

### M.Sc., ZOOLOGY (2017 – 2018)

S. No	SEM	Category	Paper Code	Title of the Paper	Maximum Marks			Minimum Marks for Pass			Hours Week	Credits
					CIA	E.E	Total	CIA.	E.E	Total		
1.	I	Core	17P1ZOC1	Biology of Invertebrates and Chordates	25	75	100	10	30	50	6	5
2.		Core	17P1ZOC2	Cell and Molecular Biology and Biophysics	25	75	100	10	30	50	6	5
3.		Core	17P1ZOC3	Microbiology	25	75	100	10	30	50	6	4
4.		Core	17P1ZOCP1	Practical I ((Invertebrate and Chordate, Cell and Molecular Biology and Microbiology)	40	60	100	16	24	50	6	4
5.		Major Elective-I	17P1ZOEL1A 17P1ZOEL1B	General and Human Genetics Genomics and Proteomics	25	75	100	10	30	50	6	4
6.	II	Core	17P2ZOC4	Developmental Biology and Bio-Techniques	25	75	100	10	30	50	5	5
7.		Core	17P2ZOC5	Environmental Biology and Conservation	25	75	100	10	30	50	5	4
8.		Core	17P2ZOC6	Biotechnology	25	75	100	10	30	50	5	4
9.		Core	17P2ZOC7	Endocrinology	25	75	100	10	30	50	4	4
10		Core PL	17P2ZOCP2	Practical II ( Developmental Biology, Bio-Techniques, Biotechnology & Environmental Biology)	40	60	100	16	24	50	6	4
11		Major Elective	17P2ZOEL2A 17P2ZOEL2B	Cell and Tissue culture Wild Life Management	25	75	100	10	30	50	5	4
12	III	Core	17P3ZOC8	Immunology	25	75	100	10	30	50	5	4
13		Core	17P3ZOC9	Animal Physiology and Bio-Chemistry	25	75	100	10	30	50	5	5
14		Core	17P3ZOC10	Clinical Biochemistry	25	75	100	10	30	50	5	4
15		Core	17P3ZOC11	Nanotechnology	25	75	100	10	30	50	4	4
16		Core	17P3ZOCP3	Practical-III ( Animal Physiology, Biochemistry, Immunology and Clinical Biochemistry)	40	60	100	16	24	50	6	4
17		EDC	17P3ZOEDC	EDC - Clinical Lab Technology	25	75	100	10	30	50	4	---
				Communicative skill and Personality development							1	---
18	IV	Core	17P4ZOC12	General and Applied Entomology	25	75	100	10	30	50	6	5
19		Core	17P4ZOC13	Research Methodology	25	75	100	10	30	50	6	4
20		Core	17P4ZOCP4	Practical-IV (General and Applied Entomology and Research Methodology	40	60	100	16	24	50	6	3
21		Major Elective	17P4ZOEL3A 17P4ZOEL3B	Estuarine Biology & Aquaculture Fisheries Science	25	75	100	10	30	50	6	4
				Communicative skill and Personality development	-	-	-	-	-	-	1	-
22		CN	17P4ZOEN	Comprehension	-	100	100	---	---	50	5	2
23		Project	17P4ZOPR	Project	40	60	100	16	24	50		4
			<b>Total</b>			<b>2300</b>				<b>120</b>	<b>90</b>	

### M.Sc. ZOOLOGY (2017 – 2018)

<b>Paper Code</b>	<b>Total No. Of Papers</b>	<b>Total Marks</b>	<b>Total Credits</b>	<b>Classification</b>
Core	17	1700	72	✓
Elective	3	300	12	✓
E.D.C	1	100	---	✓
Project	1	100	4	x
Comprehension	1	100	2	✓
Soft skill using Language lab	--	--	---	X
<b>Total</b>	<b>23</b>	<b>2300</b>	<b>90</b>	

**A.VEERIYA VANDAYAR MEMORIAL SRI PUSHPAM COLLEGE  
(AUTONOMOUS),  
POONDI, THANJAVUR DIST.**

**Question Pattern for UG and PG Programmes for students to  
be admitted during 2017 – 2018 and afterwards**

**Total Marks: 75**

**QUESTION PATTERN**

**SECTION – A  
(Question 1 to 10)**

**10 x 2 = 20 Marks**

1. Short Answer Questions
2. Two Questions from each units (All are answerable)

**SECTION – B  
(Question 11 to 15)**

**5 x 5 = 25 Marks**

1. 5 Paragraph type questions with "either / or" type choice.
2. One question from each unit of the Syllabus.
3. Answer all the questions.

**SECTION – C  
(Question 16 to 20)**

**3 x 10 = 30 Marks**

1. 5 Essay type questions – any three are answerable.
2. One questions from each unit of the Syllabus.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
<b>I</b>	<b>17P1ZOC1</b>	<b>BIOLOGY OF INVERTEBRATES AND CHORDATES</b>	<b>6</b>	<b>5</b>

**Objectives:**

1. To understand the morphology and functional anatomy of both invertebrates and chordates in a comparative aspects.
2. To know the biological aspects of minor phyla in detailed way.
3. To study the types of fossils and their phylogenic relationship with higher group of animals.
4. To study the external features inner anatomical features in a comparative manner with Chordate animals.
5. To study the evolution of chordate species.

**Unit I**

**Hrs 18**

Important human parasites and vectors. Life cycle and biology of plasmodium, Wuchereria, Schistosoma and Leishmania, vectors of human diseases – Mosquitos, flies, ticks. Cellular and physiological basis of host- parasite interaction.

**Unit II**

**Hrs18**

Locomotion in Protozoa, skeleton system in Porifera, Polymorphism and metagenesis in cnidaria, parasitic adaptations in helminthes, coelom and metamerism in annelids, Larvae of crustaceans, Respiration in Arthropods(Prawn, Cockroach, Scorpion) Torsion in Mollusca and larval forms in Echinoderms.

**Unit III**

**Hrs18**

General organization and phylogeny of Rotifera, Chaetognatha, Ectoprocta – Entoprocta, Phoronida. Study of Invertebrate fossils – Trilobites, ammonoids, Living fossils- Peripatus, Limulus, Nautilus, Vertebrate fossil – Archaeopteryx – Sphenodon.

**Unit IV**

**Hrs18**

Comparative study of digestive, respiratory, circulatory and urinogenital system of Invertebrates and Chordates (Earthworm, Cockroach, Freshwater Mussel, Frog, Calotes and Rabbit).

**Unit V**

**Hrs 18**

Parental care in fishes and amphibians – Mesozoic Reptiles - Migration of birds – Primitive mammals – Monotremes and Marsupials.

**Reference:**

1. Ekambaranathan ayyar, 1993 – Outline of Zoology – Vol -I & II, S.Viswanathan (Printers & Publication) Pvt. Ltd, Chennai.
2. Hyman, L.H. The invertebrates, Vol 3 to 6 – Mc Graw Hill Book Co., London.
3. Kotpal, R.L. Minor Phyla, Rastogi Publishers, Meerut.
4. Kotpal, R.L. Phyla Series, Rastogi Publishers, Meerut.
5. Moore, R.C. Lallicker and A.G. Fisher (1952) "Invertebrate Paleontology". Mc Graw Hill book Co., New York.
6. Woods, H. (1961) Paleontology – Invertebrata Cambridge University Press
7. Hyman L.H.(1967) Comparative Vertebrate anatomy. Mc Graw Hill BookCo. New Delhi
8. Parker and Haswell (1967), Text Book of Zoology Vol-I and Col-II.
9. Newmann, W.H. (1961) Phylum Chordate. The University of Chicago Press. Chicago.
10. Romer, A.S (1960) Vertebrate Paleontology, University of Chicago Press, Chicago.
11. Yong, J.Z. (1962) The life of vertebrates, Oxford University Press. London.
12. Colbert, E.H. (1970) Evolution of vertebrates. John Wiley and Sons, New York.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
<b>I</b>	<b>17P1ZOC2</b>	<b>CELL AND MOLECULAR BIOLOGY AND BIOPHYSICS</b>	<b>6</b>	<b>5</b>

**Objectives:**

1. To understand, the working mechanisms of the different Cytological instruments and their applications in cell study.
2. To study the cellular interaction, cell signaling mechanisms
3. To study the ultra structure of different cell organelles in a detailed way.
4. To study the molecular aspects of Nucleus, Nucleolus, Chromosomes of prokaryotes and Eukaryotes and to study the process of cell division and protein synthesis.
5. To study the Biophysics with reference to the Law of Thermodynamics, U V radiation.
6. To understand the Osmo-ionic diffusion of molecules in to the cells.
7. To understand the Tyndall effect and their application in Radiobiology.

**Unit I**

**Hrs 18**

Structure of Prokaryotic cell- Bacteria, Structure of Eukaryotic animal cells. Cell cycle and its regulation. Plasma membrane: Cell Signalling -Cell-Cell Interaction; Cell adhesion molecules. Signal transduction, Signalling via G-protein linked receptors (PKA,PKC,CaM kinase) and Enzyme linked receptor signaling (Growth factor receptor signaling;JACK-STAT pathway).

**Unit II**

**Hrs 18**

Structure and functions of cell organelles – Mitochondria, ER, Golgi complex, Lysosome, Peroxisomes, Centrioles, Ribosomes, Nucleus and Nucleolus. Structure and organization of chromosomes; Giant chromosome, polytene and lamp brush chromosome; Structure and Functions of Nucleic acids-DNA and RNAs;

**Unit III**

**Hrs 18**

Cancer biology – Genetic rearrangement of progenitor cells, oncogenes, tumour suppressor genes, cancer and the cell cycle – virus induced cancer, metastasis, interaction of cancer cells with normal cells; Apoptosis and cancer : Mechanism of apoptosis - proteins involved in apoptosis- Signaling pathways: types and their impact on apoptosis and oncogenesis - Principle and methods of cancer diagnosis: – Biochemical, Genetic, Cytotoxic and cell growth and viability tests

**Unit IV**

**Hrs 18**

Biophysics – Light – wave length – photoelectric effect – Biophysical Aspects of Vision, Thermodynamics laws – free energy – Natural radiation – properties – Photodynamics sensitization – effects of UV light and ionizing radiation and X-ray diffraction, fluorescence.

**Unit V**

**Hrs 18**

Diffusion– Principles of diffusion and osmosis - methods of Transport phenomenon - determination of osmotic pressure. Colloids: Sol/gel changes – Tyndall effect. Isotopes: Methods of study, Geiger – Muller Counter. Radiobiology – Principle and application in laser technique in biology – Radioactive isotopes and half life of isotopes, effect of radiation on biological systems, Autoradiograph.

**Reference:**

1. De Robertis, R.OP and De. Robertis, E.M.F. (1980) Cell and Molecular Biology, Holt Saunders imitational Edn, Japan.
2. DePraw, E.L (1960) Cell and Molecular Biology, Academic Press, New York.
3. Gieses, A.C. (1957) Cell Physiology, W.E. Saunders Co., Threadgold, L.T. (1975). The ultra structure of the animal cell, Pergmann Press, New York.
4. Brude Alberts, Bennis – bray Lewis, Martin Raff Kiety – Rovers and James D.Wastern (1963). Molecular Biology of the cell, Garland Publishing Inc, New York and London.
5. Ackerman, E. (1962). Biophysical science, Prentice Hall. Casey, E.J. Biophysics Concepts and mechanisms.
6. Epstein, J.F. (1963) Biophysics – Selected topics, Addition, Wesley Publishers Co. Thayer, J., Biophysical technique – Chapman and Hall.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>I</b>	<b>17P1ZOC3</b>	<b>MICROBIOLOGY</b>	<b>6</b>	<b>4</b>

**Objectives:**

- 1.To know the scope of Microbiology,
- 2.To learn the techniques on the isolation of Microbes.
- 3.To study the Food contamination by Bacteria.
- 4.To study the role of microbes in Industry.
- 5.To study the role of microbes in Environment.
- 6.To analyse the Pathogens and their treatment in human diseases

**Unit I**

**Hrs 18**

Introduction and Scope of Microbiology – Classification of microorganisms – Prokaryotes and Eukaryotes – Ultrastructure and organization of Virus (Bacteriophages), Bacterial cell, Fungal cell and Yeast. Methods and isolation of microbes, Preservation and identification of Microbes. Preparation of culture media and culture methods for bacteria, algae, fungi and virus and maintenance of pure culture.

**Unit II**

**Hrs 18**

Food contamination, poisoning and spoilage – sources, symptoms and prevention of food borne infections – Bacterial and fungal toxins – methods of detection and detoxification – Food sanitation in food manufacturing industries and safety measures.

**Unit III**

**Hrs 18**

Biogeo-chemical role of microbes in nitrogen, carbon and phosphorous cycle- Biofertilizer-Bacteria – Phosphobacteria, mass culture techniques of Cyanobacteria, Mycorrhizae, Azolla – Anabaena sp., – Microbial biopesticides and biodegradation of herbicides and pesticides – Xenobiotics.

**Unit IV**

**Hrs 18**

Microbiology of water – Methodology of bacterial analysis industrial and municipal effluences- Microbiological sewage water purification methods – Role of microorganisms in oil pollution-soil pollution and water pollution-control microbes as indicator of pollution.

**Unit V**

**Hrs18**

Pathogen, Pathogenesis, Clinical conditions, diagnosis, Epidemiology, Chemotherapy and prevention of the following diseases in Man : Bacterial disease : Pneumonia, Diphtheria, Rheumatic fever, Whooping cough, Tuberculosis, Meningitis, Botulism, Typhoid Cholera, Gonorrhoea, Plague and leprosy, Viral diseases – Influenza, Measles, Mumps. Chicken Pox, hepatitis, Poliomyelitis, Rabies, Japanese encephalitis, Yellow fever and HIV infection (AIDS).

**Reference:**

1. Pelzer, M.J., R.D. Reind and ECS. Chan, Microbiology (McGraw Hill)
2. Purohit, S.S, Microbiology, Fundamentals and Applications (Agro botanical Publications).
3. Patel, A.H. Industrial Microbiology (Tata McGraw-Hill).
4. Ross, F.C., Introductory Microbiology (Bell and Howell Company, London)
5. Dubey, R.C. Microbiology, S. chand Co., New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>I</b>	<b>17PIZOCP1</b>	<b>Core –PL-I-INVERTABRATES AND CHORDATA, CELL AND MOLECULAR BIOLOGY AND MICROBIOLOGY</b>	<b>6</b>	<b>4</b>

**Objectives:**

1. To know the internal organs of the Invertebrata and chordate animals.
2. To know the cells of Buccal smear, Blood smear and cell divisions.
3. To study the preparation of microbial culture medium and isolation of microbes.

**DISSECTIONS**

Invertebrates and Chordates:

Dissection of Nervous and Reproductive Systems of Prawn, Squilla, Pila and Ariophanta.

Dissection of Circulatory, Nervous and Reproductive Systems of Fish, Calotes and Rat.

**MOUNTINGS**

Parapodia of Neries – Mouthparts of Insects – Aristotle’s lantern and Pedicellariae of sea Urchin- Brain of fish and Rat.

**IDENTIFICATION OF INVERTEBRATE AND CHORADATE SPECIMENS**

Trypanosoma, Physalia, Tape worm, Round worm, Nereis, Peripatus, King crab, Octopus, Sea cucumber, Sea urchin, Phylogenetic relationship of Trochophore, Veliger, Pluteus larve. Minor phyla forms: Rotifera, Chaetognatha. Chordate Specimens: Narcine, Echeneis, Diodon, Ostraction, Tetrodon, Hippocampus, Synapta, Periophthalmus, Rhacophorus, Ichtyyophis, Najanaja, Viper, Draco, Chaemeleon, Pyrinosoma, Uromastix, Bat. Study of Invertebrate and Vertebrate fossils.

**CELL and MOLECULAR BIOLOGY**

Micrometry - Study of Buccal smear-Blood smear in Frog and Man-Mitosis stages in Onion root tips-Meiosis stages in grass-hopper testes. Spectrophotometric analysis of nucleotides;

**MICROBIOLOGY**

1. Sterilization of Glasswares and culture media, preparing and dispensing culture media
2. Microbiological instruments and equipments
3. Culture Techniques : Streak plate and Pour plate
4. Bacterial and Fungal colony Counting and staining
5. Fermentation techniques
6. Isolation of microbes from spoiled food – Wheat, Milk, Cereals, Bread

A record of laboratory work and a report on local field trip should be maintained and submitted at the time of practical examination for valuation.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>I</b>	<b>17P1ZOEL1A</b>	<b>Major Elective – I GENERAL AND HUMAN GENETICS</b>	<b>6</b>	<b>4</b>

**Objectives:**

- 1.To learn the General Principles and application of genetics in Human.
- 2.To understand, the genetic inheritance of blood groups, chromosomal and extra chromosomes in animals and man.
- 3.A thorough study on genes and their mutational effect at molecular level.
- 4.To study the human genetics with reference to their behavior genetic engineering and genetic counseling.

**Unit I**

**Hrs 18**

Introduction to principles of Genetics: Dominant and recessive Epitasis Multiples factor inheritance–Skin colour in Man. co-dominance – Pleotropism – Lethal genes in Man and Mice.

**Unit II**

**Hrs 18**

ABO and Rh type of Blood groups – Erythroblastosis foetalis, Haemophilia, Linkage and crossing over and mapping of chromosome, Non-disjunction-Free Martin, Sex linked inheritance in Drosophilae and Man –Y-linked inheritance – Barrbody, Extrachromosomal inheritance – Kappa particles – coiling in snail – mirablis – Episome.

**Unit III**

**Hrs 18**

Mutation at molecular level, Genetic structure of population – Application of Hardy Weinberg’s law – Fine structure and Functions of Gene. Methods of genetic transfer – transformation, conjugation, transduction and sexduction – structural and numerical alteration of chromosomes – Deletion, duplication, inversion, translocation, ploids and their genetic implication.

**Unit IV**

**Hrs 18**

Application of Mendel’s Law to Human Genetics – variation in Gene expression in man, Environment and gene expression in man – human chromosome and karyotype-sex chromosome and genetic theory. Genes and molecular diseases: Chromosomal anomalies and approaches to the problem of genetical disorders.

**Unit V**

**Hrs 18**

Pedigree analysis and probability: Banding techniques of chromosomes. Genetic Engineering and Gene Targeting. **Prenatal diagnosis:** Chorionic villi sampling - Foetoscopy, Ultrascopy - Amniocentesis. **Postnatal diagnosis:** Peripheral blood leucocyte culture - Sister Chromatid Exchange - Fragile site - Mitotic index. **Genetic Counseling.**

**Reference:**

1. Edge Alton burg, Genetics, Oxfor and IBH Publishing Co, New Delhi. Dinogg and Dunn, Genetics.
2. Dobzhansky, T. principles of genetics, Mc Graw Hill Book Co Ltd, New Delhi.
3. Norman, V. Rothwell, Human genetics – Prentice Hall of India Pvt Ltd – New Delhi.
4. Jenkins, J.B. Human Genetics, the Benjamin Cumming Publishing Co.
5. Jenkins, J.B. Human Genetics, The Benjamin Cumming Publishing Co. Anita Rozar-2002. Practical methods for Environmental Microbiology and Biotechnology, Krishna Prakasam Media (P) Ltd. Meerut.



Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>I</b>	<b>17P1ZOEL1B</b>	<b>MAJOR ELECTIVE – I GENOMICS AND PROTEOMICS</b>	<b>6</b>	<b>4</b>

**Objectives:**

1. To learn the Genome mapping, assembly and comparison
2. To understand, Sequence based approaches and Microarray based approaches
3. A thorough study on Proteomics.
4. To understand, Protein-protein interactions and Applications of proteomics.

<p><b>Unit I: Genome mapping, assembly and comparison.</b> Genome mapping, Genome sequencing. Base calling and assembly programs, Genome annotation: Gene ontology, Automated genome annotation, Annotation of hypothetical proteins and Genome economy. Comparative genomics: Whole genome alignment, Finding a minimal genome, Lateral gene transfer, Within-genome approach and Gene order comparison.</p>	<b>Hrs 18</b>
<p><b>Unit II: Functional Genomics.</b> Sequence based approaches: EST, EST index construction and SAGE. Microarray based approaches: Oligonucleotide design, Data collection, Image processing, Data transformation and normalization. Comparison of SAGE and DNA Microarrays and their applications.</p>	<b>Hrs 18</b>
<p><b>Unit III: Strategies in Proteomics</b> 2D-PAGE, Mass spectrometry, protein identification through database searching, Differential in-gel electrophoresis and Protein Microarrays. Post translational modification: Prediction of disulphide bridges and Identification of posttranslational modifications in proteomics analysis. Protein sorting.</p>	<b>Hrs 18</b>
<p><b>Unit IV.: Protein-protein interactions.</b> Prediction of protein-protein interactions: prediction interactions based on domain fusion, predicting interactions based on gene neighbors, predicting interactions based on sequence homology, predicting interactions based on phylogenetic information and prediction interactions using hybrid methods.</p>	<b>Hrs 18</b>
<p><b>Unit V Applications of proteomics.</b> Medical proteomics-disease diagnosis: Biomarkers, Biomarker discovery using 2DGE and mass spectrometry and Biomarker discovery and pattern profiling using protein chips. Pharmaceutical proteomics-drug development: The role of proteomics in target identification, Proteomics and target validation, Proteomics in the development of lead compounds and Proteomics and clinical development.</p>	<b>Hrs 18</b>

**References**

1. Xiong J.(2006).Essential bioinformatics. Cambridge, UK:Cambridge University Press.
2. Goodman N.(2002). Biological data becomes computer literature: New Advances in Bioinformatics. Curr. Opin. Biotechnol. 13: 68-71.
3. Hagen J.B. (2000).The origin of bioinformatics. Nat. Rev. Genetics. 1: 231-236.
4. Apweiler R.(2000). Protein sequence databases. Adv. Protein Chem. 54: 31-71.
5. Hughes A.E.(2001). Sequence databases and the internet. Methods Mol. Biol. 167: 215- 223.
6. Stein L.D.(2003). Integrating biological databases. Nat. Rev. Genet. 4: 337-45.
7. Batzoglou S.(2005). The many faces of sequence alignment. Brief.Bioinformatics. 6: 6-22.
8. Xiang X.(1994). On global sequence alignment. Comput. Appl. Biosci. 10: 227-235.
9. Pearson,W.R.(1996).Effective protein sequence comparison. Methods Enzymol.266: 227
10. Spang R. and Vingron M. (1998). Statistics of large scale sequence searching. Bioinformatics. 14: 279-284.
11. Mullan L.J. (2002). Multiple sequence alignment- The gateway to further analysis. Brief. Bioinform. 3: 303- 305.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>II</b>	<b>17P2ZOC4</b>	<b>DEVELOPMENTAL BIOLOGY AND BIO-TECHNIQUES</b>	<b>5</b>	<b>5</b>

**Objectives:**

1. To know organization and nature of aquatic and terrestrial animals in relation to egg activation during fertilization – cleavage and gastrulation.
2. To study the Embryonic organizers, nature of genetic information during cell differentiation
3. To understand the important hormones in relation to growth and metamorphosis in amphibian and other important animals.
4. To know the Biotechniques for the preparation of permanent slides Homogenize, Chromatography, Electrophoresis, etc.

**Unit I**

**Hrs 18**

Scope of embryology – Gametogenesis, Types of Egg, Egg polarity and Symmetry – Organisation of egg Cytoplasm. Egg activation during fertilization – Cleavage patterns; Transplantation studies on nuclei of cleaving cells- Morphogenetics movements - Gastrulation – Metabolism during gastrulation–Activity of Genes during gastrulation, parthenogenesis.

**Unit II**

**Hrs 18**

Embryonic Induction and Competence: Gene action in cell determination and differentiation–Nature of genetic information and its utilization during cell differentiation – Control of gene expression during development – Influence of cytoplasm on differentiation, Organizers–Classical experiments on Organizers. Nuclear factors in development, Environmental regulation of normal development.

**Unit III**

**Hrs18**

Influence of Hormones on growth and metamorphosis of amphibians, Regeneration – Regenerative ability in various animals – Release of regeneration stimulants – stimulation and suppression of regeneration – Polarity and Gradients in regeneration – Irradiation and radio labeling experiment in super regeneration – hormones and sexual cycles.

**Unit IV**

**Hrs 18**

**BIOTECHNIQUES-** Cell fractionation techniques – Homogenizer, Centrifugation – Principle, types of centrifuges. Cell and tissue preparations for microscopic studies – Fixatives, stains, Microtechnique principles: Preparation of permanent slides for whole mounts and tissue sections.

**Unit V**

**Hrs 18**

Separation techniques: Chromatography–principles and types Column, Paper Chromatography, Thin Layer Chromatography (TLC) and Gas Liquid Chromatography (GLC), Electrophoresis: Principle, Electrophoresis (PAGE & SDS-PAGE)

**Reference:**

1. Bodemer, C.W. (1968) Modern embryology, Holt Rinebert Winston, New York.
2. Balinsky, B.L. (1981) An introduction to Embryology, V. Edn. Saunders Co., Philadelphia.
3. Willer, B.H. Oppenheimer. J.M, (1964) Foundations of Experimental Embryology, Prentice Hall.
4. Rough, R. (1945) Experimental Embryology, Burgess Minneapolis
5. Needham, J (1958) a History of embryology, II Edn. University Press, Cambridge.
6. Willer, B.H. Oppenheimer, J.M. (1964) Foundations of Experimental Embryology, Prentice Hall.
7. Balinsky, B.L. (1981) An introduction to Embryology, Vedn, Saunders, Co., Phila elphia.
8. Berrill, N.J. (1961) Developmental biology TMH Edn., New Delhi.
9. Gry, P. (1958) Hand book of Basic Micro techniques McGraw Hill, New York.
10. Weesner, Principles of Microtechniques.
11. Baker, J.F. (1958) Hand book of Basic Microtechniques, McGraw Hill, New York.
12. T. Plummer, Introduction of Practical Bio-chemistry.
13. Oser (1968). Hawk's Physiological chemistry.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>II</b>	<b>17P2ZOC5</b>	<b>ENVIRONMENTAL BIOLOGY AND CONSERVATION</b>	<b>5</b>	<b>4</b>

**Objectives:**

1. To know the ecosystems of terrestrial and water in a comparative manner.
2. To study the various Biotic community and Biodiversity. To know the survey of natural resources and conservation and management.
3. To study the Air pollution, various pollutants – effects of ozone – green house effect and Noise pollution.
4. To know the water resources and its management. To study various water pollution and prevention and control of water pollution.
5. To study the radiation ecology – space ecology – Exobiology – hazards of space travel.

**Unit I**

**Hrs 18**

Dynamic aspects of Ecosystems, comparative study of ecosystems: Terrestrial, forest, grassland, salt marsh, crop land and Aquatic ecosystems, food chain –food web. Ecological pyramids – primary and secondary production – energy flow – ecological niche.

**Unit II**

**Hrs 18**

Biotic community – organization and characteristics of community Biodiversity – importance of biodiversity – dominance, Ecotone and Edge effect -community Stratification – succession.

Survey of natural resources –conservation of natural area and biota – Soil conservation of biosphere reserve. Environmental quality standard. Wild life conservation-conservation of forest. Fisheries management –Convention on international Trade of endangered species (CITES).

**Unit III**

**Hrs 18**

Population ecology–characteristics of population, population growth curve, regulation of population ; concept of metapopulation – demes and dispersal – interdemic extinctions, age structured population, species interaction – Types of interactions, inter specific, Intra specific interactions.

**Unit IV**

**Hrs 18**

Air Pollution: Environmental effects ozone, depletion – Green house effect – Global warming – Noise pollution. Water resources and its management – Water pollution – sources and effects – industrial pollution–with reference to paper mills, Pesticides – Indicator organisms – Bioaccumulation and Bio-monitoring of pollutants – Prevention and control of pollution.

**Unit V**

**Hrs 18**

Radiation Ecology – comparative radio sensitivity, Remote sensing, and Radio – Telemetry as tools for ecological research – Space ecology – Exobiology – hazards of space travel, Water shed management and Rain water harvesting.

**Reference:**

1. Dowd swell, W.H. An introduction to Animal Ecology, Melthuen, London.
2. Odum, E.P. 1953. Fundamentals of Ecology. W.B. Saunders, Philadelphia.
3. Mellarnby, K., The Biology of Pollution.
4. Dash, M.C. Fundamental of Ecology

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>II</b>	<b>17P2ZOC6</b>	<b>BIO-TECHNOLOGY</b>	<b>5</b>	<b>4</b>

**Objectives:**

1. To study the concept and scope of Biotechnology and techniques in Biotechnology.
2. To understand the recombination DNA technology.
3. To aware the programs of cell culture, preparations hormones and vaccines, engineered Hb, transgenic animals and Human genome project.
4. To study the Bio process Technology and their application.

**Unit I**

**Hrs 18**

Concepts and scope of Biotechnology – Gene cloning – the basic steps – various types of restriction enzymes – ligase – linkers and adapters – cDNA – transformation – Selection of recombinants. Gene probe – Molecular finger printing (DNA finger printing) – RFLP – the PCR techniques – Genomic library – Blotting techniques – Southern blotting – Northern blotting – Western blotting.

**Unit II**

**Hrs 18**

Plasmid biology – cloning vector based on E.coli, PBR322 and bacteriophage. Cloning vector for yeast. Cloning vector for Agro bacterium tumefaciens. Cloning vector for mammalian cells – Simian virus 40 – Gene transfer technologies.

**Unit III**

**Hrs 18**

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

**Unit IV**

**Hrs 18**

Bioprocess and applications – Survey and uses of enzymes in industries – Isolation and purification of enzymes – Enzyme Immobilization techniques – Fermenters, their design and types – Down stream processing – Recovery of Fermented products; Commercial production of single cell protein (SCP) – Primary metabolites – Ethanol, Vitamins ;Secondary Metabolites – Penicillin.

**Unit V**

**Hrs 18**

Bioremediation – bioremediation of hydrocarbons – industrial wastes – Heavy metals- Xenobiotics – bioleaching – biomining – biofuels. Applications of biotechnology in agriculture, medicine and food science. Genetically modified micro organism (GMO'S) – Regulations in Biotechnology - Biosafety – Contaminants and IPR.

**Reference:**

1. Dubey, R.C.-A text Book of Biotechnology, S. Chand and Co., Ltd., New Delhi. 1996.
2. Gupta, P.K. – Biotechnology and genomic, Restage Publications, Meerut 2004.
3. Rebert F. Weaver – Molecular Biology II Edn., Tata McGraw-Hill, New Delhi.
4. D. Balasubramanian et al – Concepts in Biotechnology – Concepts in Biotechnology – Concepts in Biotechnology.
5. Link, E.R. and Pastenak – J.J. Molecular biotechnology.
6. Putohit, S.S. –Biotechnology Fundamentals and Application-Agrobios, Jothpur-2005.
7. Alberghina – Protein Engg. In Industrial Biotechnology – New Era Books, Bangalore,
8. Eun – Enzymology primer for recombinant DNA Technology, Glazer-Microbial Biotechnology.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
<b>II</b>	<b>17P2ZOC7</b>	<b>ENDOCRINOLOGY</b>	<b>4</b>	<b>4</b>

**Objectives:**

1. To make the students to learn the objectives and scope of comparative Endocrinology.
2. To know the anatomy, morphology and histology of endocrine tissues of vertebrates, crustacean and insect endocrine organs and their functions.

**UNIT-I: Introduction to endocrinology**

**Hrs18**

Introduction, objectives and scope of endocrinology - modern concepts and problems in Endocrinology - Experimental methods of hormone research - general classes of chemical messengers.

**UNIT-II: Pituitary and thyroid glands**

**Hrs18**

Pituitary gland - characteristics, structural organization - hormone secretion and its functions - Hypothalamic control. Thyroid gland - structural organizations, metabolic effects of thyroxine - effects on reproduction - parathyroid and its structure and functions.

**UNIT-III: Pancreas and adrenal glands**

**Hrs18**

Structure of pancreas, pancreatic hormones and their functions. Structural organizations of adrenals, functions of cortical and medullary hormones.

**UNIT-IV: Insects and crustacean endocrinology**

**Hrs18**

Concepts of neurosecretions - endocrine systems in crustaceans - endocrine control of moulting and metamorphosis - neuroendocrine system in insects - endocrine control of moulting - metamorphosis and reproduction.

**UNIT-V: Vertebrate reproductive endocrinology**

**Hrs18**

Structure of mammalian testis and ovary - male and female sex accessory organs - hormones of testis and ovary - estrous and menstrual cycle - hormones of pregnancy - parturition - hormonal control of lactation. Hormonal control of metamorphosis in an anuran amphibian.

**Reference**

1. Haris, G.W. and B.T. Donovan. 1968. The Pituitary Gland. S. Chand and Co.,
2. Bentley, P.J. 1985. Comparative vertebrate endocrinology, Second Edition, Cambridge University Press. Cambridge.
3. Mac Hadley. 1992. Endocrinology, 3rd Edition. Prentice - Hall Inc. A Simon & Schuster Company, Englewood Cliffs, New Jersey. USA.
4. Ingleton, P.M. and J.T. Bangara. 1986. Fundamentals of comparative vertebrate endocrinology, Kluwer Academic Publishers.
5. Turner, C.D. and J.T. Bangara. 1986. General endocrinology. Saunders.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
<b>II</b>	<b>17P2Z0CP2</b>	<b>Core -PL- DEVELOPMENTAL BIOLOGY, BIOTECHNIQUES, BIOTECHNOLOGY &amp; ENVIRONMENTAL BIOLOGY</b>	<b>6</b>	<b>4</b>

**Objectives:**

- A. Study and mounting of chick embryos – study of Amphioxus and Frog.
- B. MICRO TECHNIQUES: To know the slide preparation of Tissues, Organs and whole mount of invertebrate larvae.
- C. To learn the Techniques in Biotechnology
- D. To study about the dissolved O<sub>2</sub>, pH, CO<sub>2</sub>, Salinity in water samples, identification of plankton and animal relationship with suitable examples.

**A.DEVELOPMENTAL BIOLOGY**

Study of mounting of developmental stages – CHICK 24, 36, 48, 72, and 96 hours, developmental stages of Amphioxus and Frog, Metamorphosis of Tadpole larvae.

**B. BIOTECHNIQUES**

Micrometry, fixation, embedding, serial sections, cytological staining, mounting of tissues, organs, embryos and whole mounts of invertebrates larvae. Chromatography – Circular Paper Chromatography.

**C.ENVIRONMENTAL BIOLOGY**

- 1.Measurement of Physico-chemical parameters in aquatic environment.
  - a.Salinity
  - b.Dissolved oxygen
  - c.Free Carbon-di-oxide, carbonates and bicarbonates.
  - d.pH (using pH paper or pH meter or Lovidbond comparator)
- 2.Study of examples illustrating animal associates.

**D.BIOTECHNOLOGY**

1. Separation of proteins by SDS and PAGE electrophoresis.
2. Isolation of plasmid and genomic DNA.
3. Restriction, Ligation and transformation – demonstration.
4. Southern blotting.
5. Instrument and Equipments-Centrifuge, PCR, BOD incubator, Densitometer, Chromatogram, Transilluminator, Electrophoretic apparatus .

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
<b>II</b>	<b>17P2ZOEL2A</b>	<b>Major Elective – II CELL AND TISSUE CULTURE</b>	<b>5</b>	<b>4</b>

**Objectives:**

1. To know the plant cell, aseptic Techniques, callus induction.
2. To know about Micro propagation.
3. To know cell culture Manipulation.
4. To know the principles of cell and Tissue Culture.
5. To know Tissue Culture Techniques.

**Unit I**

**Hrs 18**

History of plant and animal cell, tissue and organ culture– laboratory organization– aseptic techniques– nutritional requirements and culture media–Types of cultures – solid– liquid–stationary–agitated–batch cultures–Organogenesis–Callus induction–Caulogenesis– Rhizogenesis techniques of hairy root production.

**Unit II**

**Hrs 18**

Micro propagation–mass production of plantlets–Hardening and mist chambers – transplantation to field–techniques for Maintaining plantlets in the field – somatic embryo genesis– induction of haploids and triploids–techniques of overcoming incompatibility barriers –embryo rescue protoplast and pansexual hybridization– exploitation of Somaclonal and Gametoclonal variations.

**Unit III**

**Hrs 18**

Mass culture of Cells– Manipulation of cell line selection– immobilization of cells and its application– synchronization of cell cultures and cell division– production of secondary metabolites–biotransformation–Induction of cell line mutants and mutations–cryo preservation– germplasm conservation and establishment of gene banks–synseed technology.

**Unit IV**

**Hrs 18**

Principles of Cell and Tissue Culture, Advantages and disadvantages of tissue culture methods – cell markers – types of cells– Primary and established cell lines – Kinetics of cell growth – genetics of cultured cells –metabolism – applications of Animal Tissue Cultures.

**Unit V**

**Hrs18**

Techniques of Cell and Tissue Culture: Sources of cells – techniques of cell culture, Mechanical, biochemical and types of animal cells – equipment – cells culture media – culture procedures – preparation of animal materials – primary culture, cell lines and cloning – Slide and coverslip cultures, washing and feeding, double coverlid cultures, text tube culture – Organ culture – whole embryo culture – specialized culture techniques – cell synchronization – measurement of cell death – stemcell culture and transplantation.

**Reference:**

1. Kalyan Kumar De, 1992, Plant Tissue Culture, New Central Book Agency, Calcutta.
2. D.C.Daring and S.J.Morgan, 1994, Animal Cells, Culture and Media, BIOS Scientific Publishers Limited.
3. Robert N. Trigiano, Dennis J.Gray, 1996, Plant Tissue Culture Concept and Laboratory Excurses. CRC Press London.
4. Ann Harris, 1996, Epithelial Cell Culture, Cambridge University Press.
5. P.S.Srivasta, 1998, Plant Tissue Culture an Molecular Biology, Narosa Publishing House, New Delhi.
6. David W. Galbraith, Hans J. Bohnert an Don p. Bourque, 1995, Methods of Plant Cell Biology, Academic Press, New York.
7. Jennie P. Mathur and David Barnes, 1998, Methods in Cell Biology, Volume 57: Animal Cell Culture Methods Academic Press.
8. John H.Dods and Lorrin W. Roberts, 1995, Experiments in Plant Tissue Culture, Cambridge University Press, USA.
9. M-M-Ranga, 2000, animal Biotechnology, Agro bios (India).

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>II</b>	<b>17P2ZOEL2B</b>	<b>Major Elective – II WILDLIFE MANAGEMENT</b>	<b>5</b>	<b>4</b>

**Objectives:**

1. Know the wild life – Tourism foreign exchange. Important wildlife sanctuaries of the world.
2. To know the wild life in India such as wild life resources and sanctuaries.
3. To know the behavior of grazers (Elephants) carnivores (Lion) and primates (Orange, chimps and Gorillas).
4. To study the behavior and migration of Birds – various Bird sanctuaries Bird watching, Fishing etc.
5. To know the wild life activities-By filming, Videography and documentation and wild life protection acts and laws-wild life conservation.

**Unit I**

**Hrs 18**

**WILD LIFE:** Introduction Scope for the study of wildlife resources and forestry. Wild life Tourism – Employment prospects. Important wildlife sanctuaries of the world. Need for the production and conservation and conservation of wildlife and endangered species. Red data book.

**Unit II**

**Hrs 18**

**WILD LIFE IN INDIA:** Important wildlife game reserves and sanctuaries in India, Gir Lion forest, Jim Corbett Tiger reserve, Kasiranga Sanctuary, Point Calimere, Bharatpur Kaleodeo bird sanctuaries, Rann of Kutch, Mudumalai, Karkudi and Wynad sanctuaries and their wildlife species.

**Unit III ETHOLOGY OF ANIMAL BEHAVIOUR**

**Hrs 18**

Grazers–Elephant– herds, their behaviour, family hierarchy, feeding, reproduction, and migration, Carnivores–Lions–family life, hunting behavior and feeding, mating and reproduction, hierarchy, Primates–larger primates–Orange, Chimps and Gorillas and group behavior.

**Unit IV**

**Hrs 18**

**BIRD WATCHING** as hobby – equipment needed for Bird watching, -Important migratory birds of India, checklist of birds, Migratory behavior, and influencing factors. Point Calimere, Vedanthagal, Muthupert, Bharatpur and other bird sanctuaries.

**Unit V**

**Hrs 18**

Wildlife watching and tours as hobby and research. Wildlife filming. Videography and documentation. Silent Valley Project, Wildlife parks. Zoos, Treatment of animals in captivity and circuses. Wildlife conservation measures – Wildlife Protection Acts and Laws, World Wildlife conservation and funding agencies and programmes (WWF). Tiger projects (UNEP), ICUN (International Union for conservation of Nature and Natural Productively).

**Reference:**

1. The International wild life encyclopedia. Eds. Maurice Burton and Robert Burtons.
2. Insearch of Wild India (1982) By Charlie – Pye Smith, North, South Productions. Publishers, Boxtree Ltd.
3. Insearch of Wild India (1982) By Charile – Pye Smith, North, South Productions, Publishers, Boxtree Ltd.
4. The International wild life Encyclopedia. Eds. Maurice and Robert Burtons.
5. Mammalogy (1972), Terry Vaughan, A., W.B. Saunders Company. London.
6. Encyclopedia of Animal World. Vol. I-XX, By Smith, North, South Productions, Publishers, Boxtree Ltd.
7. Birds of India and Pakistan (1978), By Salim Ali, Hindustan Publishers, New York.
8. Animal Behaviour, Times Illustrated World of Science, Time Life Asia.
9. Encyclopedia of Animal World, Vol.I-XX, By stargazers – Tatis, Bay Books, Sydney.



Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>III</b>	<b>17P3ZOC8</b>	<b>IMMUNOLOGY</b>	<b>5</b>	<b>4</b>

**Objectives:**

1. To study the History of Immunology.
2. To study the important of Immunology.
3. To study the cell mediated antigen and antibody reaction.
4. To study the different types of antigens.
5. To learn the techniques in organ transplantation
6. To know the common, Auto Immune diseases.

**Unit I**

**Hrs 18**

History of Immunology – important discoveries – kinds of Immunities – Innate, Acquired, Natural, artificial and passive -lymphoidal organs in Man – Primary Lymphoidal organs – Thymus, Bursa Fabricii, Bone marrow. Secondary Lymphoidal organs – Lymph nodes, Payer’s patches.

**Unit II ANTIGENS – Types of Antigens**

**Hrs18**

IMMUNOGLOBULINS – Classification and properties of IgG, IgM, IgA, IgD and IgE. Biosynthesis of ImmunoglobulinsG. Humoral immunity and Cell Mediated Immunity - various Theories of Antibody formation; Killer Lymphocytes, Lymphokinins, Lymphotoxins, Interferon.

**Unit III**

**Hrs 18**

ANTIGEN – ANTIBODY INTERACTIONS: Characteristics feature of Ag – ab reaction, Precipitation, Agglutination, Opsonisation, Cytolysis, Flocculation, Complement fixation. Histocompatibility, Hypersensitivity and this types, Type I- Anaphylactic Hypersensitivity Type II-antibody dependent hypersensitivity. Type III- Immune complex mediated hypersensitivity, IV –cell mediated hypersensitivity, V-Stimulated hypersensitivity, Tolerance.

**Unit IV**

**Hrs 18**

COMMON AUTOIMMUNO DISEASES-Thrombo - cytopenia, Thyrotoxicosis, Addison’s diseases’ Rhematoid Arthritis, Autoimmune haemolytic anaemia-brief descriptions.

IMMUNOTECHNIQUES: Brief procedure of ELISA, HLA Typing,VDRL Test, Immunoelctrophoresis, Radioimmuno Assay, ABO Blood typing, Hybridoma technology

**Unit V**

**Hrs 18**

TRANSPLANTATION: Types of Transplantations – Autoplasic Transplantation (skin), Homoplastic (eye, Kidney) transplantations, Graft acceptance, Immunosuppressors, Graft rejection. Types of allograft rejection, and prevention of allograft rejection - Transfusion of blood – Rh factor – Erythro – blastosis foetails.

**References :**

1. IMMUNOLOGY–Jean Francois Bach (1982) 6<sup>th</sup> Edition Wily Medical Publications, New York.
2. IMMUNOLOGY – An Introduction (1984) – By Tizard Saunders College Publishing
3. Structure and Function of Antibodies (1977) Glynn. L and Steward M.W. John Wiley and sons, New York.
4. ESSENTIALS OF IMMUNOLOGY (1984) Hidemann W.H. Elsevier Publication, Oxford.
5. IMMUNOLOGY–An Introduction(1984) 6<sup>th</sup> Edition Wiby Medical Publications, New York.
6. Structure and Function of Antibodies (1977) Glynn, L and Steward M.W. Johy Wiley Sons, New York.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>III</b>	<b>17P3ZOC9</b>	<b>ANIMAL PHYSIOLOGY AND BIOCHEMISTRY</b>	<b>5</b>	<b>5</b>

**Objectives:**

1. To study the physiology of Nutrition, Respiration, and circulation.
2. To learn the physiology of Excretion, Muscular coordination.
3. To know the physiology of nervous coordination, Sensors exhibition
4. To know the biochemistry of water and minerals.
5. To study the Enzymes and their kinetics and the role of Nucleic acid.

**Unit I**

**Hrs 18**

Nutrition: Structure and functions of digestive organs of man. Respiration : Types of respirations, respiratory pigments – Transport of O<sub>2</sub> and CO<sub>2</sub> in man– Respiratory quotient–Regulatory mechanisms. Circulation: Chemistry of Blood coagulation–Types of transport mechanisms–physiology of mammalian heart–blood pressure–pacemaker, Regulatory mechanisms.

**Unit II**

**Hrs 18**

Excretion: Excretion in relation to different habitat – Excretory Physiology of Man detoxication pathways of Ammonia–Regulation of nitrogen excretion. Osmo-Ionic Regulations: Osmoregulations in freshwater, marine and estuarine fishes. Thermo regulation in animals. Muscles: Types- ultra structure– Properties – Mechanisms of muscle contraction– chemistry, Energetics and Regulation of Muscle contraction–Electric organs and Bioluminescence.

**Unit III**

**Hrs 18**

Nervous Co-ordination : Structure and types of nerves, transmission of nerve impulse – Synapses – Reflexes – Animal behavior and learning.  
Receptors : Photo, Chemo and Mechano reception.  
Chemical Co-ordination : Reproductive cycle in Mammals – hormonal regulation of ovulation, implantation. Gestation, Lactation – Family planning.

**Unit IV**

**Hrs 18**

Biochemistry : water and minerals – functions – hormonal regulation of mineral metabolism – pH – buffers, Structure properties and classification of carbohydrates, proteins and fat – their metabolism, hormonal regulation.

**Unit V**

**Hrs 18**

Classification of enzymes, enzymes kinetics –Mechanism of enzyme action – regulation of enzymatic activity – Co-enzymes – Isoenzymes – functions of enzymes - Energy rich compounds and their roles, Nucleic acids – DNA and RNA – Polymerization.

**Reference:**

1. Hoar, S.W., 1978. General and comparative Physiology, Prentice Hall, London, New York.
2. Prosser, O.D. and Brown, A.F. (Jr), 1961. Comparative Animal Physiology, W.B. Saunders Co., New York, London.
3. Prosser, O.D. and Brown, A.F. (Jr), 1961. Comparative Animal Physiology, W.B.Saunders Vo., New York, London.
4. Verma, P.S., Tyagi, B.S, and Agarwal, Animal Physiology, Saras Publications, S. Xhand and Co., New Delhi.
5. Verna,P.S.,Tyagi, B.S.and Agrwa,Animal Physiology, Saras Publications, S.Chand Co., New Delhi.
6. Ambika Shanmugam, Biochemistry for medical students.
7. Join, J.L. Biochemistry
8. David T. Plummer, An introduction to Practical Biochemistry, Tata McGraw Hill Publishing Co-Ltd., New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>III</b>	<b>17P3ZOC10</b>	<b>CLINICAL BIO-CHEMISTRY</b>	<b>5</b>	<b>4</b>

**Objectives:**

1. To study the lab setup and safety measures
2. To learn about the metabolic disorders
3. To study about the disorders of kidney and liver
4. To know about the hormonal imbalances.

**UNIT I: LABORATORY SETUP AND SAFETY**

**Hrs 18**

Requirements of setting up of clinical laboratory, SI units in clinical laboratory, Collection preparation, preservation, and handling of clinical samples, quality control, Safety measures in clinical laboratory. Formulation of clinical and diagnostic kits, Safety aspects.

**UNIT II METABOLIC DISORDERS**

**Hrs 18**

Disorders of Carbohydrate Metabolism – Diabetes mellitus, glucose and galactose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level, glycogen storage diseases, pentosuria, galactosemia.

Disorders of Lipid metabolism – Plasma lipoproteins, cholesterol, triglycerides & phospholipids in health and disease, hyperlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease, ketone bodies, Abetalipoproteinemia.

**UNIT III**

**Hrs 18**

**NEUROLOGICAL AND PSYCHIATRIC DISORDERS:** Symptoms, diagnosis and treatment of Schizophrenia, Alzheimer's disease, Wernicke-Korsakoff syndrome, dementia, Wilson's disease, antipsychotic drugs – anti depressants.

**Ageing-** Physiological and biochemical changes in ageing. Different theories of ageing, importance of superoxide dismutase in ageing, plasticity and regeneration

**UNIT IV**

**Hrs 18**

Disorders of liver and kidney–Jaundice, fatty liver, normal and abnormal functions of liver and kidney. Inulin and urea clearance. Digestive diseases – Maldigestion, malabsorption, creatorrhoea, diarrhoea and steatorrhoea- Electrolytes and acid-base balance – Regulation of electrolyte content of body fluids and maintenance of pH. Disorders of acid-base balance and their respiratory and renal mechanisms

**UNIT V**

**Hrs 18**

Inborn errors of Metabolism- Disorders of amino acid metabolism– Phenylalanaemia, homocystinuria, tyrosinemia; Disorders of nucleic acid metabolism- Disorders in purine /pyrimidine metabolism. Infact of Hormonal imbalances: GH, TSH, ACTH, FSH, LH, Testoteran, Oestrogen.

**Reference:**

1. Burger, A., Med. Chem.
2. Wilson and Gisvold, Organic Med. Pharmaceutical Chem.
3. Ariens, Drug Design, Academic press, NY,1975.
4. Allan Gen, Clinical Biochemistry, 1995.
5. John W. Baynes. Med H.Dominick, Medical Biochemistry, 2005.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>III</b>	<b>17P3ZOC11</b>	<b>NANOTECHNOLOGY</b>	<b>4</b>	<b>4</b>

**Objectives:**

1. To know about the Nanotechnology.
2. To learn about the nanoparticles and targeted drug delivery.
3. To learn the improved diagnostic products and techniques.
4. To study about the applications of nanomaterials.

**UNIT – I**

Principles of Nanobiotechnology; Introduction to nanotechnology - History of nanotechnology – Fundamental concept of Nanotechnology – Scope and application of Nanotechnology.

**UNIT – II**

Nanomaterials - classification of nanomaterials - properties of nanomaterials – Preparation of Nanomaterials – Synthesis of nanomaterials.

**UNIT – III**

Synthesis of nanoparticles. Using natural sources – nanotubes, carbon nanotubes, Formation of carbon nanotubes – uses of nanotubes – Biological applications of nanotubes.

**UNIT – IV**

Measurement techniques for nanomaterials – x-ray crystallography – Atomic force microscope – Electron microscope – SEM, TEM – Fluorescence microscope.

**UNIT – V**

Applications of nanomaterials – Present and future nanoparticles in medicine – Introduction of drug delivery in pharmaceuticals. Nanoparticles carrier and their carrier characteristics.

**Reference:**

1. Claudio Nicolini, Nanobiotechnology & Nanobiosciences Pan Stanford Publishing Pte. Ltd.2009.
2. O.Skoseyov, Ilan Levy, Nanobiotechnology – BioInspired Devices and Materials of the Future, Humana Press Inc, 2008.
3. N.Yao and Zhong Lin Wang, Handbook of Microscopy for Nanotechnology Kluwer Academic Publishers, 2005.
4. Nanotechnology – N.Arumugam – Saras Publications.
5. Introduction to Nanotechnology – Neal Lane and James R. Heath.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
<b>III</b>	<b>17P3Z0CP3</b>	<b>Core -PL-ANIMAL PHYSIOLOGY, BIO-CHEMISTRY, IMMUNOLOGY &amp; CLINICAL BIOCHEMISTRY</b>	<b>6</b>	<b>4</b>

**Objectives:**

1. To learn the physiology of proteins, carbohydrates lipids.
2. To study the concentrate of the sugar, Glycogen, aminoacids, Salt in selective species.

**ANIMAL PHYSIOLOGY AND BIOCHEMISTRY**

1. Determination of chemical nature of tissues –proteins, carbohydrates and lipids.
2. Estimation of blood sugar/Glycogen in muscles.
3. Chromatographic analysis of amino acids.
4. Estimation of chlorides in biological samples.
5. Salt-loss and Salt-gain in Crab.
6. Quantitation estimation of ammonia and urea.
7. Estimation of oxygen consumption in fish.
8. Study of cardiac cycle of frog and its response to temperature
9. Effect of salinity on oxygen consumption of crab
10. RBCs in different vertebrates and in different physiological condition.

**IMMUNOLOGY**

1. Dissection of Lymphoid organs in Rat.
2. Inoculation of Antigens and observation of Blood parameters.
3. Immuno Electrophoresis(demonstration).

**CLINICAL CHEMISTRY & DRUG DESIGN**

1. Estimation of Haemoglobin in blood samples
2. Estimation of Bile pigments
3. Estimation of Creatinine
4. Estimation of triglycerides, steroid

**Reference:**

1. Experimental physiology – S.C. Rastogi.
2. Lab Manual in Biochemistry – K. Jayaraman.
3. Biochemical methods By S.Sadasivam and A.Manickam.
4. ELIZA as a Diagnostic Tool – S.Ialakshi, S. Mohan (eds).
5. Methods in biotechnology-Schmauder, New Era Books, Bangalore.
6. Basic Separation Techniques in biochemistry by R.O.Okotore.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
<b>IV</b>	<b>17P4ZOC12</b>	<b>GENERAL AND APPLIED ENTOMOLOGY</b>	<b>6</b>	<b>5</b>

**Objectives:**

1. To Study the taxonomy of Insects.
2. To study the Morphology of Insects.
3. To know the Anatomy and Physiology of Insects.
4. To know the insect Ecology and their welfare aspects.
5. To study the Biology and Bionomics of insects and Integrated Pest management.

**Unit I**

**18 Hrs**

TAXONOMY: Classification of insects upto orders with South Indian examples – Bionomics of Aptergotes, Orthoptera, Diptera, Hemiptera and Coleoptera.

**Unit II**

**18 Hrs**

MORPHOLOGY: Integument, Head, antennae, Mouthparts, Thorax, abdomen, wings, Legs, and external genitalia.

**Unit III**

**18 Hrs**

ANATOMY AND PHYSIOLOGY: General organization and physiology of digestive, respiratory, circulatory, excretory, nervous and reproductive systems of insects. Insect hormones and metamorphosis, pheromones.

**Unit IV**

**18 Hrs**

INSECT ECOLOGY : hibernation, Aestivation, Diapause and Migration.  
SOCIAL BEHAVIOUR : Isoptera and Hymenoptera.  
Insects of Medical and Veterinary Importance : Vectors of Diseases – Mosquito – bedbug, fleas and housefly, BENEFICIAL INSECTS : Sericulture, Apiculture, Lac and Cochineal insects.

**Unit V**

**18 Hrs**

Biology and Bionomics of pests of Crops : Sugarcane, Paddy and Pest of stored products - pests of common fruits and vegetables, Pest Management : Mechanical, Chemical, Biological and Intergrated Pest management (IPM) and Biotechnological Pest Management.

**Reference:**

1. Manim, M.S., 1973 General Entomology, Oxford and IEM, London.
2. A.D.Imms and Richards, General Entomology, Vol.1 & II, English Language Book Society (ELIBS), London.
3. Chapman, Insect Structure and function.
4. Snodgrass, Morphology of Insects.
5. Fox and Fox, General Entomology.
6. Wigglesworth, W.B., Physiology of Insects
7. Rockstein, M.Physiology of Insects, academic Press, London.
8. Rockstein, M.Physiology of Insects, Vol.1 – 111, Year Volumes, Academic Press London.
9. Fox and Fox, General Entomology,
10. Novak, V.J.A., Insect Hormones, Chapman Halls, London,
11. Vincent and Wigglesworth, Insect Hormones, Freeman and Co.Inn.Franchises.
12. Economic Entomology – Vasantha Rao David.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>IV</b>	<b>17P4ZOC13</b>	<b>RESEARCH METHODOLOGY</b>	<b>6</b>	<b>4</b>

**Objectives:**

1. The course aims to train students in the statistical analysis and presentation of the data with the interpretation based on the already existing literature.
2. To write report / thesis / dissertation and or for publications in appropriate research journals.
3. The aim of the paper thus is to lay a strong foundation for the student for thesis writing, editing, analysis and interpretation of the generated data with hands on experience with model sums.

**Unit I**

**Hrs 24**

Collection of data-diagrammatic representation: Bar, Pie diagrams; graphic representation-Histogram, frequency polygon; Measures of central tendency: Arithmetic mean, median & mode (direct methods and model sums) Measures of dispersion: Universe and population-delimiting population-sampling methods: random sampling, stratified random sampling-standard deviation-standard error-coefficient of variation: elucidation with model sums.

**Unit II**

**Hrs 24**

Types of Correlation and Karl Pearson's correlation coefficient: model sums with elucidation - Regression analysis: Components of regression equation - Confidence intervals of regression line. Fitting simple regression lines: model sums, calculations of equation and fitting of regression line, estimated and calculated Y.

**Unit III**

**Hrs 24**

Probability-Theorems: Addition and Multiplication-Patterns of distributions: Poisson, Normal and Binomial; Test of significance - Comparison of means: Chi square test, student t test, ANOVA, model sums on one way ANOVA with interpretation of data - Introduction to MANIVA AND STASTICA - Use of statistical softwares.

**Unit IV**

**Hrs 24**

Research: Selection of research problem-stages in the execution of research: choosing a topic to publication-preparation of manuscript-report writing-format of journals - proof reading - sources of information : journals, reviews, books, monographs etc -Thesis writing and their standard format-standard organization of bibliography. Planning of research: Research proposals, time scheduling of research, available sources and generation of funds and facilities.

**Unit V**

**Hrs 24**

Journals: Standard of research journals - paid and refereed journals - impact factor, citation index, H-index. Choice of journals for publication. Information retrieval: access to archives and databases, search engines: Google, Pubmed, NCBI, etc., National Informatic Center - Online data base library.

**Reference:**

1. Davis, G.B. and C.A. Parkar 1997, Writing the doctoral dissertation. Barons Educational series, 2<sup>nd</sup> edition. Pp 160. ISBN: 0812098005.
2. Duncary, P. 2003. Authoring a Ph.D. thesis: how to plan, draft, write and finish a doctoral dissertation. Plagrave Macmillan, Pp 256. ISBN 1403905843.
3. Saxena, S. 2001, MS office, Vikas Publishing House Pvt. Ltd. New Delhi 110014.
4. Snedecor, G.W. and W.G. Cocharn, 1978. Statistical methods. Oxford and IBH Publishing Co Pvt. Ltd.
5. Sokal, R.R. and F.J. Rohif, 1981. Biometry. W.H. Frecman, New York.
6. Zar. J.H. 1996. Biostatistical analysis. Prentice Hall, Uppar Saddle River, New Jersey, USA.
7. Biostatistitcal Analysis, Zar (2004).

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	17P4Z0CP4	<b>PRACTICAL IV GENERAL &amp; APPLIED ENTOMOLOGY AND RESEARCH METHODOLOGY</b>	6	3

**Objectives:**

1. To study the preparation of microbial culture medium and isolation of microbes.
2. To study Internal systems of the insects.
3. To study the Techniques of mounting of mouth parts and wings.
4. To study the biology and Bionomics of insect
5. To study the methods involved in writing a research paper.

**A – Entomology**

Mounting of Mouthparts, wings and external genitalia of common insect.

1. Collection and identification of insects of economic importance. Preparation of key for classification of insects upto orders with examples.
2. Dissection of digestive, nervous and reproductive systems of insects of representative orders (Orthoptera, Hemiptera, Coleoptera, Lepitoptera) Endocrine system of cockroach.
3. Ligature experiments to demonstrate the role of hormones in mounting and metamorphosis. Demonstration of allocate in cockroach. Demonstration of the role of cubucula lipids, in prevention and evaporation. Demonstration of the functioning of Malpighian tubules, demonstration of insect with reference to temperature, demonstration of efficacy commonly used pesticides, demonstration of LD<sub>50</sub> for the common insecticide concentrations.

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**B-Research methodology**

1. Prepare flat file in NCBI, DDBJ & EMBL format for the given query sequence.
2. Search for similar DNA sequence of the query DNA using BLAST.
3. Retrieve a query sequence from NCBI and predict the secondary structure of the query using PDB & PEP TOOL.
4. Retrive any five microbial gene sequence from any DNA data bank and using the server 123 Genomics and malign program found in 123 genomics construct a phylogenetic tree.
5. Methods involved in writing a research paper
6. Presentation of a research paper

**C – Field Work Report**

A record of lab work and report on field trip ( places of zoological interest) should be maintained and submitted at the time of practical examination for valuation.

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**Reference:**

1. Laboratory Manual of Entomology - Alkaprakash.



Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>IV</b>	<b>17P4ZOEL3A</b>	<b>Major Elective - III ESTUARINE BIOLOGY AND AQUACULTURE</b>	<b>6</b>	<b>4</b>

**Objectives:**

1. Introduction of Estuaries and its salient feature
2. To study the Biology of the Estuarine biotic community.
3. To Understand the present status of Aquaculture in India.
4. To Study the Engineering and culture aspects of Aquaculture system.
5. To know the induced breeding and pathology of culturable species.

**Unit I**

**18Hrs**

Estuary : Definition – Classification – Estuaries of India – physico-chemical and biological characteristics of Estuaries – Primary and Secondary productivity of Estuary – Estuarine fishery resources of India.

Mangroves : Ecology and adaptations of mangrove – Mangrove fauna and flora – Conservation of mangroves.

**Unit II**

**18Hrs**

Aquaculture : History and present status in India – site selection – pond construction – Pond maintenance – Ploughing, liming, Irrigation, Fertilization, weed control, water quality management – control of predatory organisms.

**Unit III**

**18Hrs**

Cultivable species – fin fishes and shell fishes – composite carp culture, Tilapia culture in freshwater – shrimp farm in coastal water.

Feeding biology – Live feed organisms (Algae, Phytoplankton, Rotifers, Artemia etc.) – Supplementary feeds – Simple feed, compound feed, food conversion Ratio (FCR), Fed formulation, Types of feed.

**Unit IV**

**18Hrs**

Seed transportation and stocking – growth and reproductive biology of prawn – Crab and carp fish – Harvesting - Processing and Marketing – Commercial products of fisheries.

**Unit V**

**18Hrs**

Hypophysation or Induced breeding in carps, preservation of gametes, genetic selection and hybridization – pathology – parasitic infection – Diseases of fish and prawns and their control measures.

1. C.M.F.R.I. Coastal Aquaculture – Marine Prawn culture
2. V.C. Jhingarn and Gopalakrishnan Ray, P. and Ghosh, A., Methodology for survey of brackish water areas V. in India, for coastal – Aquaculture Indopacific fish Council, 14<sup>th</sup> session.
3. T.A. Aanson and Goodwin, H., Shrimp and prawn farming in the Hemisphere, Dordrecht, Dordrecht, Rea, Ind., Pennsylvania.
4. T.A. Qureshi and N.A. Qureshi, Indian Fishes, Brig, Brothers, Sullania Road, Bhopal, India.
5. Donald, Mc Lusky, Ecology of Estuaries, Heinemann publications Glasgow and London.
6. Barton Lias, Estuarine Chemistry.
7. Kennedy, Estuarine Perspective.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>IV</b>	<b>17P4ZOEL3B</b>	<b>Major Elective - III FISHERIES SCIENCE</b>	<b>6</b>	<b>4</b>

**Objectives:**

The aim of the paper is to understand the morphology, classification and identification of fishes and the fisheries and fishery resources of India. Moreover information about the biology of the fishes goes a long way in managing the fishery resources and their sustainable utilization. As fishes constitute perishable commodity, preservation and processing are also quite essential.

**Unit I: Biology of fishes and classification**

**18Hrs**

General morphology and outline classification of fishes - major groups of fishes and their characteristics - morphometric and meristic characters of elasmobranchs and teleost fishes. Basic anatomy of fish - digestive, circulatory, respiratory, nervous and reproductive systems. Food and feeding habits, maturity, fecundity, spawning and survival of Indian fishes.

**Unit II: Growth and population dynamics**

**18Hrs**

Length-weight relationship and factors influencing growth condition, age determination Theory of fishing, unit stock, recruitment, growth, mortality, migration, fish tagging and marking.

**Unit III: Inland and marine capture fisheries of india**

**18Hrs**

Fishery zones and type of fisheries in India. Riverine, Estuarine, Coldwater, Reservoir and Pond fisheries. Present status and scope of inland capture fisheries. Present status and scope of marine capture fisheries - crustaceans (prawn/shrimp, lobster and crabs), Molluscs(clam, cockle, mussel, oyster, cephalopods) and fishes - their fishery characteristics, distribution and importance.

**Unit IV: FISHERY SURVEY METHODS**

**18Hrs**

Methods of surveying the fishery resources - acoustic method, aerial method, survey of fish eggs and larvae, analyzing population features - growth mortality selection.

**Unit V: CRAFTS AND GEARS**

**18Hrs**

Principal methods of exploitation of fishes - indigenous and modern gears and crafts. Principal methods of fish preservation and processing in India Types of spoilage, causative factors - marketing and economics.

**References:**

1. Day, F. 1981. Fishes of India, Vol.I and Vol.II. William Sawson & Sons Ltd., London.
2. Jhingran, C.G. 1981. Fish and Fisheries of India. Hindustan Publishing Co., India.
3. Maheswari, K. 1993. Common fish diseases and their control. Institute of Fisheries Education, Powakads, M.P.
4. Santhanam,R. 1980. Fisheries Science. Daya Publishing House, New Delhi.
5. Yadav, B.N. 1997. Fish and Fisheries. Daya Publishing House, New Delhi
6. FAO Volumes for fish identification.
7. Bal D.V. and Rao, K.V. 1990. Marine Fisheries of India. Tata McGraw Hill Publishing Co. Ltd., New York.
8. Biswas, K. P. 1996. A Text Book of Fish, Fisheries and Technology. Narendra Publishing House, Delhi.
9. Srivastava, C.B.L. 1999. Fish Biology. Narendra Publishing House, Delhi

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<b>Semester</b>	<b>Subject Code</b>	<b>Title of the Paper</b>	<b>Hours of Teaching / Week</b>	<b>No. of Credits</b>
<b>IV</b>	<b>17P4ZOPR</b>	<b>PROJECT WORK</b>	<b>-</b>	<b>4</b>

**Aim:** (a) Application of knowledge to real life situation (b) to introduce research methodology.

Topic of dissertation may be chosen from the broad area of Zoology and may be laboratory based, field based or both or computational, with emphasis on originality of approach. It may be started during 2nd / 3rd semester and shall be completed by the end of the 4th 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.