

**NEHRU MEMORIAL COLLEGE (AUTONOMOUS)**  
(Accredited with 'A' Grade by NAAC)  
**PUTHANAMPATTI – 621 007, TIRUCHY – Dt.**  
**P. G. AND RESEARCH DEPARTMENT OF ZOOLOGY**  
**M.Sc., ZOOLOGY – SEMESTER - I**  
**CBCS: 2015-2016 - CORE COURSE**

**CC – I: ANIMAL DIVERSITY**

6 Hours :5 Credits

Course Code: 15PZ101

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**Objectives:**

This title deals with Animal diversity which is an essential topic for biologists to know the distribution of animal kingdom of various forms. To improve the taxonomic expert's strength, this paper is included. To enlighten the students about the primitive forms, invertebrates and vertebrates distribution. To help our students to understand the status and mode of living of different forms of animals from Unit I to IV.

**UNIT-I: Invertebrata:** Protozoa: Polymorphism in Protozoa, feeding and reproduction in Protozoa. Origin and evolution of Metazoa - theories. Porifera: Interrelationship between different classes. Mesozoa. Coelenterata- Polymorphism in Coelenterates. Ctenophora: Structural peculiarities and affinities. Origin of Bilateria: Origin and evolution trends in coelom formation.

**UNIT-II: Invertebrata:** Salient features and type study for platyhelminthus (Tape worm and Liver fluke), annelida (Earth worm and nereis), arthropoda (Insects and mites), mollusca (Pila and snails) and echinodermata (Starfish and sea urchin) - Comparative study of digestive system, respiratory system and excretory system of platyhelminthus, annelid, arthropoda, mollusca and echinodermata.

**UNIT-III: Vertebrata:** Salient features and type study for fishes (Lung fish and Bony fish), amphibian (frogs and toad), reptiles (snake and crocodile) - Comparative study of digestive system, respiratory system and excretory system of fishes, amphibian and reptiles.

**UNIT-IV: Vertebrata:** Salient features and type study for aves (Pigeon and Pheasants), mammals (Rat and Whales) - Comparative study of digestive system, respiratory system and excretory system of aves and mammals.

**UNIT V: Taxonomy:** Definition and basic concepts of taxonomy – importance and applications of taxonomy in biology - taxonomic collections, preservations, curretting process of identification. Taxonomic keys and their merits and demerits. International Code of Zoological Nomenclature (ICZN) - formation of scientific names of various taxa. Origin of higher taxa from living forms – evidence for the origin of higher taxa from the fossil record. Diversity indices – Shannon and Weinear diversity index.

**Book for Study:**

1. Kotpal, R.L. 1982. Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Minor Phyla. Rastogi Publications.
2. Simpson, G.G. 1987. Principles of animal taxonomy. Oxford IBH Publishing Co. P 247.
3. Mayer, E. Elements of Taxonomy.
4. Clark, R.B and A.L. Panchen. 1971. Synopsis of animal classification. Chapman and Hall Publications, London. P 126.
5. Newman, H.H. 1987. The Phylum Chordata. Sathis book Enterprise Publishers.

**Book for Reference:**

1. Barnes R. D. 1982. Invertebrates Zoology 6th endn. Toppan International Co.,
2. Hyman L.H. 1940 - 1959. The Invertebrata, Vol. I to VI.
3. Carter, G. S. A. (1946) General Zoology of Invertebrates 2nd endn. (Wick and Jackson Ltd., London).
4. Borradile, L.A. 1955. The Invertebrata.2nd endn. Cambridge University Press.
5. Barrington, E. J. W. 1969. Invertebrate Structure and functions. English Language. Book Society.
6. Gardinar, M. S. 1972. Biology of the invertebrates, Mc Graw Hill Book Co., New York.
7. Waterman, AJ. 1971. Chordate Structure and Function. Macmillan Co. London.
8. Jolie, M. 1968. Chordate Morphology. East West Press.
9. Young, J.Z. 1950. Life of Vertebrates. Clarendon Press Oxford.
10. Kapoor, V.C. 1991. Theory and Practice of Animal Taxonomy. Oxford and IBH Publishing Co., Pvt. Ltd. New Delhi.

**M.Sc., ZOOLOGY – SEMESTER - I**

**CBCS: 2015-2016**

**CORE COURSE**

**CC – II: CELL AND MOLECULAR BIOLOGY**

6 Hours : 5 Credits

Course Code: 15PZ102

**Objectives:**

To enlighten our students about the DNA and its functions. The knowledge in the molecular biology and genetics will provide diagnosis of genetical disorders and treatment. This course facilitates to understand the structure at molecular level and function of prokaryote and eukaryote cell.

**UNIT-I: Cell organization:** Sub cellular structures of prokaryotic, mycoplasmas, virus and viroids. General organization of eukaryotic cells - membrane structure and function - cytoplasm - Intracellular compartments - mitochondria, Golgi bodies, endoplasmic reticulum,

**UNIT-II: Nuclear material:** Nucleus, - Chromatin structure and nucleosome concept - Structure of DNA and RNA. DNA Replication - Mechanism of DNA replication in eukaryotes. Recombination- mechanism of recombination – DNA repair – mechanism of DNA repair.

**UNIT-III: Gene and protein relationship: Central Dogma – Transcription – translation - post translation modification.** Regulation of protein synthesis– The operon system, gene regulation in higher eukaryotes. Mechanism of positive and negative control of gene expression. Genetic code – Decoding of gene control – alphabets of the code, coding dictionary.

**UNIT-IV: Cell cycle and programmed cell death:** Components of cell cycle control system - intracellular control of cell-cycle events - Programmed cell death - extra cellular control of cell division - cell growth and cell death - Biology and genetics of cancer and cell aging.

**UNIT-V: Cell communications:** general principles of cell communication - signaling through G-protein linked cell surface receptors - signaling through enzyme-linked cell surface receptors - signaling pathways that depend on regulated proteolysis.

**Text Book:**

1. Alberts, B., Johnson, A., Lewis, J, Raff, M., Roberts, K and Walter, P. 2002. Molecular biology of the Cell. Garland science, New York.
2. Bolsover, S.R, Hyams, J.S, Shephard, E.A, White, H.A and Wiedemann, C.G. 2004. Cell Biology. John Wiley & sons, Inc. Publication, New Jersey.
3. De Robertis, E.D.P., and De Robertis, Jr. E.M.F. 2001. Cell and molecular biology. Williams & Wilkins, USA.
4. Hartl, D.L. and Jones, E.W. 2005. Genetics analysis of genes and genomes. Jones and Barlett. UK.
5. Klug, W.S and Cummings, M.R. 2005. Concepts of Genetics. Pearson Education P(ltd), Singapore.
6. Lewin, B. 2000. Genes VII. Oxford University Press Inc. New York.
7. Lewis, R. 2005. Human genetics – concepts and applications. McGraw-Hill. New Delhi.
8. Watson, J.D, Baker, T.A, Bell, S.P., Gann, A., Levine, M and Losick, R. 2004. Molecular biology of the gene. Pearson Education P(ltd), Singapore.

**M.Sc., ZOOLOGY – SEMESTER - I**

**CBCS: 2015-2016**

**CORE COURSE**

**CC – III: ANIMAL PHYSIOLOGY**

6 Hours: 5 Credits

Course Code: 15PZ103

**Objectives:**

This paper gives information about the structure and function of body organs. This course Animal Physiology helps the students in understanding how the body functions adapts with respect to its external and internal environment, related to nervous integration, sensation, metabolism and reproduction.

**UNIT-I: Nutrition and Digestion:** Modes of nutrition – Nutritive requirements. Digestion and absorption of proteins, carbohydrates and lipids in man. Role of gastrointestinal enzymes and hormones in digestion.

**UNIT-II: Circulation:** Components of circulatory system – Cardiac cycle – Composition of blood – Blood groups – coagulation – Structure of mammalian heart – Blood pressure and its regulation. Respiration: Respiratory organs – mechanism of breathing – respiratory pigments – properties of respiratory pigments – transport and exchange of gases – buffer systems of blood – factors affecting respiration.

**UNIT-III: Excretion** – Organs of excretion in invertebrates and vertebrates – changes in nitrogen excretion with life cycle – ornithin cycle – Physiology of excretion in man - fluid control in the body - acid-base balance. Nerve physiology: Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture. Muscle physiology: Types of muscles – ultra structure – mechanism of contraction of skeletal muscles – Nervous control of muscles.

**UNIT-IV: Sensory mechanisms:** Classification of receptors – mechanism of hearing, vision, olfaction and taste. Reproduction: Male and female reproductive system, structure – accessory reproductive structures. Patterns of reproduction – breeding cycles – Hypothalamo – hypophyseal – gonadal axis.

**UNIT-V: Osmoregulation:** Ionic and osmoregulation in aquatic and terrestrial animals. Thermoregulation: Regulation of body temperature – role of behavior – peripheral and central receptors. Chronobiology: Biological rhythms – rhythms in man – biological clock.

**Book for References:**

1. Hoar, W.S. 1991. General and Comparative physiology (3rd edition). Prentice Hall of India, New Delhi.
2. Nelson, K.S. 1997. Animal physiology. Cambridge University press. Oxford.
3. Barrington, E.J.W. 1975. An introduction to general and comparative endocrinology 2<sup>nd</sup> edition. Clarendon Press, Oxford.
4. Welson, A. 1979. Principles of Animal Physiology. Macmillan publishing co., Inc. New York.
5. Herkat, P.C. and Mathur, P.N. 1976. Text book of Animal physiology. S. Chand and Co. Pvt. Ltd., New Delhi.
6. Pradeep V. Jabde. 2005. Text of general Physiology. Discovery Publishing House, New Delhi.

**M.Sc., ZOOLOGY – SEMESTER - I**

**CBCS: 2015-2016**

**CORE COURSE**

**CC – IV: PRACTICAL (COVERING CC-I to CC-III)**

6 Hours : 4 Credits

Course Code: 15PZ104L

**Objectives:**

To obtain knowledge about the identification and classification of animals. To impart training on the technique of dissection of invertebrate and vertebrate animals and to understand the various systems present in the body. To get the information of animal population and – to know the fossil forms in the title of animal diversity.

## I. ANIMAL DIVERSITY

1. Identification and study of selected Protozoans and Helminthes of medical importance.
2. **Dissection:** Digestive/Nervous system of Earthworm/Cockroach/Pila/Fish. Reproductive system of Cockroach/Urino genital system of Fish.
3. **Mounting:** Appendages of Prawn and Honey bee sting.
4. **Composition assessment of the taxonomic diversity/biodiversity of birds/mammals in a habitat.**
5. Collection of insects and identification up to order level (Field work).
6. **Use of taxonomic keys for identification of stuffed animal (birds).**
7. Study of prepared slides of mouth part of Honey bee, Housefly, Mosquito, Bed bug and Butterfly to relate structure and function.  
**Spotters:** Euglena, Paramecium, Obella, Physalia, Scorpion, Chiton, Balanoglossus, Torpedo panther, Sea Horse, Cat fish, *Ophocephalus punctatus* (snake headed fish), Ichthyophis sp, Draco, Chameleon, Indian cobra, king fisher, blue rock pigeon, rat, bat.

## II. CELL AND MOLECULAR BIOLOGY

1. **Cell size determination using micrometer**
2. **Human blood smears.**
3. **Cell counting and cell viability using trypan blue dye exclusion assay.**
4. **Buccal smear**  
**Spotters:** Mammal nerve cell, cardiac muscle, non-striated muscle, compound microscope, micrometer.

## III ANIMAL PHYSIOLOGY

1. **Estimation of amylase activity in relation to different pH.**
2. **Quantitative estimation of Ammonia & Urea.**
3. **Rate of salt loss and gain in fish using different experimental media.**
4. **Estimation of blood chloride.**
5. **Estimation of hemoglobin**  
**Spotters:** i. Vital organs (model) Brain of man, Heart of man, Kidney of man  
ii. ECG iii. Sphygmomanometer iv. Clinical thermometer.

**M.Sc., ZOOLOGY – SEMESTER - I**  
**CBCS: 2015-2016**  
**CORE ELECTIVE COURSE - I**

**CEC- Ia: APPLIED ENTOMOLOGY**

6 Hours : 4 Credits

Course Code: 15PZ105a

**Objectives:**

To enlighten the students on harmful insects and their biology, nature of damage and management measures. To teach our students about various invertebrate pests which

attack our crops and belongings and their management measures. To know information about useful insects.

**UNIT I: Insect Pest:** Classification – Major and minor insect pests. Biology, damage causes and pest of Paddy, Groundnut, Sugarcane, Cotton and Vegetables (Brinjal and Tomato). Pest of stored products. Primary and secondary pests, pest outbreak – pest resurgence.

**UNIT II: Methods of insect control:** Prophylactic measures – Cultural, Mechanical, Physical and Chemical methods. Pesticides – Classification, Types of formulations, mode of action, Toxicity, insecticide resistance, environmental safety.

**UNIT III: Biological control:** Parasites, Predators, Microbial agents and Botanicals. Non-Conventional methods – IGR, Repellents, Antifeedants, Pheromones, Chemosterilants, Irradiation, Genetic and Quarantine. IPM: Definition and Integration of methods. Potential components need for IPM and its application. Insect plant interaction. Pest – Predator complex and Ecological balance. Pest resistant crops – Transgenic crops.

**UNIT IV: Insects and diseases:** Biology of insect vectors and control of Housefly, Mosquito, fleas, Lice, cockroaches and sandfly. Mode of transmission and epidemiology of relapsing fever, plague, malaria, dengue, encephalitis and filariasis. Pest of domestic animals.

**UNIT V: Beneficial insects:** Pollinators, predators, soil builders, parasitoids and scavengers. Sericulture – Biology and culture of Silkworm. Apiculture techniques – Biology and culture of Lac insect – Other productive insects (Cochoneal insect and insect galls), insects useful in medicine.

**Book for Study:**

1. Vasantharaj David, B and T. Kumaraswami. 1996. Elements of economic entomology. Popular Book Depot Publishers. P 536.
2. Tembhare, D.B. 1984. Modern entomology. Himalaya Publishing House, Mumbai.
3. Fenemore, P.G and A. Prakash. 2000. Applied entomology. New Age International (P) limited publishers, New Delhi.
4. Verma, D.K. 1999. Applied entomology. Mittal Publications, New Delhi.

**M.Sc., ZOOLOGY-SEMESTER I  
CORE ELECTIVE COURSE - I**

**CEC - Ib: BIOPHYSICS**

6 Hours : 4 Credits

Course Code: 15PZ105b

**Objectives:**

This paper gives information about molecules structure and function (Unit I to IV). The Unit V deals with different techniques of molecule separation by using different methods and kits.

**UNIT-I:** Introduction to Biophysics – Proteins : Amino acids – classification, structure, conformations, Ramachandran plot, peptide-peptide bond isomerisation. Molecular organization, different levels, organization of proteins - primary, secondary, tertiary and quaternary structure.

**UNIT-II:** Sequencing of proteins and nucleic acids. Protein-DNA interactions. Physical and chemical methods for immobilization of small and macro molecules. Glyco and lipo – proteins – Structure and function. Nucleic acid hybridization – structural analysis and biological studies.

**UNIT-III:** Laws of thermodynamics, chemical equilibrium, Microscopy (compound – phase contrast – polarising – Electron (TEM and SEM) microscopy), sedimentation and viscosity, chromatography, X-ray diffraction. Spectroscopy: Absorption and emission spectroscopy- Beer- Lambert Law, Principles – instrumentation and applications of Visible, UV, Mass, Florescence, Raman Spectroscopy, IR, AAS, NMR, and ESR. Microarray technology.

**UNIT-IV:** The colloidal phenomena – Classification, properties, Donnan Equilibrium. Diffusion and osmosis – molecular kinetic approach, method of determination of diffusion coefficient, significance of osmosis in Biology. Viscosity – factors affecting viscosity, measurement, application and significance. Surface tension - factors affecting surface tension and measurement of surface tension.

**UNIT-V:** Analytical techniques: Principle and application of Chromatography (paper, thin-layer, column and GLC), Centrifugation – Density gradient centrifuge. Spectroscopic techniques, UV and visible spectroscope, NMR, Atomic absorption spectroscope, Radioactivity and radioactivity measurements-GM counter and Scintillation counter. Properties of Natural Light – Biological applications of Xrays, UV rays and infra red rays – Isotopes and their uses in biological investigation – X ray diffraction and Autoradiography and their applications in biology.

**Book for References:**

1. Ackerman, E., Ellis, L.B. and Williams, L.E. 1979. Biophysical Science. Prentice hall of India, New Jersey, USA.

2. Daniel, M. 1989. Basis biophysics for biologists. Agro – Botanical publishers, India.
3. Pattabhi, V. and Gautham, N. 2003. Biophysics. Narosa publishing House, New Delhi.
4. Skoog, A., Douglas, J and Leary, J.J. 1992. Principles of Instrumental analysis. Saunders Golden Sunburst Series. Philadelphia.
5. Zubey. 1994. Biochemistry. The International books.
6. Arora, M.P. 2004. Biophysics. Himalaya publishing House, Mumbai. P 378.
7. P.Narayanan (1999) 'Introductory Biophysics' New Age Publishing Co., Mumbai, India.
8. Bose, S. (1982) Elementary Biophysics. Jyoth Books.
9. Casey, E. J. (1962) Biophysics concepts and Mechanism. Affiliated East –West Press Pvt. Ltd., New Delhi.
10. Epstein, H. T. (1963) Elementary Biophysics selected topics. Addison – Wesley Publishing Company Inc London.
11. Vasantha Pattabhi and N.Gautham (2001) 'Biophysics' Narosa Publishing Company, New Delhi.

**M.Sc., ZOOLOGY – SEMESTER - I**  
**CBCS: 2015-2016**  
**CORE ELECTIVE COURSE - I**

**CEC- Ic: CLINICAL ANALYSIS AND LABORATORY TECHNIQUES**

6 Hours : 4 Credits

Course Code: 15PZ105c

**Unit - I: Instrumentation**

The laboratory: Accidents – Universal work precautions (UWP) for laboratory personnel. Sterilization : Introduction – sterilization by heat – cold – ultra violet radiation – Ionizing radiations – Filtration – chemical sterilization – Glass preparation for use.

**Unit – II: Blood counting:**

Knowledge and skill in collecting blood samples. Analysis of blood and basic haematological techniques. Blood cell morphology in health and disease – RBC, WBC, Total count and differential count, Haemoglobin estimation.

**Unit – III: Haematological techniques:**

Haematocrit, packed cell volume, MCH, MCHC, MCV, Erythrocyte sedimentation rate, RBC fragility test, platelet count. Reticulocytocrit, haemorrhagic disorders, clotting time, Bleeding time, prothrombin time.

**Unit – IV: Clinical Analysis**

Knowledge and skill in the study and analysis of urine. Physical parameter, Colour, Odor, pH, Density. Chemical parameters routinely required to be analysed –Sugar, Albumin, Ketone bodies and their clinical significances pregnancy tests.



**Unit – V: Clinical Studies**

Analysis of faeces, semen, cerebrospinal fluid for clinical investigation. Study of vectors in the transmission of diseases with suitable examples. Techniques - RIA, ELISA, WESTERN BLOT and WIDAL TEST.

**Text Book**

1. Sood, Ramnik. 1985. Medicinal Laboratory Technology, Jaypee brothers, New Delhi – 384 pp.
2. Kanai. L Mukherjee. 1988, Medical Laboratory Technology, vol. I to III, Tata McGraw Hill publishing company Ltd., New Delhi.64

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**P. G. AND RESEARCH DEPARTMENT OF ZOOLOGY**  
**M.Sc., ZOOLOGY – SEMESTER - II**  
**CBCS: 2015-2016**  
**CORE COURSE**  
**CC-V: DEVELOPMENTAL BIOLOGY**

6 Hours : 5 Credits

Course Code: 15PZ206

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**Objectives:**

This course is an experimental science, which provides understanding of the process of early embryonic development, manipulation of developing embryos and to review the current development in the field of embryology. The Unit I to IV provides knowledge about formation of embryo and also provides embryological disorders and treatment methodology. The Unit V provides artificial fertilization and preservation of germs.

**UNIT-I: Gametogenesis in animals: Spermatogenesis:-** Origin of primordial germ cells- differentiation of spermatozoa – structure and motility of sperm. **Oogenesis:** Development of Oocytes – types of eggs – Biochemical changes during Oogenesis. **Fertilization: Types** – Biochemical and Molecular events during fertilization - egg activation – acrosomal reaction. Post-fertilization changes: changes in the organization of egg cytoplasm caused by fertilization.

**UNIT-II: Cleavage:** Cell division and chemical changes during cleavage - Cleavage patterns – Morphogenetic determinants in egg cytoplasm. Totipotency and nuclear transplantation. Gastrulation: Principle and pattern - fate maps. Concepts of determination – competence - induction – **Cell differentiation and differential gene activity – Genes in development – expression and regulation transcription pattern - role of Hox and Hoxa genes.**

**UNIT-III: Organizer:** Spemann's primary organizer – analysis of nature and mechanism of induction. Organogenesis: Development of limb and kidney. Cellular interaction – differentiation and organogeny - Role of maternal contributions in early embryonic development. Embryonic adaptation – Extra embryonic membrane structure in Reptiles and Birds. Placenta: Classification, structure and physiology.

**UNIT- IV: Post embryonic developmental events:** Metamorphosis in insects and amphibians – influence of hormones. Asexual reproduction – occurrence and forms of asexual reproduction. Regeneration in various animals – mechanism and factors affecting regeneration.

**UNIT – V: Cryopreservation of gametes and embryos** – Assessment of sperm quality, sperm banking – ART - *in vitro* fertilization - *in vitro* oocyte maturation – superovulation. Multiple ovulation and embryo transfer technology (MOET). Embryonic stem cells. Fertility control and regulation.

**Book for References:**

1. Berril, N.T. 1971. Developmental biology. McGraw Hill Co., New York.
2. Berril, N.T. and Karp, G. 1988. Developmental biology. Tata McGraw Hill Co., New York.
3. Balinsky, B.I. 1961. An Introduction to Embryology. W. B. Saunders Co. Philadelphia.
4. Gilbert, S.F. 2003. Developmental Biology. Sinauer associates, Inc. Publishers, Sunderland.

**M.Sc., ZOOLOGY – SEMESTER - II**  
**CBCS: 2015-2016**  
**CORE COURSE**  
**CC-VI: GENETICS AND EVOLUTION**

6 Hours : 5 Credits

Course Code: 15PZ207

**Objectives:**

This subject provides the detailed knowledge about gene and gene structure to enable the students different gene transportations and mechanisms. Also it provides basic information of genes, mutations, sex determinations and pattern of inheritance. To detect the genetic diseases in different ways and means. The pattern of evolution are discussed in Unit IV and V.

**GENETICS:**

**UNIT I:** Mendalian concept. Gene interaction and types: Epistasis, Additivity, Modifiers, Lethality – Linkage – linkage in human beings – Mechanism of crossing over – Gene mapping in chromosome by crossing over method. Structure of gene – cistron, muton, recon, introns, and exons – over lapping genes. Chromosomal aberrations – Molecular basis of mutations. Genes in populations - Hardy–Weinberg principle and gene frequency – Factors affecting Hardy–Weinberg equilibrium.

**UNIT II:** Gene regulation:– Lytic cascade and lysogeny regulation in Lambda phage – recombination in phages – Fine structure of rII locus in T4 phage. Gene regulation in eukaryotes: Short term regulation and Long term regulation. Bacteria: Genetic material – Parasexual processes, transformation, conjugation, sexduction, and transduction – Mapping of bacterial chromosomes – Transposon – types and mechanism of transposition.

**UNIT III:** Inborn errors of metabolism: Phenylketonuria, alkaptonuria, albinism, Lesch-Nyhan syndrome, ADA deficiency, galactosemia, G6PD deficiency, Tay Sach's disease, and Gaucher's disease. Human karyotype: preparation and analysis - chromosomal syndromes in man. Detecting genetic diseases – genetic counseling, prenatal diagnosis, genetic diseases - Treating genetic diseases - Altering genetic traits.– Features, methods and future prospects.

## **EVOLUTION:**

**UNIT IV:** Theories of evolution; Neo Lamarckism, Neo Darwinism, micro, macro and mega evolution, morphological evolution. Fishes: Evolution and adaptive radiation in fishes. Amphibia: Evolution and Adaptive radiation in Ambhibia. Reptilia: Evolution and Adaptive radiation in Reptiles. Aves: Evolution and Adaptive radiation in birds. Mammals: Evolution and adaptive radiation in mammal.

**UNIT-V: Molecular evolution** – Gene evolution, evolution of gene families, molecular drive, assessment of molecular variation. Molecular phylogenies and evolution – Immunologic techniques, amino acid sequences, DNA sequences. Nucleic acid phylogeny based pm DNA – DNA hybridization and restriction enzymes, combined nucleic acid – amino acid phylogenies – Rate of molecular change, molecular clock, regulatory genes and evolution.

## **Reference Books:**

### **Genetics**

1. Benjamin Levin (2005) Genes VIII, Oxford University Press, New York.
2. Daniel L. Hartl (1996) Genetics, III Ed., Jones Bartlett Publishers. Boston.
3. David Friefelder (1998) Microbial Genetics, Narosa Publishing House, New Delhi.
4. Jenkins, J. B. (1983) Human Genetics, The Benjamin Cummings Publishing Co.,
5. John D. Hawkins (1996) Gene Structure and Expression, III Ed., Cambridge University Press.
6. Robert H. Tamarin (1996) Principles of Genetics, WCB Publishers.
7. Strickberger Monroe, W. (1996) Genetics, Prentice Hall of India Pvt. Ltd., New Delhi.

### **Evolution**

1. Moody, P.A. 1978. Introduction to Evolution. Harper International.
2. Dodson. 1990. Evolution, Reinhold, New York.
3. Evolution, Barton, N. H., Briggs, D. E.G., Eisen, J. A., Goldstein, A. E., Patel, N. H., Cold Spring Harbor Laboratory Press, New York, USA
4. Evolution, Hall, B. K. and Hallgrimsson, B., Jones and Bartlett Publisher, Sudbury, USA
5. Evolution, Futuyma, D. J., Sinauer Associates, Inc., Sunderland, USA

**M.Sc., ZOOLOGY – SEMESTER - II**  
**CBCS: 2015-2016**  
**CORE COURSE**

**CC – VII: PRACTICAL (COVERING CC-V & CC-VI)**

6 Hours : 4 Credits

Course Code: 15PZ208L

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**I. Developmental Biology:**

1. Examination of fresh sperms of rat (count, motility and vitality).
2. Suspension and smear preparation of bull sperm and observation of spermatozoa.
3. Vaginal smear preparation in rat.
4. Mounting of different stages of chick embryo.
5. Pregnancy test.

**Spotters:**

- i. Different developmental stages of chick embryo and frog embryo.
- ii. Blastula of Frog, Gastrula of Frog

**II. Genetics and Evolution**

1. Pedigree analysis
2. Rh blood group and their genetic significance.
3. Estimation of gene and genotypic frequencies in the light of Hardy-Weinberg Law based on ABO blood group data in a class room sample.
4. Human karyotyping and chromosomal abnormalities.
5. To prepare a survival curve for the given bacterial culture using UV radiation as a mutagen.

**Spotters:** Klienfelter's syndrome, Down's syndrome, Turner's syndrome, Salamander fish, squilla, fossile forms (Ammonoids, Belemnoids, Nautiloids).

**M.Sc., ZOOLOGY – SEMESTER - II**  
**CBCS: 2015-2016**  
**OEC – OPEN ELECTIVE COURSE**  
**(OPEN TO ALL)**

**OECa – HUMAN HEALTH AND HYGIENE**

6 Hours : 4 Credits

Course Code: 15PZ209a

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**Objectives:**

The main aim of this paper is to give information about human health and diseases and preventive measures.

**Unit I: Health:** Definition – dimensions of health – Health education: definition – objectives – principles – Nutrition and health: malnutrition - Balanced diet – food

hygiene Environment & Health: Water, Air and Noise pollution -Pollutants, effects, prevention and control – effects of smoking and alcoholism.

**Unit II: Concept of disease:** Phases of disease – Prepathogenesis and Pathogenesis – concept of prevention and control – common Arthropod borne diseases. Classification of communicable diseases – agent factors - mode of transmission – symptoms and treatment of Tuberculosis, Typhoid, Hepatitis A & B and AIDS - Family planning: Definition – scope – contraceptive devices

**Unit III : Mental health:** Definition - characteristics – causes and prevention of mental health - Occupational health & hazards – prevention – Health care services – primary health care – hospitals –Principles of First Aid. Production of human insulin. Disease Diagnosis. Gene therapy and Transplantation therapy.

**Unit IV: Structure and function of various organs:** eye, ear, skin, heart, lung, digestive system, reproductive system, excretory system, nervous system – pathogens affecting the various system – effects of smoke, drug on human health. UTI infections. Drug side effects.

**Unit V: Air borne, water borne diseases:** heavy metal contamination on human health – food toxins – climate change and diseases – organ transportation and success – plastic surgery – role of herbal drugs in human health - role of WHO in human health and hygiene.

**Reference book:**

1. E. Park & Park: Textbook of Preventive and Social Medicine (Published by Banarsidos Bhanot, 1278 Napier Town.)

**M.Sc., ZOOLOGY – SEMESTER - II**  
**CBCS: 2015-2016**  
**OEC - OPEN ELECTIVE COURSE II**  
**(OPEN TO ALL)**  
**OECb – MEDICAL ZOOLOGY**

6 Hours : 4 Credits

Course Code: 15PZ209b

**Objectives:**

The main aim of this paper is to give information about life cycle and diseases caused by parasites (viral, bacterial, fungal, helmenths) in human being and also their effects and control measures.

**UNIT I: Medical Protozoology:** Definition – human welfare - Detailed study – Malarial parasite – Structure, Life cycle – Mode of transmission-Disease Symptoms-treatment and preventive measures. Pyorrhoea, Diarrhoea, Leishmaniasis, Trichomoniasis.

**UNIT II: Medical Helminthology:** Detailed study – *Ascaris*, *Taenia solium*: Structure, Life cycle-Mode of transmission – Disease caused and symptoms – treatment and preventive measures. Helminth diseases: General account and diseases of

Schistosomiasis, Ancylostomiasis, Enterobiasis, Trichuriasis, Trichinosis, Trichinella, Strongyloidiasis and Filariasis. Accommodation and tolerance in host-parasite relationship.

**UNIT III: Medical Entomology:** Morphology and life cycle of Mosquitoes and Housefly – role as vectors and control measures. General account and diseases transmitted by cockroach, Flea, ticks, mites, Louse, Bedbug.

**UNIT IV: Methods of diagnosing diseases:** Examination of stool: Direct examination – sedimentation technique, floatation technique and egg counting technique. Examination of blood – thick smear and thin smear methods. Examination of urine: Bacterial examination – Gram Positive and Gram Negative. Plate count method, Direct microscope count. Health Education: Health Plans of India – Role of WHO

**UNIT V: Bacterial and Viral diseases:** Bacterial diseases: Cholera, Typhoid, Tuberculosis – Mode of transmission – Symptoms and diagnosis – Treatment and preventive measures. Viral diseases: Dengue, Chickungunya, Swine fever, Measles, Influenza, Rabies, Encephalitis, Polio, Plague, AIDS and SARS. Mode of transmission – symptoms and diagnosis – treatment and preventive measures - Geographical influence of diseases and step taken by government.

**Book for References:**

1. Manson-bahr, P.E.C and Bell, D.R. 1892. Manson's Tropical diseases. English Language Book Society Bailliere Tindoll. P 1535.
2. Asa. C Chanler and Clark, P. Read. Introduction to Parasitology. Wiley Eastern Private Ltd. New Delhi. P 822.
3. Ramnik sodd. 1993. Parasitology. CBS Publishers & Distributor, Delhi. P 281.
4. Park, K. 1995. Preventive and social medicine.

**M.Sc., ZOOLOGY – SEMESTER - II**  
**CBCS: 2015-2016**  
**CORE ELECTIVE COURSE - II**  
**CEC-IIa: ETHOLOGY**

6 Hours : 4 Credits

Course Code: 15PZ210a

**Objectives:**

The main aim of this paper is to know the behavior, activities of animals for various functions will be discussed.

**UNIT: History of the study of animal behaviour:** Field and laboratory methods of studying behaviour –Ethogram. Analysis of behaviour; taxes, kinesis and reflexes.

**UNIT: Instinct Behaviour:** Classical theory of Instinct –Phases of instinct behaviour, fixed action pattern – Sign stimuli – Drive and motivation – models of instinct behaviour–Ritualization. Learning Behaviour: Types of learning (Habituation, classical

conditioning I & II, trial and error learning, latent learning, insight learning, imprinting) – evolution of learning – memory. Aggressive behaviour

**UNIT-III: Social behaviour:** Social behaviour of Bees, Deers, Primates, Elephant and Lion. Foraging behaviour: Optimal foraging- Group foraging.

**UNIT-IV: Play behaviour:** Types of Play – Play in mammals – biological effects of play. Reproductive behaviour: Sexual selection, mating pattern, parental care in birds and mammals. Display in birds.

**UNIT-V: Animal communication:** Visual, auditory, chemical and vocalization in birds & mammals. Chronobiology: Circadian, lunar, tidal and annual rhythms. Animal architectural ability: Insects and birds. Animal navigation.

**Book for study:**

1. Leshner, A.I. 1978. An introduction to Behaviour Endocrinology, Oxford University Press, New York.
2. McFarland.D. (Ed) 1981. The Oxford companion to Animal Behaviour. Oxford University Press, New York.
3. Ridley, M. 1968. Animal Behaviour. A concise introduction Blackwell Scientific publication, Oxford.
4. Slater, P.J.B. 1985. An introduction to Ethology, Cambridge University Press, Cambridge.
5. Wallace, R.A. 1979. The ecology and evolution of Animal Behaviour, Goodyear Publishing Company, Inc. Santa Monica, California.
6. Wilson, E.O. 1978. Sociobiology. The Belknap press of Harard University Press, Cambridge.

**M.Sc., ZOOLOGY – SEMESTER - II**  
**CBCS: 2015-2016**  
**CORE ELECTIVE COURSE - II**

**CEC-IIb: MARINE BIOLOGY**

6 Hours : 4 Credits

Course Code: 15PZ210b

**Objectives:**

The main aim of this paper is to know the status of marine animals. To create an awareness to the students about marine biology. This paper is used for conservation issues.

**UNIT I: Marine ecology:** Physical parameters of sea: tides, waves, light, temperature, currents, density & pressure. Chemical parameters of sea: salinity, dissolved oxygen, pH and nutrients. Shore Environment: Distribution of life on rocky shore, sandy shore and



muddy shore; Ecology of coral reefs and mangrove habitats; their special features. Benthos: Distribution of shallow water benthic organisms; Fauna of deep sea and hadal regions – their adaptations.

**UNIT II: Biological Oceanography:** Larval Ecology: Types of larvae and their distribution. Chemical communications and settlement of larvae of marine benthic organisms. Classification of marine environment: general characters of the populations of the primary biotic divisions (plankton, nekton and benthos). Introduction to plankton: general classification and composition of plankton. Floating mechanisms in plankton. Distribution of plankton in space and time: Horizontal distribution: Phytoplankton and Zooplankton relationships.

**UNIT III: Fishery Science:** General account of systematic classification of fishes. Classification based on degrees of movement, zones inhabited and manner of reproduction. Economically important groups of fishes: General account of life history of Indian fishes. General account of food and feeding habits of fishes; reproduction and spawning and fish eggs and larvae. General account of movement and migration in fishes. Nutrition : Types of food, general mechanisms of feeding, transport of food through gut; digestion and digestive enzymes. Excretion: Nitrogen excretion, mode of nitrogen excretion and elimination of nitrogenous wastes. Respiration: Respiratory mechanisms; factors affecting respiration (salinity, temperature and oxygen tension).

**UNIT IV:** Estuarine environment: Physico-chemical properties of estuaries; Classification of estuaries Distribution of estuarine plankton, nekton and benthos. Estuarine plants : Distribution of mangroves Estuarine birds and estuarine foodweb. Coastal Zone Management : Coastal resources : finfish, shellfish and non-living Resources and their management. Coastal Zone Regulations Remote sensing applications in coastal zone management.

**UNIT V: Marine Pollution and Biodeterioration:** Sources of marine pollution, Composition of domestic, industrial and agricultural discharges. Their fate in the marine environment. Toxicity and treatment methods. Oil pollution: Sources, composition and its fate in marine habitats. Solid dumping, mining and dredging operations: their effects on marine ecosystem. Role of biotechnology in marine pollution control. Biofouling and biodeterioration: Agents and protection methods. Global environmental monitoring methods: status, objectives and limitations.

**Book for References:**

1. Carl E. Bond. 1996. Biology of Fishes. 2 nd Edition, W.B. Saunders Company, Philadelphia.
2. Miller, R. I. 1994. Mapping the Diversity of Nature, Chapman & Hall. pp. 218.
3. Heywood V.H. 1995. Global Biodiversity Assessment. UNEP, Cambridge University Press PP. 1140.
4. King, M. 1995. Fisheries Biology: Assessment and Management, Fishing News Books.

5. Agarwal et. al. 1996. Biodiversity and Environment. APH., pp 351.
6. Naskar K. and Mandal R. 1999. Ecology and Biodiversity of Indian Mangroves. Daya. pp 361.
7. Jeffrey S. Levinton, C.D. 2001. Marine Biology: Function, biodiversity, ecology (515pp) with cd- rom”.
8. Artikeya, K. 2005. Biodiversity: Extinction and Conservation, (202pp).

**M.Sc., ZOOLOGY – SEMESTER - II**  
**CBCS: 2015-2016**  
**CORE ELECTIVE COURSE - II**

**CEC-IIc: WILDLIFE BIOLOGY AND MANAGEMENT**

6 Hours : 4 Credits

Course Code: 15PZ210c

**Objectives:**

The main aim of this paper is to know the status of wild animals, contribution of NGOs and also importance of sanctuaries and national parks. To create an awareness to the students about wildlife. This paper is used for conservation and management issues.

**UNIT-I: Introduction to Wildlife:** Definition, importance, causes for depletion, methods of conservation. IUCN classification: Rare, threatened, vulnerable, Endangered and Extinct animals. Endangered animals of India- amphibians, reptiles, birds and mammals. Forest types in India – characteristics and animal adaptation.

**UNIT-II: Wildlife management and conservation:** Bird migration and conservation. Different capturing technique of avian and mammal categories - **Evaluation of Wildlife habitat:** Reconnaissance type technique – vegetative analyses techniques. Convention on wetlands of International Importance (Ramsar convention). Climate changes and wildlife conservation – *in situ* and *ex situ* methods.

**UNIT-III: Sanctuary, National park and Zoo:** Aim and management of Sanctuaries, National parks and Zoos. Brief account of Mudumalai, Periyar Tiger reserve, Point Calimere, Vedanthangal wildlife sanctuary, Barathpur Kealadeo, Silent Valley, Kaziranga and Gulf of Mannar National parks. Project Tiger- aims and tiger reserves. Project elephant – aims and elephant reserves - Corridor protection - Biosphere reserves.

**UNIT-IV: Population Estimation:** Direct count (Total counts, Drive counts, Transect methods, block count) - Indirect counts (play back, track count, pellet count, pugmark, camera trap) – Mark-recapture method.

**UNIT-V: Wildlife Health:** Importance of wildlife health management. Major diseases of wild animals (Anthrax, Foot and Mouth Disease, Rabies, Tuberculosis, Yellow fever). Wildlife Forensics and postmortem examinations. Captive Breeding of Wild Animals. Community participation in wildlife management. Wild life Trade & legislation. Salient features of Indian wildlife protection act (1972). Role of governmental and non-governmental organizations in wildlife conservation: IUCN, FAO, UNDP, WWF, BNHS, SACON.

**Book for References:**

1. Dasmann, R.F. 1964. *Wildlife Biology*, John Wiley and Sons Newyork. P 231.
2. Giles, R.H.Jr. (Ed.). 1984. *Wildlife Management Techniques* 3<sup>rd</sup> edition. The Wildlife Society, Washington. D.C. Nataraj Publishers, Dehra Dun. India. P 547.
3. Robinson, W.L. and Eric, G. Bolen, 1984. *Wildlife Ecology and Management*. Max Millan Publishing Co, New York. P 478.
4. Rodgers, W.A. 1991. *Techniques for Wildlife census in India – A field Manual: Technical Manual – TM – 2*. WII.
5. Saharia, V.B. 1982. *Wildlife of India*, Nataraj Publishers, Dehra Dun, P 206.
6. Teague, R.D. (Ed.). 1987. *A manual of wildlife conservation*. The wildlife Society, Washington. D.D.Nataraj Publisheers, Dehra Dun, P 206.

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P. G. DEPARTMENT OF ZOOLOGY  
M.Sc., ZOOLOGY – SEMESTER - III  
CBCS: 2015-2016  
CORE COURSE

CC- VIII: RESEARCH METHODOLOGY AND BIOTECHNIQUES

6 Hours : 5 Credits

Course Code: 15PZ311

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**Objectives:**

The main aim of this paper is (Unit I) to give information about how to write/publish a thesis and its basic steps. Other units are dealing with microtechniques, immunotechniques and tissue culture techniques. The Unit V gives information about cryotechniques.

**UNIT I: Research Methodology:** Concept of Scientific research – selection of a research problem – Research design – sampling methods – Hypothesis and null Hypothesis – Data collection – Making observation and records. Preparation of index and reference cards. Reference collection – Refereed journals, Impact factor, Citation index –H-factor. Components of thesis- Preparation of scientific paper for publication in a journal. Internet and e-journals. Using computers in research – Computer aided techniques for data analysis, data presentation. Power point slide preparation.

**UNIT II: Model organisms:** Culture and Maintenance of Hydra, C. elegans, drosophila, xenopus, zebra fish, rat, mouse. *In vitro* cell lines culture and maintance Design and functioning of tissue culture laboratory – CPCSEA regulations- animal ethics.

**UNIT III: Microtechniques :** Permanent mounting: Narcotization and killing – fixing – washing – processing – staining – mounting – labeling. Histological preparation of tissues for SEM and TEM. Microphotography principles and applications. Detection of molecules in living cells, *in situ* localization by techniques such as FISH and GISH.

**UNIT IV: Instrumentation:** Structure and function of microscope - spectrophotography – centrifuge — chromatography – TLC – pH meter – laminar air hood - Electrophoresis techniques – Gel electrophoresis – PAGE – Two dimensional gel electrophoresis. GCMS – LCMS.

**UNIT V: Cell proliferation measurements** – Cell viability testing – Culture media preparation. Types of culture: – Flask, Test tube, Organ and Embryo culture. Protoplast culture. Stem cell culture – Cloning techniques - Dolly. Cryopreservation: Cryopreservation for cells, tissues and organisms. Cryotechniques for microscopy. Freeze drying for physiologically active substances. Germplasm storage: Cryobank – Pollen bank, sperm bank. Biosensors and biochips – Applications.

**Book for References:**

1. Anderson, Dunston and Pole. 1970. Thesis and Assignment writing. Wiley Eastern Ltd., New Delhi.
2. John, R.W and Masters, D. 2000. Animal cell culture. A practical approach. IRC Press.
3. Sathyanarayana, U. 2006. Biotechnology. Books and Allied (P) Lit. India.
4. Dubey, R.C. 2001. A text book of biotechnology, Rajendra Printers, New Delhi.
5. Gurumani, N. 2006. Research methodology for biological science, MJP Publishers, Chennai, P 753.
6. Das, H.K. 2005. Text book of biotechnology (second edition). Wiley Dreamtech India Pvt Ltd., New Delhi. P 149.
7. Ignacimuthu, S. 1996. Basic Biotechnology. Tata McGraw – Hill publishing company Limited, New Delhi.

**M.Sc., ZOOLOGY – SEMESTER - III**  
**CBCS: 2015-2016**  
**CORE COURSE**

**CC -IX: BIOSTATISTICS AND BIOINFORMATICS**

6 Hours : 5 Credits

Course Code: 15PZ312

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**Objectives:**

The aim of this paper is to know the statistical problems in biological science which is useful for the students for their research works. Through bioinformatics the various bio techniques may be obtained for further research.

**BIOSTATISTICS**

**UNIT I: Basic Concepts of Biostatistics:** Introduction to statistics – sampling and sampling design - Collection of data – personal interview – Indirect oral interview – Correspondence – Questionnaire – Experiments – Census- Sampling – primary and secondary data – Classification of data – Types of Classification – Methods of classification. Tabulation – Frequency distribution – Graphic and Diagrammatic presentation of data.

**UNIT II: Descriptive statistics:** Arithmetic mean, median, mode, range – Standard deviation – Standard error - Co-efficient of variations – Probability distribution – Binomial and Poisson distribution, Normal distribution - chi- square and goodness of fit test. Estimation and testing of hypotheses; Tests of significance: Z test, t test, F test, Chi-square test, ANOVA (one way and two way), multi-variate analyses.

**UNIT III: Analytical Statistics:** Analysis of variance – Single and two way analysis of variance – Regression - simple Linear regression – Correlation analysis: Karl – Pearson’s and Spearman’s Rank. SPSS Applications. Distance programme for population estimation.

**BIOINFORMATICS**

**UNIT IV: Basics of internet – Biological /Specialized Databases - Analysis of DNA and Protein sequences – Protein and Nucleic Acid sequence Databases – PIR, SwissProt, GenBank; Pattern and motif searches – BLOCKS, Pfam; Servers for Bioinformatics**

(NCBI, EBI, Genom) Virtual Library - Data mining - Data Warehousing Structural Databases – PDB; Classification, alignment and analysis – SCOP, CATH, FSSP.

**UNIT V: Alignment and Algorithms:** Sequence alignment– Local and Global alignment concepts – dynamic programming methodology – Needleman and Wunsch algorithm, Smith – Waterman algorithm - Multiple sequence alignment – Progressive alignment – Databases searches for homologous sequences – FASTA and BLAST. Scoring matrices PAM and BLOSUM. Gene finding - Protein prediction - Biomolecular visualization.

**Book for Study:**

**Biostatistics**

1. Daniel, W.W. 2000. Biostatistics - A foundation for analysis in the Health science. John Wiley and sons, New york.
2. Sokal, R.R. and Rohlf, F.J. 2000. Biometry. Freeman, San Francisco.
3. Zar, J.H. 2003. Biosatistical Analysis. Person Edition Asia, New Delhi.

**Bioinformatics**

1. Arthur M.L., 2003. Introduction to Bioinformatics. Oxford University press, New Delhi.
2. Baxevanis, A. and Ouellette, B.F. 1998. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. Wiley Interscience, Hoboken, NJ, USA.
3. Durbin, R., Eddy, S.R., Krogh, A and Mitchison, G. 1998. Biological sequence Analysis. Cambridge University. Press, Cambridge, UK.
4. Higgins, D. and Taylor, W. 2000. Bioinformatics: Sequence, structure and Databanks. Oxford University pres, New Delhi.
5. Claverie, J.M and Notredame, C. 2006. Bioinformatics – A beginner’s Guide. Wiley India Pvt. Ltd. New Delhi.
6. Lesk, A.M. 2005. Introduction to Bioinformatics. Oxford University Press. New York.
7. Mount, D. 2001. Bioinformatics: Sequence and Genome analysis. Cold Spring Harbor Laboratory Press. New York.

**M.Sc., ZOOLOGY – SEMESTER - III**

**CBCS: 2015-2016**

**CORE COURSE**

**CC - X: BIOCHEMISTRY**

6 Hours : 5 Credits

Course Code: 15PZ313

**Objectives:**

The objective of the Biochemistry course is to provide a basic approach to biochemistry. This paper gives information about molecules structure and function (Unit I to V).

**UNIT I:** Carbohydrate: Classification-Monosaccharides – general structure and properties; oligosaccharides; Polysaccharides; structure and properties of functional groups. Carbohydrate metabolism – Glycolysis – oxidative phosphorylation - citric acid cycle – electron transport – HMP path way.

**UNIT-II:** Amino acids and Peptides: Amino acids - Structure, classification, properties. Amino acid metabolism – transamination– nitrogen excretion. Peptides- types. Protein: Protein configuration – classification – properties. Synthesis of polypeptides. Principles of isolation and purification.

**UNIT III:** Lipids: Classification, properties – saturated and unsaturated fatty acids – plant waxes, steroids, cholesterol and lecithin. Lipid metabolism - oxidation and biosynthesis of even chain fatty acids (oxidation), unsaturated fatty acids and odd chain fatty acids.

**UNIT IV:** Enzymes: Classification, thermodynamics - Kinetics, Co-factors, coenzyme A. Enzyme inhibition, Enzyme substrate compounds in living cells – factors affecting enzyme activities. Biological functions – industrial applications.

**UNIT V:** Vitamins and minerals: Fat soluble vitamins – occurrence – structure – properties- deficiency; water soluble vitamins – occurrence – structure – properties – deficiency and diseases. Minerals - medical and biological importance.

### **Book for References:**

#### **TEXT BOOKS**

1. Lehninger, L. 1993. Principles of Biochemistry CBS publishers and distributors, New Delhi.
2. Stryer, Lubert, 1975. Biochemistry W.H. Freeman & Company, San Francisco.

#### **REFERENCE BOOKS:**

1. Frunton J.S. & S. Simmonds, G. General and R.H. Dol. 1987. Outlines of Biochemistry, John Wiley & Sons.
2. Baldwin, E. 1964. An introduction to comparative Biochemistry, CUP, London.
3. Jain, J.L. 2003. Fundamentals of Biochemistry, S. Chand & Compnay Ltd. New Delhi.
4. Freifelder, D. 1993. Physical Biochemistry. W.H. freeman and company. New york.
5. Mallikarjuna Rao. 2006. Medical biochemistry. New Age International publishers, New Delhi.
6. Voet. G. 1989. Biochemistry. John Wiely and Sons, Inc.
7. Dubay, G. 1989. Biochemistry. Mac Millan publishing company, New York.

**M.Sc., ZOOLOGY – SEMESTER -III**  
**CBCS: 2015-2016**  
**CORE COURSE**

**CC – XI: PRACTICAL (COVERING CC-VIII to CC-X)**

6 Hours : 4 Credits

Course Code: 15PZ314L

**I. Research methodology and Biotechniques**

1. Preparation of index and reference cards.
2. Power point presentation.
3. Buffer preparation – phosphate and acetate, citrate and Tris-HCL
4. Agrose Gel Electrophoresis (AGE) to detect DNA.
5. Preparation of different media of animal tissue culture.
6. Microtechniques – slide preparation
7. Assay of cell viability

**Spotters:**

- i. Electrophoresis
- ii. Microtome
- iii. Quebec colony counter
- iv. Buffer
- v. Eosin stain
- vi. Haemotoxylin stain

**II. Biostatistics and Bioinformatics**

Biostatistics

1. Problems relating to test of significance (Chi - square test and t - test)
2. Problems relating to correlation, regression and ANOVA.

Bioinformatics

1. Familiarization of biological and bioinformatics web sites.
2. BLAST search for similar nucleotide sequences

**III. Biochemistry**

1. Preparation of solution- molar, millimolar, micromolar and nanomolar; solutions of normality and percentage.
2. Determination of pH using pH meter.
3. Preparation of standard graph using Spectrophotometer.
4. Chromatographic techniques:
  - a. Paper Chromatographic technique to separate amino acids.
  - b. Thin layer chromatographic technique to separate lipids
5. Quantitative estimation of amino acid, protein, carbohydrate and lipid in animal tissues.
6. To isolate the Casein from milk.



7. To determine the iodine value for different fat/lipid samples
8. Ammonium sulphate precipitation of protein

**Spotters:**

Thin layer chromatography, paper chromatography, silica gel, spectrophotometer, Centrifuge.

**M.Sc., ZOOLOGY – SEMESTER - III**  
**CBCS: 2015-2016**  
**CORE ELECTIVE COURSE - III**  
**CEC-IIIa: APPLIED BIOTECHNOLOGY**

6 Hours : 4 Credits

Course Code: 15PZ315a

**Objectives:**

The main aim of this paper is to give information about applied biotechnology among students. All units are more informative and essential for student's lab and research work.

**UNIT I: Industrial Biotechnology:** Industrial microbial products-fermentation products- Microbial biomass and single cell proteins. Cell and Enzyme immobilization. Biofuels- Production of ethanol, Biogas, Biodiesel and Methane. Production of enzymes-Amylase, Protease and Lactase. Production of alcoholic beverages.

**UNIT II: Microbial and Environmental Biotechnology:** Introduction- Waste treatment system- Aerobic and anaerobic waste treatment. Biodegradation – Microorganisms in pollution control. Bioremediation – MEOR. Biomass as a renewable source of energy. Production of hydrocarbons and hydrogen fuel- Bioplastics.

**UNIT III: Agricultural Biotechnology:** Introduction – Micropropagation-protoplast culture- Micro propagation technique for production of disease resistant plants – Nitrogen fixation- transfer of nif genes – Bio fertilizers –mass production of BGA, VAM Rhizobium culture. Biopesticides. Transgenic plants. Genetically engineered crops. Mushroom culture.

**UNIT IV: Pharmaceutical Biotechnology:** Production of Antibiotics, Vaccines- Bacterial and Viral. Steroids. Hormones, Interferon and interleukins. Production of human insulin. Disease Diagnosis. Gene therapy and Transplantation therapy.

**UNIT V: Intellectual Property Rights:** IPR Patent- Patenting of biological material- international convention and cooperation- Obligation with patent applications- Implication of patenting. Patents for higher plants and animals. Patenting transgenic organisms, isolation gene and DNA sequences- Currents of patenting. Plant breeders and farmers rights.

**Reference books for study**

1. Chopra, V.L and Nanin, A. 1992. Genetic Engineering and Biotechnology. Oxford and IBH Publishing Company, New Delhi.

2. Copping, G and Rodgers, P. 1986. Biotechnology. Oxford and IBH Publishing Company, New Delhi.
3. Dubey, R.C. 1993. A textbook of Biotechnology. S. Chand and Co.Ltd., New Delhi.
4. Gustafon, J.P. 1984. Gene Manipulation in Plant Improvement. Plenum Press, New York.
5. Ignacimuthu, S. 1996. Basic Biotechnology, Tata McGraw- Hill Publishing Company Limited, New Delhi.
6. Lewin, B. 1990. Gene IV. Oxford University Press. Oxford.
7. Marx, J.L., 1989. Reevaluation in Biotechnology. Cambridge University Press, Cambridge.
8. Old R.W. and Primrose, S.B. 1985. Principles of gene manipulation. An Introduction to Genetic Engineering. Oxford Blackwell Publishers, London.

**M.Sc., ZOOLOGY-SEMESTER III**  
**CBCS: 2015-2016**  
**CORE ELECTIVE COURSE - III**  
**CEC-IIIb: GENETIC ENGINEERING**

6 Hours : 4 Credits

Course Code: 15PZ315b

**Objectives:**

To know the DNA modification and mode of cloning, treatment of genetic disorders and gene transfer technology.

**UNIT-I: Introduction to Genetic engineering:** Molecular structure of DNA (genetic material), upstream, down stream. Gene cloning – the basic steps. Molecular Tools and their application. Cutting and Joining of DNA – Restriction enzymes – Type- I,II and III – DNA Ligases – Linkers, adaptors, homopolymer tails. Cloning and expression Vectors: Plasmids, phages, cosmids, viruses, transposons, YAC, BAC, PAC and MAC; binary and shuttle vectors; expression vectors for high level of cloned genes.

**UNIT-II: Gene transfer technology (bacteria, plant and animals):** Ca-Mediated transfection, Particle bombardment, Microinjection, Electroporation and Lipofection. Selection and screening of transformants:– Insertional inactivation – genetic complementation, immunological screening, hybridization technique and designing molecular probes. Expression strategies: Expression in bacteria, yeast, mammalian cells and plants.

**UNIT-III: Basic Techniques of genetic engineering:** Isolation and purification of nucleic acids – Cellular DNA, Plasmid DNA, mRNA and c-DNA. Isolation of chromosomes – Fluorescence-activated cell sorting – collection of chromosomes with identical sizes. Blotting techniques – Southern, Western and Northern blotting – methods and applications.

**UNIT-IV: DNA Sequencing:** Chemical cleavage and dideoxy methods, automated sequenced method. Chemical synthesis of DNA. Gene Probe – molecular finger printing (DNA Finger Printing) – RFLP, RAPD and AFLP techniques. Purification and refolding, characterization and stabilization of proteins.

**UNIT V: Genetic engineering in Human welfare:** Fermentation production of amino acids- antibiotics – vitamins -enzymes. Biofuels- Production of ethanol –Biodiesel and Methane. Biogass. Genetic engineering in Environment. Biodegradation-Microorganisms in pollution control. Bioremediation - MEOR. Biomass as a renewable source of energy. Risks, Ethics, patenting and property rights.

**Book for References:**

1. Old R.N. and S.B. Primrose. 1996. Principles of Gene manipulation. Blackwell scientific publication.
2. Watson, J.D. Gilman, M. Witkowski, Zollu, M. 1992. Recombinat DNA scientific American books.
3. The molecular biology of the Gene – J.D. Watson et al. Benjamin Cummings.
4. Glick. B.R and Pasteric Jack, J. 2001. Molecular biotechnology A.S.M press London.
5. Chopra, V.L and nanin, A. 1992. Genetic engineering and biotechnology. Oxford and IBH publishing company, New Delhi.
6. Dubey, R.C. 1993. A text book of biotechnology. S.Chand and Co Ltd, New Delhi.
7. Lewin, B. 2000. Genes X. Oxford university press, New York.
8. Marx, J.L. A revolution in biotechnology. Cambridge university press. Cambridge.
9. Das, H.K. 2005. Text book of biotechnology (second edition). Wiley dreamtech India Pvt Ltd, New Delhi. P 149.

**M.Sc., ZOOLOGY – SEMESTER - III**  
**CBCS: 2015-2016**  
**CORE ELECTIVE COURSE - III**  
**CEC- IIIc: NANOBIO TECHNOLOGY**

6 Hours : 4 Credits

Course Code: 15PZ315c

**Objectives:**

The main aim of this paper is to give information about nanbiootechnology among students. To encourage the students to take nanobiotechnology as their career as it provides ample scope for bright feature. All units are more informative and essential for student’s lab and research work such as synthesis of nonmaterial in different ways.

**UNIT I: Fundamentals and overview of Nanoscience:** History of nanotechnology - Definitions and scaling. Properties at nanoscale (optical, electronic and magnetic). Metal and Semiconductor Nanomaterials, Quantum Dots, Wells and Wires, Bucky balls and Carbon Nanotubes.

**UNIT II: Nanomaterials:** Introduction-Biocompatibility – anti bacterial activity – principles involved – Biomaterial nanocircuitry; Neurons for network formation. DNA nanostructures for mechanics and computing

**UNIT III: Biomedical Applications:** Nanoparticles in Drug delivery - Nanotechnology in Diagnostics applications: Biochipsanalytical devices, Biosensors- Natural nanocomposite systems as spider silk, bones, shells; nanomaterials in cancer treatment.

**UNIT IV: Nanobiotechnology and Environment:** Application of nanotechnology in Green energy, sustaining Natural resources, Global climate changes. Nanotechnology and energy production: Fuel Cells — applications in power and transportation.

**UNIT V: Nano Toxicology:** Nanomaterials in Environment - Toxicology of Airborne and Manufactured nanomaterials in the environment - Nanoparticles and Living Organisms: Portals of entry and target tissues- Mechanisms and Health Effects - Risk assessment – Ethical – Legal and Social Implications.

### References

1. Nanotechnology by Mark Ratner and Daniel Ratner, Pearson Education.
2. Nanomaterials by A.K. Bandyopadhyay; New Age International Publishers
3. Hari Singh Nalwa, “*Nanostructured Materials and Nanotechnology*”, Academic Press, 2002.
4. Yuliang Zhao and Hari Singh Nalwa, ‘Nanotoxicology: Interactions of Nanomaterials with Biological Systems, American Scientific Publishers, 2007
5. "Nanotoxicology - Interactions of Nanomaterials with Biological Systems", Ed Yuliang Zhao and Hari Singh Nalwa, June 2006
6. Springer handbook of nanotechnology by Bharat Bhushan
7. MEMS and nanotechnology – Based sensors and devices communication, Medical and Aerospace applications - A.R.Jha.

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**P. G. AND RESEARCH DEPARTMENT OF ZOOLOGY**  
**M.Sc., ZOOLOGY – SEMESTER - IV**  
**CBCS: 2015-2016**  
**CORE COURSE**

**CC - XII: ENVIRONMENTAL BIOLOGY AND TOXICOLOGY**

6 Hours : 4 Credits

Course Code: 15PZ416

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**Objectives:**

The main aim of this paper is to give information about the environment of biotic and abiotic factors. The Unit II deals with pollution and their control measures. Unit III deals with different instrumentation. Unit IV-V deals with toxicant related with environment. The aim of this paper is to know the toxic effects in different fields and the structure and to find out the environmental pollutants.

**ENVIRONMENTAL BIOLOGY**

**UNIT I: Abiotic factors:** Water, soil, light. Biotic factors; Intra (Aggregation, colony formation, social organization) and inter specific associations (Neutralism, symbiosis and antagonism). Structure and function of an ecosystem: - Autotrophic and heterotrophic producer, consumer - pyramids - primary productivity - methods of measurements - different trophic level - energy flow in an ecosystem - food chain - food web - characteristics of different biomes - adaptations of animals living in deserts and caves - Population ecology and biological control.

**UNIT II: Environmental Pollution:** Effects and control measures of Air, Water, Soil, Marine pollution. Acid rain, Ozone layer depletion. Bio accumulation – Bio magnification, BOD, COD, TDS, TSS. EIA – Steps in EIA – Methods of EIA. Acute toxicity – Chronic toxicity – Assessment of safety/risk. Natural resources - sustainable development – survey. Energy resources - environmental quality standards – soil conservation - bioremediation of toxic substances.

**UNIT III: Remote sensing and instrumentation:** Remote sensing, Satellite image – Aerial photography – Thermal and infra red images, radar in ecological applications. Instrumentation – GPS, radio telemetry and satellite telemetry techniques used in ecological research. GIS techniques in ecological research.

**TOXICOLOGY**

**UNIT IV: Scope of toxicology:** types of toxins - Pesticide toxicity: Pesticides and their types – Insecticides – Herbicides – fungicides – rodenticides – nematicides – fumigants. Properties and effects of pesticides on organisms – acute and chronic effects, biological monitoring and regulation.

**UNIT V: Toxicological methods:** Acute, sub-acute chronic and special tests. Statistical concept of toxicity - Concentrations. Response relationship – Margin of safety, Toxicity

curve, Cumulative toxicity, and toxicity of chemical mixture.  $LC_{50}$ , – Storage and excretion.

**Book for References:**

**Environmental Biology**

1. Ahmad, Y.J and Sammy, G.K. 1985. Guidelines to Environment Impact Assessment in developing countries. Hodder and Stoughton Ltd., London.
2. Asthana, D.K and Asthana, M. 2001. Environment problems and solutions. S. Chand and Co., New Delhi.
3. Chapman, B.C and Reigs. M.J. 1997. Ecology principles and application. Cambridge University Press, U.K.
4. Clark, G.C. 1963. Elements of ecology. John Wiley and Sons Inc., New York.
5. Odum, E.P. 1996. Fundamentals of Ecology (III Ed.). Nataraj Publishers, Dehradun. P 574.
6. Trivedi, P.R and Gurdeepraj, K. 1992. Environmental biology. Akashdeep Publishing House, New Delhi.
7. Kumar, H.D. 1997. Modern concepts of ecology. Modern Printers, New Delhi. P 478.

**Toxicology**

**Book for study:**

1. Srivastava, R.P. and Saxena, R.C.1989. Textbook of Insect toxicity. Himansha publications, Rajasthan.
2. R.T.Williams. 1959. Detoxification mechanisms. Wiley. New York.
3. O'Brien, R.D. and Yamamoto, I. 1970. Biochemical Toxicity of Insecticides. Academic Press. New York.
4. Corbett, J.R.1974. The Biochemical mode of Action of pesticides. Academic Press. New York.
5. Sood, A.1999. Toxicology. Sarup & Sons. Darya Ganj. New Delhi.

**M.Sc., ZOOLOGY – SEMESTER - IV**

**CBCS: 2015-2016**

**CORE COURSE**

**CC – XIII: MICROBIOLOGY AND IMMUNOLOGY**

6 Hours : 5 Credits

Course Code: 15PZ417

**Objectives:**

The main aim of this paper is (Unit I to III) to obtain knowledge about microorganisms, and their existence in different environments. The role of microorganisms will be discussed. The Unit IV – V deals with different immunological techniques and different immune system in our body.

**UNIT-I: Introduction to microbiology:** Scope of microbiology – Structure and physiology of bacteria and virus. Culture of microorganisms: Methods of collection of samples –microorganism in soil, water and air – isolation and identification of bacteria. Methods of sterilization and disinfection: Microbial control – physical and chemical. Techniques of pure culture: method of cultivation of bacteria – phases of growth –

influence of environment on bacteria – nutritional requirements of heterotrophic bacteria. Environmental Microbiology – role of microbes in Environment protection and Management.

**UNIT-II: Applied microbiology:** Microorganisms in agriculture – Microorganisms in industry - Microbes of milk and food - methods of detection, pasteurization and food poisoning; food preservation. Application of microorganism in biotechnology.

**UNIT III: Medical microbiology:** Microbes as pathological agent in man: Bacterial and viral Infections of the respiratory system – digestive system – Urinogenital system. Microbial technology: Vaccine – types, vaccination and schedule - single cell protein production – organic acid (acetic acid) - production of antibiotics – microbial toxins – vitamins.

## IMMUNOLOGY

**UNIT-IV: Immunity:** Basis of immunity – Types; Immune system – Cells of the immune system: b-lymphocytes, T-lymphocytes – subsets, third population of lymphocytes – polymorphonuclear cells and macrophages; lymphokines.–  $\beta$  and T Cell maturation, differentiation and activation.  $\beta$  and T cell receptors. Antigen and antibody: Reactive and receptor sites – Immunoglobulin – structure, synthesis and function – genetic mechanism in the generation of antibody and diversity - Antigen-antibody reaction. Complement system: Salient features and biosynthesis of complement.

**UNIT-V: Immunopathology:** Hypersensitivity – types; Major Histocompatibility complex (MHC) and its significance. Immunological disorders: Immunodeficiency diseases - Transplantation immunology – types of graft – mechanism of allograft rejection. Immunotechnology: Active immunization – passive immunization – immunological techniques – RIA, RIST, RAST; EIA and ELISA.

### Book for References:

#### Microbiology

1. Ananthanarayanan, T. and Paniker. J.C.K. 2000. Text Book of Microbiology. Orient Longman Ltd. Madras.
2. Pelczar M.J. Reid, R.D. and Chan, E.C.S. 1996. Microbiology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. Ingraham, J.L. Ingraham, C.A. 2004. Introduction to Microbiology (3<sup>rd</sup> edition) . Thomson, UK.
4. Dubey, R.C. and Maheshwari, D.K. 2005. A Textbook of microbiology. S. Chand & Co. New Delhi.

#### Immunology:

1. Gupta, S.K. 1999. Immunology. Narosa Publishing House, New Delhi.
2. Ivan Roit. 1994. Essential immunology. Blackwell Scientific publication, New York.
3. Weir, D.M. and Stewart, J. 1997. Immunology, 8<sup>th</sup> edition. Churchill Livingstone, New York.
4. George Pinchuk. 2004. Immunology. Tata McGraw Hill publishing co. Ltd. New Delhi.

**M.Sc., ZOOLOGY – SEMESTER -IV**  
**CBCS: 2015-2016**  
**CORE COURSE**

**CC- XIV: PRACTICAL (COVERING CC-XII & CC-XIII)**

6 Hours : 4 Credits

Course Code: 15PZ418L

**I. Environmental Biology and Toxicology**

**Environmental Biology**

1. **Adaptation of selective sandy, muddy and rocky shore fauna.**
2. **Estimation of hydrological parameters: Chlorides, Silicates, Calcium, Total Hardness, Phosphates, Nitrate, Nitrite, Dissolved Oxygen, Dissolved CO<sub>2</sub>, Hydrogen sulphide, BOD, COD and TDS.**
3. **Quantitative and Qualitative estimation of plankton.**
4. **Calculation of diversity indices: Species diversity, Species dominance, Species richness and Species evenness.**

**Spotters:** Sandy shore fauna (amphioxus, balanoglossus, albunea, hippa, arenicola, limulus); muddy shore fauna (nereis, Aphrodite, gelasimus crab, star fish, ascidian, boleophthalmus); rocky shore fauna (sea anaemone, zoanthus, balanus, chiton, mytilus, patella).

**Toxicology**

1. **LC<sub>50</sub> determination of bionanomaterials using mosquito larva.**
2. **Impact of bio nanomaterial against microbes by agarwell diffusion method.**
3. **Impact of bionanomaterial against microbes using MIC determination for bacteria/fungus Phytotoxicity evaluation of bio nanomaterial.**

**Spotters:** toxicity curve, BHC, DDT

**II. Microbiology:**

1. **Culture of bacteria**
2. **Bacterial colony counting**
3. **Bacterial growth curve**
4. **Simple and gram staining technique**
5. **Estimation bacterial from soil and water using plate count or serial dilution.**
6. **Biochemical identification of micro organisms.**

**Spotters:**

- i. Growth curve
- ii. Inoculation hood
- iii. Inoculation loop



- iv. Gram positive bacteria (slide)
- v. Gram negative bacteria (slide)
- vi. Autoclave

**Immunology:**

1. Identification of lymphoid organs in rat.
2. Heam – agglutination test.
3. Widal slide test (kit method)
4. Ammonium sulphate precipitation of proteins.
5. Immuno diffusion test.

**Spotters.**

- i. Lymphoid organs (model)
- ii. Immunoelectrophoresis
- iii. ELISA reader
- iv. Gel cutter

**M.Sc., ZOOLOGY – SEMESTER -IV**  
**CBCS: 2015-2016**  
**CORE ELECTIVE COURSE – IV**  
**CEC -IVa: AQUACULTURE**

6 Hours : 4 Credits

Course Code: 15PZ419a

**Objectives:**

The main aim of this paper is to give information about the culture of fishes and crabs with different procedures. It gives an idea for the self employment opportunities to the students. The Unit V deals with role of different research organizations and funding agencies on aquaculture.

**UNIT-I: Introduction:** History of Aquaculture. Present status and scope of Aquaculture. Types of culture: General culture techniques- Extensive, semi intensive, intensive, pond culture. Age and growth - method of age determination. Fish nutrition – FCR, Energy Budget, Food and feeding habits of important cultivable species.

**UNIT-II: Pisciculture:** Selection of species- Biological characteristics, Design and Construction of aquaculture pond: Inland and coastal pond farms, pens and enclosures- hatcheries. Farm management. Harvesting methods: Crafts and Gears, Preservation, Transport and Marketing strategies. Management of ornamental fishes and aquarium.

**UNIT-III: Culture of Prawns, Crabs, Mussels:** Selection of species- Biological characteristics Design and Construction of aquaculture pond: Inland and coastal pond farms, pens and enclosures- hatcheries. Nutrition and feeds: Requirements and sources- live feeds - Artificial feeds. Reproduction: Reproductive cycle, induced breeding techniques, Preservation of Gametes, genetic selection and hybridization.

**UNIT-IV: Different culture:** Mono culture, poly culture, raceway culture and Integrated fish farming. **Health and diseases:** Nutritional disorders. Parasitic diseases: Bacterial, Viral, Fungal, Protozoan and Helminthic diseases. Predators and eradication of algal bloom.

**UNIT-V: Role of Organizations:** ICAR, CMFRI, CIFRI, CICFRI, CIFA, CIBA, CIFT & MPEDA Legal and environmental factors. Biotechnology in aquaculture: Genetic engineering methods- Genomic manipulation- Hybridization, Androgenesis, Gynandrogenesis and Polyploidy. Economical status in aquaculture case study (income benefit rate).

**Book for References:**

1. Jhingran.V.C. 1991. Fish and fisheries of India, Hindustan Pub. Cord. New Delhi.
2. Pillay, T.V.R. 1995. Aquaculture principles and practices. Fishing New Books, Blackwell Science Ltd., Oxford.
3. Shanmugam, K. 1990. Fishery biology and Aquaculture. Leo Pathipagam, Madras.
4. Santhanam, Sugumaran and Natarajan, P. 1997. A Manual of freshwater aquaculture. Oxford and IBH Pub. Co. Ltd., New Delhi.
5. Kurian,C.V and Sebastin. 1992. Prawn and prawn fisheries of India, Hindustan Pub. Cord. New Delhi.
6. Chadar, S.L. 1980. Hypophysation of Indian major carps. Satish Book Enterprise, Agra, PP.146
7. Exporters manual and Documentation. 1999. Jain Book Agency. New Delhi.

**M.Sc., ZOOLOGY – SEMESTER –IV**  
**CBCS: 2015-2016**  
**CORE ELECTIVE COURSE – IV**  
**CEC-IVb: ENDOCRINOLOGY**

6 Hours : 4 Credits

Course Code: 15PZ419b

**Objectives:**

This paper provides knowledge about whole body control mechanism by hormones and also provides diseases caused due to hypo and hyper secretion of hormones and treatment options for imbalanced hormonal functions.

**UNIT – I: Scope of Endocrinology:** Introduction, Objectives, aims and scope of endocrinology -Nature, function and classification of hormones – Hormones as messengers - Feedback control of hormone secretion- General principles of hormonal action – Experimental methods of hormone research.

**UNIT –II: Invertebrate Endocrinology:** Concepts of neurosecretion and neuroendocrine system in invertebrate and crustacean groups – Neuroendocrine system in insects – hormonal control of reproduction, metamorphosis and molding in insects.

**UNIT – III: Pituitary and Thyroid gland:** Pituitary gland- structural organization – secretions, biosynthesis and their functions – hypothalamic control. Thyroid gland – structural organization - function and biosynthesis of thyroid hormone – metabolic effects of thyroid hormone – Effects of thyroid hormone on growth and reproduction – Parathyroid gland – structural organization – secretions, biosynthesis and Parathyroid hormone functions.

**UNIT – IV: Pancreatic Islets and Adrenal Glands:** Structure of pancreatic Islets – functions of insulin and glucagon – Diabetes. Adrenal gland – structural organization, functions of adrenal hormones – mineralocorticoids – glucocorticoids - Biosynthesis and regulations.

**UNIT – V: Reproductive Endocrinology:** Structure of mammalian testis and ovary – Male and female sex accessory organs – hormones of testis and ovary – Reproductive cycles (oestrus cycle and menstrual cycle) – Foeto-placental unit as an endocrine entry – hormonal regulation of pregnancy – parturition and lactation. Disorders of male and female reproductive systems – sexual dysfunction.

**Book for References:**

1. Barrinton, E.J.W. 1968. An introduction to general and comparative endocrinology. Academic press, New Delhi.
2. Bantley, P.J. 1985. Comparative vertebrate endocrinology. S.Chand and Co., New Delhi.
3. Mac Hadley, 1994. Endocrinology. Prentice Hall of India. New Delhi.
4. Michael, P. 1968. Endocrinology and human behavior. Oxford University press, New Delhi.
5. Turner, C.D. 1966. General Endocrinology. W.B. Saunders Co., London.
6. Vasantharaj David, B and T. Kumaraswami. 1996. Elements of economic entomology. Popular Book Depot Publishers. P 536.

**M.Sc., ZOOLOGY – SEMESTER -IV  
CBCS: 2015-2016**

**CORE ELECTIVE COURSE – IV  
CEC-IVc –MEDICAL PARASITOLOGY**

6 Hours : 4 Credits

Course Code: 15PZ419c

**Objectives:**

The main aim of this paper is to give information about life cycle and diseases caused by parasites in human being and also their effects and control measures (Unit I, III, IV and V). The Unit II provides information about human body immune system.

**UNIT I: Definition:** Human welfare – Careers in parasitology – Interaction of symbionts – Mutualism – Commensalism – Parasitism – Host – Parasites ecological niche – Adaptation for Transmission – Epidemiology. Protozoa: General characters – Morphology – Biology, Pathogenesis, diagnosis and treatment of *Entamoeba histolytica* – *Trypanosoma* – *Leishmania*, *Plasmodium*.

**UNIT II: Immunology and Pathology:** Susceptibility and resistance – Innate Immunity – acquired immunity – Innate defense mechanism – TNF – complement – Cellular defenses – Phagocytes – Antibodies – function in host defense – ADCC – T-Cell receptors – lymphocyte – cytokines – pathogenesis of parasitic infection – Accommodation and Tolerance in host – parasite relationship.

**UNIT III: Trematodes:** General characters – Morphology – Biology – Epidemiology-Pathogenesis – Diagnosis and treatment of *Schistosomes* – *Paragonimum*. Cestodes: Momozoic – Polyzoic – Biology – Pathogenesis – Diagnosis and treatment of *Taenia solium*.

**UNIT IV: Nematodes:** Historical aspects, general characters, life cycle, pathogenecity, diagnosis and treatment of *Ascaris*, *Ancylostoma*, *Wuchereria* and *Trichinella*.

**UNIT V: Parasitic Insects:** Lice as vector of human diseases: Trench and relapsing fever; General account on Lice, Bed bug, Ticks and Mites.

**Book for study:**

1. Rathanaswamy, G.K. 1986. A handbook of Medical Entomology and elementary Parasitology. Madras publishers, P . 265.
2. Park, K. 1995. Preventive and social medicine.

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### **BLUE PRINT OF THEORY QUESTION PAPER**

#### **External: Total 60 marks**

Section A = 15x1=15 marks

(Objective type model – fifteen questions should be asked and answer all the questions)  
Three questions should be asked from each unit.

Section B = 5x3=15 marks

Five questions - Either or type, two questions should be asked from each unit and answer all the questions.

(Problem or case study in any one of the questions should be asked and attended compulsory)

Section C = 3x10= 30 marks

Five questions, one question should be asked from each unit. Out of five three questions should be answered.

#### **Internal 40 Marks**

Assignment 10 marks; Test 10 marks; Seminar 10 marks and Rehearsal 10 marks)

### **BLUE PRINT OF PRACTICAL QUESTION PAPER**

#### **External: 60 marks**

- |                                   |            |             |
|-----------------------------------|------------|-------------|
| 1. Major Dissection or Experiment | (1x15=15)  | = 15 marks. |
| 2. Minor practical                | (2x10= 20) | = 20 marks  |
| 3. Spotters                       | (4x5=20)   | = 20 marks  |
| 4. Record                         |            | = 05 marks  |

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60 marks  
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#### **Internal: 40 marks**

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