variance, standard deviation , coefficient of variation, symmetry : measures of skewness and kurtosis

#### **UNIT-V**

Simple linear regression and correlations. Understand and interpret results from Analysis of Variance (ANOVA), a technique used to compare means amongst more than two independent populations' flow charts and programming techniques in statistics with R Programming

#### **REFERENCE/BOOKS**

1. Harper's Biochemistry-Murray, Robert K. Harper
2. Principles of Biochemistry-Lehninger & Neilson
3. Biochemistry-Rastogi
4. Text book of Biochemistry- by A.V.S.S. RAO
5. Biochemistry by C.V. Pawar & G.R. Chatwal
6. Essentials of Biochemistry by J.L. Farley
7. Physiology and Biophysics by Ruch & Pattern

## **Practical IV**

### **A. DEVELOPMENTAL BIOLOGY**

1. Developmental stages of frog.
2. Development stages of Chick embryo.
3. Study of larval forms (Nauplius, Zoea, Mysis, Bipinnaria).

### **B. MICROBIOLOGY**

1. Microscopic observation and identification of microorganisms in Pond water.
2. Types of bacteriophage, bacteria, fungi and algae from the prepared slides / Photographs from the book.
3. Collection and Identification of fungus: Bread mould and Coconut mould.
4. Identification of parasitic protozoan's (e.g. Plasmodium, Entamoeba, Trypanosoma, Leishmania donovani)
5. Identification of bacteria - staining methods - Gram positive and Gram negative bacteria.
6. Demonstration of
  - a. Isolation of single colonies streak plate and serial dilution.
  - b. Enumeration of microorganisms spread plate and pour plate methods. c.

Preparation techniques of culture medium for bacterial growth

### **C. IMMUNOLOGY**

1. Study of antigen and antibody reaction through human blood group and Rh factor.
2. Study and identification of primary and secondary Lymphoid organs.
3. Demonstration of immune electrophoresis.
4. Slides showing Spleen TS, Thymus TS, Lymph node TS and bone marrow.
5. Electrophoretic separation of serum proteins.

## **Practical V**

### **A. BIOCHEMISTRY**

1. Buffer preparation & determination of pH-Demonstration.
2. Enzyme kinetics - anyone enzyme (Salivary amylase) Maltose standards, influence of enzyme concentration, time course, pH, Temperature, Substrate concentration (Line weaver Burk Plot) on enzyme activity.
3. Qualitative analysis of urine - protein, glucose, Ketone and acetone bodies.
4. Chromatography: Determination of amino acids in body fluids and tissues given samples.
5. Quantitative estimation of glucose, protein, cholesterol, urea and keratinise in the serum given samples.

### **B.BIOPHYSICS**

- 1) Principles and application of spectrophotometry or colorimetry-Demonstration
- 2) Polarizing microscope, phase contrast microscope, ultra & electron microscopes demonstration.
- 3) Surface tension by drop weight method.
- 4) Liquid lens-refractive index.

### **C. BIOSTATISTICS**

1. Data collection and frequency
2. Measurements of central tendency-Mean, Median & Mode.
3. Simple Correlation.
4. Test of Significance- Chi square test.

## **ELECTIVE PAPERS**

### **3. BASIC CONCEPTS IN BIOTECHNOLOGY**

#### **OBJECTIVES**

To familiarize the use of the data and techniques of engineering and technology in biology for the study of living organisms, or derivatives of thereof, to make or modify products or processes for specific use. Also, to find solution of problems concerning human activities including agriculture, medical treatment, industry and environment and to find out the biological application of data base.

#### **UNIT I: GENETIC ENGINEERING**

Definition, objectives and outline of recombinant DNA technology procedure-RFLP - the PCR techniques - Genomic library - Blotting techniques – Southern blotting - Northern & Western blotting. cDNA - Changing genes . Enzymes: Restriction Enzymes; DNA ligase, Klenow enzyme, T4 DNA polymerase, Polynucleotide kinase, Alkaline phosphatase. Cloning vectors: Plasmids, Phages, M13 mp vectors, Cosmids, Phagemids, Bluescript vefctors. Cosmids, Artificial chromosomes (YAC, BAC, HAC), Animal Virus derived vectors-SV-40, vaccinia/baculovirus & retroviral vectors, Expression vectors; pMal; GST; pET.

#### **UNIT II: HYBRIDOMA AND TRANSGENIC TECHNOLOGY**

Scope of the technique, production of Monoclonal antibodies. Applications of monoclonal antibodies. genetically modified organisms; gene knockouts and mouse disease models Transgenic animals; Drosophila, fish, and mouse.

#### **UNIT III: ANIMAL BIOTECHNOLOGY**

Cell culture - Organ culture - Whole embryo culture - Embryo transfer - In vitro fertilization (IVF) technology - Dolly - In vitro fertilization and embryo transfer in human - Cryobiology. Transgenic animal. Human genome project- Human gene therapy.

#### **UNIT-IV: MICROBIAL BIOTECHNOLOGY**

Fermentation - bioreactor - Microbial products - Primary & Secondary Metabolites - enzymes technology - single cell protein (SCP).Biopolymers, Biopesticides and Biofertilizers.

#### **UNIT V: ENVIRONMENTAL BIOTECHNOLOGY**

Bioremediation - bioremediation of hydrocarbons - Industrial wastes – Heavy metals - Xenobiotics - bioleaching – bio-mining – bio-fuels. Applications of biotechnology in agriculture, medicine and food science. Genetically modified organism (GMO'S) - GM foods. Biotechnology & bio-safety - IPR.

## REFERENCES

1. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K and Watson, J.D. 1994. Molecular Biology of the cell III edn. Garland publishing, New York.
2. Advice., J. 1994. Molecular markers. Natural history and evolution. Chapman & Hall, New York.
3. Purohit, S. S. and S. K. Mathur, (1999), Biotechnology: Fundamentals and Application. Agro Botanica, New Delhi. ISBN. 81-87167-IO-b.
4. Alan scragg, (1999), Environmental Biotechnology; Long Mann Publication. ISBN. 0582 276829.
5. R. C. Dubey, (2001). A text book of biotechnology, Rajendra Printer. New Delhi. ISBN. 81-219-09 16-3.
6. T.A Brown Gene cloning and DNA analysis. (1996) Blackwell science, Osney Mead, Oxford, OX20EL.
7. Sathyanarayane,U. (2006) Biotechnology Books and Allied (p) Ltd, India



## **4. BASIC CONCEPTS IN BIOINFORMATICS**

### **Unit I**

Introduction to Bioinformatics, Databank search, Data management and interpretation, Data bases – sequence, structure & domain - Application and scope. Useful bioinformatics sites – Gene and protein expression data – protein interaction data.

### **Unit II**

Biological Tools: Nucleotide sequence databases – protein sequence databases – specialised sequence data bases. Data retrieval and analysis – sequence retrieval system.

### **Unit III:**

Sequence alignment: Sequence similarity searches – Amino acid substitution matrices, data base searches: FASTA and BLAST – PSI BLAST.

### **Unit IV**

Multiple sequence alignment – local and global, databases for multiple alignment – phylogenetic tree analysis, role of phylogenetic tree analysis in evolutionary biology.

### **Unit V**

Structural bioinformatics: Protein structure prediction tools RASMOL, SWISS PDB, Algorithms – Methods for secondary structure prediction – Homology modelling, Factors influencing model quality, protein – protein interaction, Docking, Ligplot interactions, Genes, Primer designing, Phylogenetic Analysis.

### **References**

1. Applied Bioinformatics – an introduction – (springer) Selzer P.M and others
3. Rashidi, Hooman H , Lukas K Buchler Bioinformatics Basics – (CRC)  
Burkowski- Structural Bioinformatics – (CRC) –
4. Bexevanis Andress D- Bioinformation a practical guide to the analysis of genes  
and proteins - ed
5. Bujnicki, Janusz M.-Practical Bioinformatics (springer) -

## **5. STEM CELL BIOLOGY**

### **Unit I**

Introduction to stem cells, classification, Sources, programming and reprogramming, tissue specific stem cells Embryonic hematopoietic and neural stem cells, Classification and Sources

### **Unit II**

Embryonic Stem Cells Blastocyst and inner cell mass cells; Organogenesis; Mammalian Nuclear Transfer Technology; Stem cell differentiation; Stem cells cryopreservation

### **Unit III**

Application of stem Cells Overview of embryonic and adult stem cells for therapy Neurodegenerative diseases; Parkinson's Alzheimer, Spinal Cord Injuries and other Brain Syndromes; Tissue systems failures; Diabetes; Cardiomyopathy; Kidney failure; Liver Failure; Cancer; Hemophilia.

### **Unit IV**

Human Embryonic Stem Cells and society. Human stem cells research : Ethical considerations; Stem cell religion consideration; Stem cell based therapies: Pre clinical regulatory consideration and Patient advocacy.

### **Unit V**

Various model organisms. Stem cell isolation & characterisation techniques

### **Texts/References**

1. Ann A Kiessling, Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential, Jones and Bartlett, 2003.
2. Peter J. Quesenberry, Stem Cell Biology and Gene therapy, 1st Edition, Wiley-Liss, 1998.
3. Robert Lanza, Essential of stem cell Biology, 2nd Edition, Academic Press, 2006.
4. A.D. Ho., R. Hoffman, Stem Cell Transplantation Biology Processes Therapy, Wiley-VCH, 2006.
5. C.S. Potten, Stem Cells, Elsevier, 2006.

## **4. NANO BIOTECHNOLOGY**

### **Unit 1:**

Definition – Nano Science, Nano Biotechnology over view – Functional concept.

### **Unit II: Process in Nano manufacturing**

Bottom up, Top down assembly Nano material synthesis (Silver, Gold) – Chemical, Physical and Biological methods – Physico chemical characteristics. UV-vis spectroscopy, FTIR, Transmission and Scanning Electron microscopic characterization.

### **Unit III:**

Nobel metal – Nanomaterials (Silver & Gold) – Application in health and environmental concern. Surface modification, Smart scaffolds.

### **Unit IV:**

Nano medicine – Nano sensor – Drug discovery. Nanoparticle mediated Drug delivery – Nanorobots – Cancer diagnosis. Colloidal nanosilver particle as an effective nano antibiotic, Controlled release mechanism.

### **Unit V:**

Nanotoxicology – Nano particle interaction with cell. Accumulation and Elimination from biological system. Factors determine toxicological nature.

### **References:**

1. Introduction to nanotechnology Henrik Bruus MIC – Department of Micro and Nanotechnology, Technical University of Denmark, Lyngby, spring 2004.
2. UN bounding the Future: the Nanotechnology Revolution Eric Drexler and Chris Peterson, with Gayle Pergamit William Morrow and Company, Inc. New York 1991 by K. Eric Drexler, Chris Peterson, and Gayle Pergamit
3. Essentials of Nanotechnology Jeremy – Ramsden Jeremy – Ramsden & Ventus Publishers. APS .2009. Springer Handbook of Nanotechnology Bharat Bhushan Springer. 3rd Edition. 2010.
4. Nanofrontiers. Visions for future Nanotechnology Keren F.Schmidt springer.2010.

## **5. AQUACULTURE AND FARM MANAGEMENT**

### **OBJECTIVES:**

The objective of the paper is to understand both the culture and capture fin and shell fisheries practices in India and World. Survey of seed resources and seed and feed production, animal health management, aquaculture and farm management and aquaculture system being practiced is giving a comprehensive idea to promote both the aquaculture and capture fisheries sectors and also to provide scope for employment opportunities.

### **UNIT – I: INTRODUCTION TO FISHERIES AND AQUACULTURE**

Importance and objective of aquaculture – Global and Indian scenario:

Capture and culture fisheries status – prospects and scopes of Fin and shell fisheries:

edible fishes, crustaceans (prawn and crabs) and molluscs (clams, muscle, oyster and cephalopods)

### **UNIT –II: SURVEY OF SEED RESOURCES AND SEED & FEED PRODUCTION**

Distribution and abundance of natural seed resources, collection methods and segregation. Artificial seed production - breeding under controlled condition, induced breeding technique, larval rearing, packing and transportation – Live feed culture and its importance: Microalgae, Rotifer and Artemia

### **UNIT – III: ANIMAL HEALTH MANAGEMENT**

Infectious bacterial and viral diseases in fin and shell fishes: Diagnosis, prevention and treatment – Disease control and management: environmental management, chemotherapeutic, vaccine, immunostimulant and probiotic

### **UNIT – IV: AQUACULTURE AND FARM MANAGEMENT**

Brackish water aquaculture: site selection, topography, water availability and supply, soil conditions and quality, design and layout, structure and construction Farm management: water quality management; temperature, salinity, pH, O<sub>2</sub>, CO<sub>2</sub> levels, nutrients and trace elements

### **UNIT – V: AQUACULTURE SYSTEM**

Traditional, extensive, semi intensive and intensive aquaculture system

Integrated aquaculture system: Paddy-cum-fish culture, poultry–cum-fish

culture, pig-cum-fish culture – culture methods: Cage culture, pen culture and rack culture .

## REFERENCES :

1. Jhingran, C.G. 1981. Fish and Fisheries of India. Hindustan Publishing Co., India.
2. Balugut, E.A. 1989. Aquaculture system and practices. A selected review publishing House, New Delhi.
3. Ghosh, P.K., 2010. Brackishwater aquaculture. Bharat Printing House, Jodhpur.
4. Arlo, W.F and L. James, 1992. Marine shrimp culture and practices. Elsevier Science Publishers, B.V.
5. Pandian, T.J., 2001. Sustainable Indian Fisheries. The Coronation Arts Crafts, Sivakasi.
6. Pillay, T.V.R. 1990. Aquaculture Principles and Practices. Blackwell Scientific Publications Ltd.
7. Biswas, K. P. 1996. A Text Book of Fish, Fisheries and Technology. Narendra Publishing House, Delhi.

## 6. ENTOMOLOGY

### OBJECTIVES

To catch up with the tremendous strides of expansion of knowledge in Entomology, this paper is meant to comprehend the classification of insects, economic importance of Entomology with special reference to beneficial insects, sericulture, insect pests & vector and their control, vector borne diseases etc.

### UNIT I: INSECT CLASSIFICATION

Outline classification of insects with examples UNIT

### II: APPLIED ENTOMOLOGY

Pollinators, Predators and scavengers- Biology of honey bees, lac insects and their management.

### UNIT III: SERICULTURE

Biology of silkworm (*Bombyx mori*) - life cycle - organization of larvae, pupae and moth – types – rearing techniques, Reeling, structure of the silk gland, diseases. Moriculture – Silk worm nutrition.

### UNIT IV: AGRICULTURAL ENTOMOLOGY

Pest of Paddy with five examples, Pest of Sugarcane with two examples, Pest of Beverages – Coffee & Tea, Pest of stored products with five examples, internal feeder -external feeder-secondary pest and scavengers- Preventive and control measures

### UNIT V: MEDICAL ENTOMOLOGY

Mosquitoes- Lifecycle- *Aedes*, *Anopheles*, *Culex* –vector borne diseases-preventive and control measures, Housefly & Diseases.

### REFERENCE BOOKS

1. Ahsan, J and Sinha, S.P, 2009. A hand book on Economic Zoology, S. Chand & company Ltd, New Delhi
2. David, B.V and Ramamoorthy, V.V. 2012. Elements of Economic Entomology (VII edition), Popular Book Depot, Chennai.
3. Nalinasundari, M.S. and Santhi, R. 2006. Entomology. MJP Publishers, Chennai.
4. Nayar, K.K., Ananthakrishnan, T.N. and David, B.V, 1989. General and Applied Entomology. Tata McGraw Hill Publications, New Delhi.
5. Ramakrishna Ayyar T.V. 1989. Handbook of Economic Entomology for South India. Books and Periodicals Supply Service, New Delhi.
6. Veda, K., Nagai, I. and Horikomi, M. 1997. Silkworm Rearing (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Ekambaranatha Iyer and Ananthakrishnan, T.N. 1987, Manual of Zoology, S.Viswanathan and Co., Chennai.

## **7. MEDICAL LAB TECHNOLOGY**

### **UNIT I: MAINTENANCE OF CLINICAL APPARATUS**

Common glass wares in clinical laboratory, care and maintenance - Sterilization methods- Physical and chemical agents, Haemocytometry (Neubaur chamber), Blood components, functions, plasma & serum, Red cell indices (MCV, MCH, MCHC)

### **UNIT II: BLOOD**

Haematopoietic system -Erythropoiesis, Leucopoiesis, Thrombopoiesis, Anaemia-classification, Blood clotting factors, mechanisms of coagulation, anticoagulants

### **UNIT III: HAEMATOLOGY**

Bleeding time, Clotting time, Estimation of Haemoglobin, Erythrocyte sedimentation rate(ESR), Packed cell volume (PCV), Differential count, Total red blood cell count, Total white blood cell count, Platelet count, Eosinophil count, Reticulocyte count,

### **UNIT IV: PATHOGENS**

Detailed account of *Plasmodium*, *Entamoeba*, *Trypanosoma*, *Ascaris*, *Taenia solium*

### **UNIT V: MICROTECHNIQUE**

Fixation, Dehydration, Clearing, infiltration & impregnation, embedding, sectioning staining, and mounting

Spermatozoa count & Pregnancy test

### **REFERENCE BOOKS**

1. Ezhilarasi, 2004. Medical Laboratory Technology (in Tamil), Paavai Printers (P) Ltd & University of Madras, Chennai
2. Kanai L Mukerjee, 2004. Medical Laboratory Technology, Volume I, II, III, Tata McGraw Hill Publishing Company Ltd, New Delhi
3. Manoharan and Sethuraman 2003, Essentials Clinical Haematology, Jaypee Brothers (Medical Publishers (P) Ltd), New Delhi
4. Monica Cheesbrough, 2006, Medical laboratory manual for tropical countries, Volume I & II Cambridge University Press, UK
5. Navanadharao, Z, 2002, Practical Medical Technology, Vasavi Graphics, Nellore
6. Pearse, A.G.E., 1970. Histicchemistry -Theoretical and applied, Vol I Churchill Livingstone
7. Ramniksood, 1999, Medical Laboratory Technology- methods and interpretations, 5th Edition, Jaypee Brothers (Medical Publishers (P) Ltd), New Delhi
8. Samuel, K.M, 1989, Notes on Clinical laboratory techniques, MKG Iyer and son (IV edition), Chennai
9. Venkatesan, P. 1998. Essentials of Medical Laboratory Technology, BICOVAS, Chennai
10. Williams and J William, 1990. Haematology, Mc Graw Hill, New York

## **8. ETHANOPHARMACOLOGY**

### **OBJECTIVES**

#### **UNIT 1: CLASSIFICATION**

Classification, Identification and naming of medicinal plants – Classification of fruits, Vegetables, ornamental plants and other operational classifications.

#### **UNIT II: FARM MANAGERMENTS**

Production and management of medicinal plants on farms – Maximum economic yield – Plant population and crop yield – time of planting – Preparation of soil – Sowing , depth – preparation of beds – Types – Crop establishment techniques – Cultivation – Eco friendly approach – types – Mulching - Diseases and protection.

#### **UNIT III: DISEASES OF MEDICINAL PLANTS**

Diseases caused on Leaf, roots and stem – Causing agents – Managements – control of pests – Physical, Chemical, Biological and legal pest control.

#### **UNIT IV: FOLK LORE AND AROMATIC MEDICINAL PLANTS**

Folklore Medical plants – Aromatic medicinal plants – Bio diversity conservation, export potential and Intellectual property rights – Indian pharmaceutical industries – source of financial aids for medicinal plants cultivation.

#### **UNIT V: CHEMICAL COMPONENTS OF MEDICINAL PLANTS**

Medicinal plants – Chemical components – Isolation, Purification of medicinal plant compounds – GC-MS, HPLC, NMR, IR

### **REFERENCES**

1. S.S.Purohi and S.P.Vyas. (2004). Medicinal plants cultivation – A Scientific approach. Agrobios. India.
2. P.C.Trivedi. (2004). Medicinal plants Utilization and conservation. Aavishkar publishers, Distributors. India.
3. Alexander, MP and Ganeshan. S. (1993). Advances in Horticulture. Vol I. Malhotra publishing House, New Delhi.
4. Claus, EP., Tyler, VE and Brady, LR. (1970). Pharmacognosy. 6th edition. Philadelphia, USA.
5. Bhattacharjee, SK. (2004). Hand book of medicinal plants. 4th revised edn., Pointer publishers. Jaipur. India.
6. ICAR (1997). Hand book of Agriculture, New Delhi.
7. Alok, SA. (1991). Medicinal plants in India. Approaches to exploitation and conservation. Cambridge University Press (1st edition).



## **9. REPRODUCTIVE PHYSIOLOGY AND ENDOCRINOLOGY**

### **OBJECTIVES**

To make the students to learn the objectives and scope of Physiology, endocrinology, anatomy, morphology and histology of endocrine tissues, hormones, hormonal regulation and development of reproductive organs and reproduction.

### **UNIT I: REPRODUCTION IN INVERTEBRATES**

Reproduction in protozoa - Reproduction in paramecium. Asexual and sexual reproduction in sponges – Medusa in obelia colony. Reproductive system in *Ascaris lumbricoides*. Reproduction in Echinoderms – fertilization and development.

### **UNIT II: REPRODUCTION IN CHORDATES**

Reproduction in Prochordates, Urinogenital system in amphibian, Reptiles and Birds. Reproductive system in mammal – Rabbit, Fertilization and development.

### **UNIT III: PITUITARY AND THYROID GLANDS**

Pituitary gland – Structural organization – Pituitary hormones & functions – Hypothalamic control. Thyroid gland - Structural organization, Thyroid hormones – Effects on reproduction - parathyroid - Structure and functions.

### **UNIT IV: PANCREAS AND ADRENAL GLANDS**

Structure of Pancreas – Function of Insulin – Adrenal gland – structural organization, function of cortical and medullary hormones.

### **UNIT: V CRUSTACEAN AND VERTEBRATE REPRODUCTIVE ENDOCRINOLOGY**

Neuroendocrine system in crustaceans – Endocrine control of moulting and metamorphosis and reproduction. Structure of mammalian testis and ovary – Hormones of testis and ovary – Estrous and menstrual cycle - Hormone control of lactation.

### **REFERENCES:**

1. R.L.Kotpal. 1998. Modern textbook of Zoology – Invertebrates. Rastogi Publications, Shivaji Road, Meerut – 250 002. India.
2. E.L.Jordan & P.S. Verma. 1998. Chordate Zoology and Elements of Animal Physiology. S.Chand & Company (Pvt) Ltd. Ram Nagar, New Delhi – 110055.
3. Barrington, EJW. 1968. An Introduction to general and comparative endocrinology, Academic press, London.
4. Bentley. PJ. 1985. Comparative vertebrate endocrinology. S.Chand and co .,
5. Turner, CD. 1966, General Endocrinology. 4th edn, WB.Saunders Co, London.
6. Bentley, PJ. 1982. Comparative vertebrate endocrinology, Cambridge University press.
7. Michael, P. 1968. Endocrinology and Human Behaviour. Oxford University Press, New York.

## **10. BIOINSTRUMENTATION**

### **Unit I .Microscopy and its application**

Principle and application of light, phase contrast, fluorescence, scanning and transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, confocal microscopy, cytophotometry and flow cytometry.

### **Unit II - Histology and specimen preparation**

Preparation of microbial, animal and plant samples for microscopy and staining techniques. Types of microtomes and microtomy,.

### **Unit III - Separation Techniques**

Centrifugation, Basic principle and application. Differential, density and ultracentrifugation. sonication, lyophilization, Principles, methodology and applications of gel – filtration, ion – exchange and affinity chromatography; thin layer and gas chromatography; high performance liquid chromatography, FPLC. Electrophoresis: Principle and applications of Native, SDS, Agarose and 2D gel electrophoresis.

### **Unit IV: Biomolecular structure analysis**

Principle and method of biophysical analysis of biopolymer structure; X ray diffraction, fluorescence. UV, visible Spectroscopy, Atomic absorption and plasma emission spectroscopy. IR, NMR and ESR spectroscopy, MS and MALDI-TOF.

### **Unit V: Radiation tracer technique**

Principle and applications of tracer technique in biology: Radioactive Isotopes and half life of isotopes; Effect of radiation on biological system; autoradiography; Cerenkov radiation; radiation dosimetry; scintillation counting. Biosensors: Principle and application.

### **References:**

1. Instrumental method of chemical analysis -Shrama BK
2. Instrumental methods of analysis- DA Skoog
3. An introduction to practical Biochemistry – Plummer
4. Instrumentation -Chatwal and Anand
5. Modern experimental Biology- Boyer

## **OPEN ELECTIVE / NON-MAJOR ELECTIVE COURSES**

### **A. FISHERIES AND AQUACULTURE**

#### **OBJECTIVES:**

The objective of the paper is to understand both the culture and capture fin and shell fisheries practices in India and World. Survey of seed resources and seed and feed production, animal health management, aquaculture and farm management and aquaculture system being practiced is giving a comprehensive idea to promote both the aquaculture and capture fisheries sectors and also to provide scope for employment opportunities.

#### **UNIT – I: INTRODUCTION TO FISHERIES AND AQUACULTURE**

Importance and objective of aquaculture – Global and Indian scenario:

Capture and culture fisheries status – prospects and scopes of Fin and shell fisheries: edible fishes, crustaceans (prawn and crabs) and molluscs (clams, muscle, oyster and cephalopods)

#### **UNIT –II: SURVEY OF SEED RESOURCES AND SEED & FEED PRODUCTION**

Distribution and abundance of natural seed resources, collection methods and segregation. Artificial seed production - breeding under controlled condition, induced breeding technique, larval rearing, packing and transportation – Live feed culture and its importance: Microalgae, Rotifer and Artemia.

#### **UNIT – III: ANIMAL HEALTH MANAGEMENT**

Infectious bacterial and viral diseases in fin and shell fishes: Diagnosis, prevention and treatment – Disease control and management: environmental management, chemotherapeutic, vaccine, immunostimulant and probiotic

#### **UNIT – IV: AQUACULTURE AND FARM MANAGEMENT**

Brackish water aquaculture: site selection, topography, water availability and supply, soil conditions and quality, design and layout, structure and construction Farm management: water quality management; temperature, salinity, pH, O<sub>2</sub>, CO<sub>2</sub> levels, nutrients and trace elements

#### **UNIT – V: AQUACULTURE SYSTEM**

Traditional, extensive, semi intensive and intensive aquaculture system Integrated aquaculture system: Paddy-cum-fish culture, poultry-cum-fish culture, pig-cum-fish culture – culture methods: Cage culture, pen culture and rack culture.

#### **REFERENCES :**

1. Jhingran, C.G. 1981. Fish and Fisheries of India. Hindustan Publishing Co., India.

2. Balugut, E.A.1989. Aquaculture system and practices. A selected review publishing House, New Delhi.
3. Ghosh, P.K., 2010. Brackishwater aquaculture. Bharat Printing House,Jodhpur.
4. Arlo,W.F and L.James,1992.Marine shrimp culture and practices. Elsevier Science Publishers, B.V.
5. Pandian, T.J.,2001. Sustainable Indian Fisheries. The Coronation Arts Crafts, Sivakasi.
6. Pillay, T.V.R. 1990. Aquaculture Principles and Practices. Blackwell Scientific Publications Ltd.
7. Biswas, K. P. 1996. A Text Book of Fish, Fisheries and Technology. Narendra Publishing House, Delhi.

## **B. SERICULTURE**

### **OBJECTIVES**

Sericulture is an agro based cottage industry and it has been identified as an industry of low investment with high output source of income. This paper aims to introduce to provide a comprehensive knowledge among young generation- on rearing of silkworm and silk production practices to take up as entrepreneur.

### **UNIT – I:**

Prospects and status of silk production in india. Economic importance of sericulture and salient features. Host plant cultivation – Mulberry propagation – various methods: seedlings, saplings, cuttings, raising of nursery and its economics. Grafting, stem and root grafting techniques; Layering. Use of growth regulators in mulberry propagation.

### **UNIT –II:**

Silkworm *Bombyx mori* : General characteristic features - classification – types of of silkworms Eri, tasar, muga. Life cycle of silkworm – Egg, larva, pupa, adult. Structure and chemistry of silk gland.

### **UNIT – III:**

Voltinism, Metamorphosis and moulting mechanism. Silkworm feeding and Nutrition of mulberry, Digestive physiology.

### **UNIT – IV:**

Silkworm reproduction and seed production. Silkworm diseases and management (Bacterial, viral and fungal borne diseases) Uzi fly menace and control.

### **UNIT – V:**

Silkworm rearing techniques: Incubation, moulting of silkworm worms, harvesting. Silk reeling techniques: Lacing, skinning etc.

### **REFERENCE BOOKS**

1. Ahsan, J and Sinha, S.P, 2009. A hand book on Economic Zoology, S. Chand & company Ltd, New Delhi.
2. David, B.V and Ramamoorthy, V.V. 2012. Elements of Economic Entomology (VII edition), Popular Book Depot, Chennai.
3. Nalinasundari, M.S. and Santhi, R. 2006. Entomology. MJP Publishers, Chennai.
4. Nayar, K.K., Ananthakrishnan, T.N. and David, B.V, 1989. General and Applied Entomology. Tata McGraw Hill Publications, New Delhi.
5. Ramakrishna Ayyar T.V. 1989. Handbook of Economic Entomology for South India. Books and Periodicals Supply Service, New Delhi.
6. Veda, K., Nagai, I. and Horikomi, M. 1997. Silkworm Rearing (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Ekambaranatha Iyer and Ananthakrishnan, T.N. 1987, Manual of Zoology, S.Viswanathan and Co., Chennai.

## **C. ENVIRONMENTAL SCIENCE**

### **OBJECTIVES**

To generate up-to-date knowledge on environmental conservation and management through a comprehensive understanding of the components of ecosystem, biological cycles, habitat ecology, resource ecology, pollution and its management and To comprehend the scientific concepts of animal evolution through an understanding of its evidences, its mechanics, process and products.

### **UNIT-I: ECOSYSTEM AND COMMUNITY**

Ecosystem and Community - Review of concept of ecosystem - Natural and Man-made ecosystem, with examples. Energy flow - Trophic structure and levels - Pyramids, food chain and web - ecological efficiencies, and productivity and its measurement.

### **UNIT-II: POPULATION ECOLOGY**

Structure and distribution - Growth curves - Groups, natality, Mortality – Density indices, Life study tables - factors affecting population growth – Carrying capacity. Population regulation and human population control.

### **UNIT-III: RESOURCES ECOLOGY AND BIOLOGICAL CYCLES**

Renewable and non - renewable resources - animal resources. Conventional and non - conventional energy sources. Review of Biogeochemical cycles: Nitrogen, Phosphorous and sulphur.

### **UNIT-IV: ENVIRONMENTAL CONSERVATION, POLLUTION AND MANAGEMENT**

Principles of conservation – ethics and values of wild life, National parks, Rain water harvesting. Bioremediation - Need & Scope of Bioremediation - Environmental applications – Phytoremediation – Biomagnification -Bioavailability.

### **UNIT-V: BIODIVERSITY AND CONSERVATION:**

Biodiversity of the animal and plants in India. Hot spot of biodiversity species, biodiversity rules and regulation for conservation of species.

### **REFERENCE BOOKS**

1. Odum. E.P. 1996. 2nd Edition. Fundamentals of Ecology. Nataraj Publishers, Dehra Dun.
2. Trivedi, P.R.and Gurdeepraj, K. 1992. Environmental Biology. Akashdeep Publishing House New Delhi.
3. Sharma, P.D. 1995. Ecology and environment. Rastogi Publications.
4. Smith, R.L.1986. Elements of Ecology. Harpet and Row Publishers, New York.
5. Dhaliwal, G.S, Sangha G.S and P.K. Raina. Fundamentals of Environmental Science. Kalyani Publication.
6. Jr. Miller, G.T. 1997. 6<sup>th</sup> Edition. Environmental Science. Wadsworth Publication.Co.

### III SEMESTER

#### **Field Study and USRR (University Social Responsibility Report)**

The aim of the Field Study is to help students connect with the society in the respective discipline. Following are the important features of the Field Study and the USRR:

**1. Aim:** The Field Study must aim at relating the subject of study with the society in so far as the application and the usefulness of the study are concerned

**2. Topic selection:** The topic for the Field Study must be chosen by the student in the second semester in the month of February; the process for the same shall begin on 1st February and shall end on the last working day of the month of February. Students are free to select the topic for the Field Study in consultation with the Experts and Faculty Members of their choice, both from within and outside the University

**3. Period and duration:** The Field Study shall be undertaken for a duration of 15 days in the summer vacation that falls immediately at the end of the second semester of the program and the same should be accounted for the Third Semester of the program

**4. USRR:** The USSR (University Social Responsibility Report) must be prepared by every student of the program written in 50 to 75 pages. The report shall be written based on the standard research methodology.

**5. Review and evaluation schedule:**

*a. Reviewing the Field work:* First week of July

*b. Report Review:* Second week of August

*c. Report submission:* First week of September

*d. Report Evaluation:* Third week of September

**6. Faculty Composition:** The following members may be nominated for confirming the topic and for evaluating the USRR:

a. Professor and Head of the concerned Department

b. One Faculty member with related field of specialization from the concerned Department

c. One senior faculty member from the Department of Sociology from other Institution