



THIRUVALLUVAR UNIVERSITY
SERKKADU, VELLORE – 632 115

M. Sc. ZOOLOGY

UNDER CBCS

(With effect from 2014 - 15 onwards)

The Course of Study and the Scheme of Examinations

Year / Semester	Subject Core/elective/paper code	Paper	Title of the Paper	Credit	Exam hrs	Max.Marks			
						IA	Uni. Exam.	Total	
I Semester	Core PDZO 11	Paper I	Comparative and functional anatomy of Invertebrates	5	3	25	75	100	
	Core PDZO 12	Paper II	Comparative and functional anatomy of Chordates	5	3	25	75	100	
	Core PDZO 13	Paper III	Molecular Cell Biology	5	3	25	75	100	
	Core PDZO 16	Lab Course -I	Comparative and functional anatomy of invertebrates, and Chordates	4	4	25	75	100	
	Elective - I PDZO 14			Fishery science & aquaculture (Elective I)	3	3	25	75	100
	Elective - II PDZO 15			3	3	25	75	100	
II Semester	Core PDZO 21	Paper IV	Genetics and Biostatistics	5	3	25	75	100	
	Core PDZO 22	Paper V	Environmental Biology and Evolution	5	3	25	75	100	
	Core PDZO 23	Paper VI	Comparative animal Physiology	5	3	25	75	100	
	Core PDZO 25	Lab Course - II	Molecular Cell Biology, Genetics and Biostatistics	5	4	25	75	100	
	Core PDZO 26	Lab Course - III	Comparative animal Physiology and Environmental Biology and	4	4	25	75	100	
	Elective III PDZO 24			Entomology (Elective III)	3	3	25	75	100
	Compulsory Paper PDHR 20			Human Rights	2	3	25	75	100

Year / Semester	Subject Core/elective/paper code	Paper	Title of the Paper	Credit	Exam hrs	Max.Marks		
						IA	Uni. Exam.	Total
III Semester	Core PDZO 31	Paper VII	Developmental Biology	5	3	25	75	100
	Core PDZO 32	Paper VIII	Microbiology and Immunology	5	3	25	75	100
	Core PDZO 33	Paper IX	Biochemistry and Biophysics	5	3	25	75	100
	Core PDZO 35	Lab Course IV	Developmental Biology, Microbiology and Immunology	5	4	25	75	100
	Core PDZO 36	Lab Course V	Biochemistry and Biophysics	4	4	25	75	100
	Elective IV PDZO 34		Basic Concepts in Biotechnology (Elective IV)		3	3	25	75
IV Semester	Core PDZO 41	Paper X	Project	6		50	150	200
	Elective V PDZO 43		Ethanopharmacology (Elective V)	3	3	25	75	100
	Total				90			

List of Elective papers

1. Basic concepts in Biotechnology
2. Basic concept in Bioinformatics
3. Stem cell Biology
4. Nano - Biotechnology
5. Fishery Science and Aquaculture
6. Entomology
7. Medical lab technology
8. Ethnopharmacology
9. Reproductive Physiology and Endocrinology

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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

Origin of metazoa - Organization of Coelom, Acoelomates, Pseudo coelomates Coelomates. Locomotion- Amoeboid, Flagellar and Ciliary movement in protozoa, Hydrostatic movements in Coelenterata , Annelida and Echinodermata

UNIT II

Nutrition and Digestion,- Patterns of Feeding and digestion in lower metazoa, Mollusca, - Echinodermata, Filter feeding in polychaeta. - Respiration - Organs of respiration : Gills, lungs and trachea. - Respiratory pigments. - Mechanism of respiration.

UNIT III

Excretion in lower invertebrates, Excretion in higher invertebrates. Mechanism of Osmoregulation.

UNIT IV

Nervous System - Primitive Nervous systems:-Coelentrata and Echinodermata. Advanced nervous system: - Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda)

UNIT V

Reproductive system- alteration of generation in Coelenterata - sexual reproduction in Turbellaria- Arachnida - Asteroidea

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 7th edit. Rastogi publications.
7. Jordan, E.L., Verma P.S. (1997). Invertebrate Zoology, 14th 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

Silent 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. 7th 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: MOLECULAR CELL 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, 4th edition, W.H. Freeman & Co.
7. Gupta, P.K. (1999). Cell & molecular Biology, Rastogi Publications, Meerut.

LAB COURSE – 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 AND BIOSTATISTICS

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.

UNIT -IV

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 skew ness 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

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-7th 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 AND BIOLOGICAL CYCLES

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. Complete and incomplete biogeochemical cycles - Sedimentary cycle – Recycle pathway of elements - Cycling of non – essential and organic nutrients.

UNIT-III: RESOURCES ECOLOGY

Renewable and non - renewable resources - animal resources. Conventional and non - conventional energy sources.

UNIT-IV: ENVIRONMENTAL CONSERVATION, POLLUTION AND MANAGEMENT

Principles of conservation - Rain water harvesting - Soil health and fauna inputs in agriculture Biosphere reserves -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. Harper 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) 4th 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 Nelszen, 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)4th edition. Animal Physiology, Pearl Publications.

LAB COURSE – 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, Klinefleter 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.

LAB COURSE – III

A. 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, Heamocytometer, Kymograph, Electrophoresis.

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. Collection, Isolation and Identification of Phyto and Zoo planktons.
4. Analysis of industrial effluents- TDS, TSS, BOD, COD.
5. Study of sandy, Muddy and rocky shore fauna with reference to adaptation to the environment
6. Animal association parasitism, Mutualism and Commensalism.
7. Field visit – To visit various industries & Processing Centres
 - i. Tanneries
 - ii. Dye making.
 - iii. Sugar mill.
 - iv. Dairy farm.
 - v. Aquaculture farms. (Marine & Fresh water)

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 immunoglobulins, 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 AND BIOPHYSICS

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

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

UNIT II: HORMONES, ENZYMES & VITAMINS

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

UNIT III: 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 IV: STRUCTURE OF BIOMOLECULES

Electron configuration of atom – Bond 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 V: 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.

REFERENCE/BOOKS

1. Murray, R. K., Granner, D. K., Maynes, P.A. and Rodwell, V.W. (1998) Harper's Biochemistry. 25th edition. McGraw Hill, New York.
2. Jain, J.L. (2001) Fundamentals of Biochemistry. S. Chand & CO. Pvt. Ltd. New Delhi.
3. Vasudevan, D.M and.8reekumar. 8. (2000) Text of Biochemistry for medical students. Jaypee Brothers, Medical Publishers (P) Ltd.New Delhi.
4. Ambika, S. (1990) Fundamentals of Biochemistry for Medical Students. Shanmugam Publishers, Chennai.
5. Bose, S. (1982) Elementary Biophysics. Jyoth Books.
6. Bums, D.M. & MacDONald, S. G. G. (1989). India (Pvt)Ltd. Physics for Biology and Premedical students. Elbs and Addisson - Wesley Publishers Ltd., London.
7. Das, D. (1982). 5th edition. Biophysics and Biophysical Chemistry. Academic Publishers. New Delhi.

LAB COURSE IV

A. DEVELOPMENTAL BIOLOGY

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

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 protozoans (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 immunoelectrophoresis.
4. Slides showing Spleen TS, Thymus TS, Lymph node TS and bone marrow.
5. Electrophoretic separation of serum proteins.

LAB COURSE 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 (Lineweaver 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 of goat.
5. Quantitative estimation of glucose, protein, cholesterol, urea and creatinine in the serum of goat.

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.

ELECTIVE PAPERS

1. 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

Biotechnology – Definition- Conventional and modern methods – Interdisciplinary aspects of Biotechnology - Restriction endonucleases – Modifying enzymes – Ligases – Host vector system – E.Coli as a host – Plasmids – Phage vectors – M13 – Cosmids – Phagemids – YACs – BACs – PACs – expression vectors.

UNIT II: RECOMBINANT DNA TECHNOLOGY

Gene probe - molecular finger printing (DNA finger printing) - Recombinant DNA technology - RFLP - the PCR techniques - Genomic library - Blotting techniques - Southern blotting - Northern & Western blotting. cDNA - Changing genes - Site directed mutagenesis and protein engineering.

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.

2. 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
2. Rashidi, Hooman H , Lukas K Buchler Bioinformatics Basics – (CRC)

3. 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) -

3. 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 Blastoyst 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 Code 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 & charecterisation techniques

Texts/References

- .1 Ann A Kiessling, Human Embryonic Stem Cells: An Introduction to the Scienceand Therapeutic Potential, jones and Bartett, 2003.
2. Peter J. Quesenberry, Stem Cell Biology and Gene therapy, 1st Edition, Willy-Less, 1998.
3. Robert Lanja, Essential of stem cell Biology, 2nd Edition, Academic Press, 2006.

4. A.D. Ho., R. Hoffiman, Stem Cell Transplantation Biology Processes Therapy, Willy-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 antibiotics, 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. FISHERIES SCIENCE 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 AQUACULTURE

Importance and objective of aquaculture – Global scenario: capture and culture fisheries status –

Indian scenario: capture and culture fisheries status – prospects and scopes

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 fish and shell fish: 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, O₂, Co₂ 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 .

REFERENCE BOOKS

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 Livingston
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. Philadelphis, 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 (Ist 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, Meent – 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. Bently, PJ. 1982. Comparative vertebrate endocrinology, Cambridge University press.
7. Micheal, P. 1968. Endocrinology and Human Behaviour. Oxford University Press, New York.