

ZO 1819 - PHYLOGENY OF INVERTEBRATA AND CHORDATA

SEMESTER : I CREDIT : 04
CATEGORY : MC NO. OF HOURS / WEEK : 05

Objective : *To enlighten the origin, evolution, adaptive radiation and phylogenetic relationships of invertebrates and chordates.*

UNIT I: EVOLUTION OF INVERTEBRATES AND CHORDATES

Origin, ancestry and evolution of invertebrates and chordates-Geological time scale-living fossils-coelom-grades of symmetry-polymorphism- metamerism- cephalization- fossil records-ostracoderms and placoderms.

UNIT II: COMPARATIVE STUDY

Comparative anatomy of digestive, respiratory, exoskeletal, skeletal, circulatory, nervous and urinogenital systems of invertebrates and chordates-Locomotory organs and movements in invertebrates -Flight adaptations of birds-Placentation in mammals.

UNIT III: ADAPTIVE RADIATION

Adaptive radiation in Annelids and Molluscs – colonial and social life of Invertebrates- Adaptive radiation in Fishes, Amphibians, Reptiles, Aves and Mammals.

UNIT IV: PARASITES AND VECTORS

Parasitic adaptations and pathogenicity of *Entamoeba* , *Plasmodium* , *Fasciola* , *Taenia solium* , *Trypanosoma* , *Echinococcus* and *Ascaris*.

UNIT V: AFFINITIES AND SYSTEMATIC POSITION OF MINOR PHyla

Nemertinea, Rotifera, Bryozoa, Brachiopoda, Chaetognatha and Pogonophora.

SUGGESTED READING

1. Bhamrah, H.S and Junoja, K. 1999. A Text Book of Invertebrates. Anmol, New Delhi, 775pp.
2. Marshall, A.J and Williams, D.1974. Text Book of Zoology, Invertebrates. ELBS and MacMillan, 874pp.
3. Barrington, E.JW.1974. Invertebrate Structure and Function, English Language Book Society and Nelson, 549 pp.
4. Pough F.H., C.M. Janis and J.B. Heiser, 2002. Vertebrate Life, Pearson Education, Singapore, 699pp.
5. Young, J.Z.1969. The Life of Vertebrates, English Language Book Society and Oxford University,786pp.
6. Colbert, E.H., 1969. Evolution of the Vertebrates, Wiley Eastern, New Delhi, 504pp.
7. Hyman, L.H.1953. Comparative Vertebrate Life. The University of Chicago, Illinois, 536 pp.

ZO 1820 - SYSTEMATICS AND BIODIVERSITY

SEMESTER	: I	CREDIT	:	03
CATEGORY	: MC	NO. OF HOURS / WEEK	:	04

Objective: To realize the biodiversity potential of our country and to understand the principle and methods of nomenclature and systematics.

UNIT I: ECOSYSTEM DIVERSITY

Concepts on Biodiversity, Ecosystem of India, Species and genetic diversity, Biodiversity hotspots, Conservation plans and treaties, Wild Life Protection Act, 1972, Zoos, Sanctuaries, National Parks, Biosphere reserves and protected areas in India. Extinct, critical, endangered and vulnerable fauna of India, Biotechnological tools for conservation of biodiversity.

UNIT II: DIVERSITY OF TERRESTRIAL AND FRESH WATER ECOSYSTEMS

Wetlands, reserve forests, rain forests and desert plains in India and their faunal resources, animals of lotic and lentic ecosystems, Threats to wetlands and conservation. Rivers of India and their faunal diversity.

UNIT III: DIVERSITY OF MARINE AND MANGROVE ECOSYSTEMS

Coastal, coral reef, mangrove, sea grass and sea weed ecosystems and their faunal resources. Threats to marine biodiversity. Animals of lagoons and estuaries. Pelagic and benthic animal of the sea. Marine productivity.

UNIT IV: INTRODUCTION TO ANIMAL TAXONOMY

Importance of taxonomy, stages in taxonomy, problems of taxonomists. Morphological, embryological, ecological, behavioural, cytological, biochemical and numerical approaches in taxonomy. Differential systematics.

UNIT V: NOMENCLATURE AND TAXONOMIC TOOLS

Kinds of classification, phyletic lineages, components of classification, Linnaean hierarchy. Species concepts, Kinds of species, Origin of code, ICZN, zoological records. Collection methods, preservation of data, curating, storing and cataloging, methods of identification, description of taxonomic characters, taxonomic keys, taxonomic publication.

SUGGESTED READINGS

1. Agarwal, and U.Gupta, 2004. Animal Taxonomy, S. Chand, New Delhi. 86pp.
2. John Milton M C, 2008. (Ed) Training Manual on GIS and Marine Biodiversity, 320pp.
3. Kapoor V.C.1998. Theory and practice of animal taxonomy, Oxford and IBH, New Delhi, 247pp;
4. Negi, S.S. 1996 Biosphere Reserves in India: Land use, Biodiversity and Conservation. Indus, New Delhi.
5. Singh B. K, 2004. Biodiversity : Conservation and Management, Mangal Deep Publication, 586pp.
6. Sivramiah Shantharam and Jane F. Montgomery, 1999. Biotechnology, Biosafety and Biodiversity, Oxford IBH, 237pp.
7. Swaminathan, M.S and S. Jana. 1992., Biodiversity Mac Millian, Chennai, 326pp.
8. Traffic India, 1990. The Wild Life protection Act, 1972, 154pp.

ZO 1822 - ADVANCED DEVELOPMENTAL BIOLOGY

SEMESTER : I CREDIT : 04
CATEGORY : MC NO. OF HOURS / WEEK : 05

Objectives: To enhance an in-depth knowledge on animal and human embryonic development.

Unit I: BASIC CONCEPTS OF DEVELOPMENT

Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients, Cell fate and commitment – mechanism of developmental commitment-mosaic and regulative development – maintenance of differentiation pattern formation and compartments – morphogenesis – model organisms – developmental mutants- transgenic cells and organisms - cellular and microsurgical techniques.; cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development.

Unit II: GENES IN DEVELOPMENT

Gene expression and regulations – chromatin and DNA methylation –signal transduction- Nuclear transplantation – cellular differentiation- differential action- developmental genetic defects – role of cell death in development- Teratogenesis.

Unit III: EXTRA EMBRYONIC MEMBRANES AND PLACENTATION

Extra embryonic membranes in birds- yolk sac, amnion, Chorion, allantois- extra embryonic membranes in mammals – placenta of mammals-implantation –formation of placenta in Human- evolution and classification of placenta – yolk sac, placenta, allantoic placenta.

Unit IV: HUMAN EMBRYONIC DEVELOPMENT

Hormonal control of ovulation and pregnancy –development of germinal layers, foetal and maternal relationships- embryonic mutation – parturition – embryonic adaptation and the development of mammals. spermatozoa – Human embryo- Prenatal diagnosis.

Unit V: APPLICATION OF MODERN TECHNIQUES IN DEVELOPMENTAL BIOLOGY

Induced ovulation in humans- multiple ovulation and embryo transfer in cattle – embryo splitting – in vitro fertilization –IVF in cattle, IVF in Human cryopreservation – Prenatal diagnosis, human cloning and its ethical implications, embryo transfer, metamorphosis, regeneration & aging and developmental potential.

SUGGESTED READINGS

1. Subramanian, T. 2002. Developmental biology, Narosa publishing house, New Delhi.
2. Balinsky, B. I. 1981. An introduction to embryology, Saunders College Publishing, 5th Edition, New York.
3. Twyman, R. M. 2003. Developmental biology, Viva Books publisher, 1st edition , New Delhi.
4. Berril N.J. 1974 Developmental Biology. Tata Mc Grawhill, New Delhi.
5. Majumdar 1985 Text Book of Vertebrate Embryology. Tata Mc Grawhill, New Delhi

ZO 1823- HISTOCHEMISTRY AND MICROTECHNIQUE

SEMESTER : I CREDIT : 04
CATEGORY : MC NO. OF HOURS / WEEK : 05

Objectives: *To provide knowledge on cell and tissue architecture in normal and abnormal states, and application of diagnostic tool.*

UNIT I: CLASSIFICATION AND HISTOCHEMICAL TECHNIQUE FOR PROTEINS, CARBOHYDRATES AND LIPIDS

Proteins–Ninhydrin Schiff method (Amino groups), Sakaguchi method (Arginine). Carbohydrates –PAS reaction, Bauer-feulgen method (Glycogen); Lipids – Oil Red O method, Sudan black B method.

UNIT II: HISTOCHEMICAL TECHNIQUE FOR NUCLEIC ACIDS

DNA & RNA detection by Methyl Green-Pyronin method and Extraction by Brachet method.

UNIT III: MICROSCOPY, AUTORADIOGRAPHY AND ITS APPLICATIONS

Fluorescence microscopy, Electron microscopy, Scanning Electron Microscope, Transmission Electron Microscope, Autoradiography- working principle and preparation of sample.

UNIT IV: COLLECTION AND PREPARATION OF MATERIAL

Collection of soil micro arthropods - Whole mount - Dry mount of insects-Kill bottle-preparation of material-pinning, spreading and labelling.

UNIT V: TYPES OF MICROTOMES, IMPORTANCE OF MICROTECHNIQUE AND PREPARATION OF TISSUE

Paraffin Microtome, Cryostat, Ultra Microtome-Steps involved in tissue processing and Microphotography.

UNIT VI: A VISIT OF HISTOPATHOLOGICAL INSTITUTES AND MAINTENANCE OF RECORD

SUGGESTED READINGS

1. Patki, L.R. *et al.*, 1983. An Introduction to Microtechnique. S. Chand.
2. Pearse, A.G.E.,1970. Theoretical and applied – Vol I Churchill livingstone, New York.
3. Bruce Casselman, W.G. 1962. Histochemical technique. Butler and Tanners, London.
4. John D. Bancroft and Marilyn Gamble, 2008. Theory and Practice of Histological Techniques. Churchill Livingstone Elsevier.

**ZO 1824-INVERTEBRATA, CHORDATA AND DEVELOPMENTAL BIOLOGY
LAB COURSE**

SEMESTER : I CREDIT : 02
CATEGORY : MC (P) NO. OF HOURS / WEEK : 06

UNIT I: MAJOR DISSECTION

Crab--- nervous system , sepia--- nervous system , shark--- arterial and nervous system , frog--- arterial system , venous system and cranial nerves .

UNIT II: MINOR DISSECTION

Vaginulus—digestive system , reproductive system and nervous system , Prawn—nervous system , Frog--- spinal and sympathetic nervous system

UNIT III: MOUNTING

Mouth parts of honeybee , cockroach , millipede , housefly and mosquito

Placoid scales of shark

Brain of frog

UNIT IV: SPOTTERS

Systematic position :Centipede , holothuria , scorpion , amphioxus , narcine , ostracion , Anguilla , and syngnathus.

Mode of life :Porpita , nautilus , haliotis , mytilus , spirula , neries .poison apparatus of russels viper , uromastix , exocoetus , synapta , myxine , rhacophorus , and enhydrina .

Structural Modifications :Hippocampus , ambystoma , phrynosoma.

Ecological adaptations :Brain coral , brittle star , starfish , echinus , octopus , murex , chameleon , cobra , turtle , varanus , bat , draco .

Evolutionary importance : Balanoglossus , peripatus , limulus , chiton , axolotl larva

Parasitic adaptation : Ascaris , fasciola , taenia , cymathoa , sacculina .

Osteology: Frog—skull,pectoral and pelvic girdles and typical vertebra, Bird--- skull , palates in birds and synsacrum, Rat—skull, Calotes--- skull

Embryology: Chick embryo--24h, 48h, 72h , 98h , 11th day , 16th day and 21st day: Placenta of shark , sheep , goat and pig; Huma embryo

UNIT V: FIELD STUDY AND RECORD

SUGGESTED READINGS

1. Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut.
2. Ekambaranatha Ayyar and T.N.Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1,2) S.Viswanathan, Chennai.
3. Lal, S.S., 2005. A text Book of Practical Zoology: Vertebrate, Rastogi, Meerut.

ZO 2817 MOLECULAR CELL BIOLOGY

SEMESTER : II CREDIT : 05
CATEGORY : MC NO. OF HOURS / WEEK : 05

Objectives: To understanding the cellular and molecular basis of life processes.

UNIT I: MOLECULAR TECHNIQUES

Microscopy (Conventional and confocal), Cytological techniques, Ultracentrifugation, X-ray diffraction, Chromatography, Autoradiography, Electrophoresis, Blotting techniques, fluorescent activated cells, Cell Sorter, microplate high through put readers, Fluorescent in situ Hybridization (FISH) and Animal Cell / tissue culture-cell imaging.

UNIT II: CELLULAR ORGANIZATION

Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

Structural organization and function of intracellular organelles: Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.

Organization of genes and chromosomes: Operon, interrupted genes, gene families, structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin, transposons.

Cell division and cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle, and control of cell cycle.

UNIT III: FUNDAMENTAL PROCESSES

DNA replication, repair and recombination: Unit of replication, enzymes involved, replication origin and replication fork, extrachromosomal replicons, DNA damage and repair mechanisms.

RNA synthesis and processing: Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA, RNA transport.

Protein synthesis and processing: Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, translational proof-reading, translational inhibitors, post- translational modification of proteins.

Control of gene expression at transcription and translation level: Regulation of phages, viruses, prokaryotic and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing.

UNIT IV: CELL COMMUNICATION AND CELL SIGNALING

Host parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals, cell-cell fusion in both normal and abnormal cells.

Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial chemotaxis.

Cellular communication: General principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, neurotransmission and its regulation.

Cancer: Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

UNIT V: GENETIC ANALYSIS

Inherited genetic disorders in man, pedigree analysis, gene transfer for desired human behaviour, genetics of aging, human genome project, DNA finger printing, DNA from museum specimen, modern genetics and bioethics.

SUGGESTED READINGS

1. Ajoy Paul, 2011. Text books of cell & molecular biology, 3rd edition, Books & allied (P) Ltd., Kolkata, India.
2. George M. Malacinski, 2010. Essential of molecular biology, 4th edition, Narosa publication.
3. John t. Hancock, 2006. Cell signaling, 2nd edition, oxford University press.
4. Bruce, A *et al.* 2002 Molecular Biology of the Cell, IV edition, Garland, New York.
5. Watson, J.D, 2004. Molecular Biology of the gene. Pearson Education, New Delhi.
6. Stephns, D. 2006. Cell imaging, Scion publication.

ZO 2818 - APPLIED ENTOMOLOGY

SEMESTER	:	II	CREDIT	:	04
CATEGORY	:	MC	NO. OF HOURS / WEEK	:	04

Objectives: *This core paper has been designed to understand the biology of insects, insect pest management, Integrated Pest Management and biological control.*

UNIT I: AGRICULTURAL ENTOMOLOGY

Causes for insects assuming pest status, Biology, nature, extent of damage and control measures of insect pests of some important crops – paddy, sugarcane, cotton, groundnut, coconut, mango and tea - Locust and their control and insect pests of stored grains and their control measures.

UNIT II: VETERINARY ENTOMOLOGY

Cattle (horse fly, stable fly, cattle fly), Fowl (shaft louse and chicken flea), Sheep and Goat (head maggot and sheep ked).

UNIT III: MEDICAL ENTOMOLOGY

Mosquitoes, housefly, eye fly, sand fly, black fly, bed bug, assassin bug, flea, human body louse and head louse. Insects associated with household materials.

UNIT IV: PRODUCTIVE INSECTS

Apiculture - apiary, types of honey bees, selection of bees and location of apiary- sericulture - silkworm races, moriculture, rearing of silkworms and postcocoon processing.

UNIT V: PEST CONTROL

Classification of insecticides on the basis of their chemical nature, mode of entry and mode of action ; biological control of Insect pests, Integrated Pest Management and biopesticides – plant protection appliances - Field trips to Agricultural Institutes in and around Chennai.

SUGGESTED READINGS

1. Vasantharaj David, B 2001. Elements of Economic Entomology, Popular Book Depot, Chennai
2. Ministry of Agriculture, Government of India, 1995. Manual on Integrated Pest Management in Rice and Cotton
3. John William S., 1995. Management of Natural Wealth, Loyola College Publications, Chennai.
4. John William, S., 2007. Defeating The Public Enemy The Mosquitoes: A real Challenge, Loyola College Publications, Chennai.
5. Abishek Shukla, D 2009. A Hand Book of Economic Entomology, Vedams e Books, (P) Ltd. New Delhi.

ZO 2819 – IMMUNOLOGY

SEMESTER : II CREDIT : 04
CATEGORY : MC NO. OF HOURS / WEEK : 05

Objectives: *This core paper has been designed to understand the nature and components of defense mechanism of human body.*

UNIT I: BASICS OF IMMUNOLOGY

Introduction-historical perspective. Innate immunity (Non- specific), Adaptive immunity (Specific)- Humoral immunity, Cell mediated immunity.

UNIT II: CELL AND ORGANS OF IMMUNE SYSTEM

Cells of immune system- haemopoiesis, stem cells, lymphoid cells, mononuclear cells, granulocytes, mast cells, Dendritic cells. Organs of Immune system- primary lymphoid organs and secondary lymphoid organs.

UNIT III: ANTIGENS

Antigens immunogenicity vs. antigenicity, heptens. Factors influencing immunogenicity. Epitopes- B cells epitope and T cell epitope, immunity against protozoan, Fungi and bacteria.

UNIT IV: ANTIBODIES

Immunoglobulin- structure, isotypes and biological function. Immune response and theories. Antigenic determinant on immunoglobulin – isotype, allotype and idio type. B-cell receptor. Immunoglobulin superfamily, Monoclonal antibody, Organization and expression of immunoglobulin genes. Synthesis of immunoglobulin and disorder of immunoglobulin synthesis. Antigen – antibody interaction and immunodiagnostics. MHC- restriction. Organization and inheritance of MHC. Antigen processing and presentation.

UNIT V: MEDIATORS OF IMMUNE SYSTEM AND VACCINES

T cell receptors, cytokine, adhesion molecules, complement, hypersensitive reaction, Transplantation immunology. Vaccines schedule- principles and types of vaccines – DNA recombinant vaccines, serum therapy.

UNIT VI: IMMUNITY IN HEALTH AND DISEASE

Introduction to infectious disease, innate and adaptive immunity to infection, evasion of the immune response by pathogens; inherited immunodeficiency diseases, acquired immune deficiency syndrome; allergy and hypersensitivity- IgE and allergic reactions, hypersensitivity diseases; autoimmunity- responses to self antigens, transplant rejection- responses to alloantigens; manipulation of immune responses, vaccines; evolution of immune system- evolution of innate and adaptive immune system.

SUGGESTED READINGS

1. Immunology, David, Brostoff and Roitt, (7th Ed., 2006), Mosby & Elsevier Publishing, Canada, USA.
2. Roitt, I. M. 1994. Essential Immunology Blackwell Scientific, Oxford ISBN
3. Richard, A Golds Thomas J. Kindt and Barbara A. Osborn. 2000. Kuby- Immunology. Freeman and Co. New York.
4. Paul, W.E. 1989. Fundamentals of Immunology, Raver Press. New York.
5. Srivastava, R., Ram, B. P and Tyle, P. 1991. Molecular mechanism of Immune regulation. VCH Publishers. New York.
6. Fatima, D and N.Arumugam2005, Immunology. Saras, Nagercoil.

ZO 2820 - CELL AND MOLECULAR BIOLOGY LAB COURSE

SEMESTER : II CREDIT : 04

CATEGORY : MC(P) NO. OF HOURS / WEEK : 06

Objective: To provide hands-on training on techniques to explore cell and macromolecules of biological importance.

UNIT I : Measurement of nucleocytoplasmic index, culturing suspension and monolayer cells, trypsination procedure, cellular measurement using micrometers, cell culture.

UNIT II: *Drosophila* culture and maintenance, morphology and sex identification, mutants, Monohybrid and dihybrid crosses and sex linked inheritance. Mounting of salivary glands of *Drosophila/Chironomous* larva for observing giant chromosomes with banding and balbiani rings. Comparing blood smear of an invertebrate and chordate – Insect, Frog and human.

UNIT III: Metaphase chromosome preparation from mouse bone marrow cells/ fish gill cells and Karyotyping – Squash preparation of cockroach/ grasshopper testis/ mouse and observation of meiotic stages using plant/animal serum.

UNIT IV: Study of Mendelian traits in man and testing probability and chi square, using coin tossing and beads.

UNIT V: Permeability test using erythrocytes, Analysis of erythrocyte membrane lipids using Thin Layer Chromatography. Differential centrifugation of cell organelles and identification of mitochondrial fractions: Isolation and partial purification of DNA/ RNA/Plasmid. Demonstration of bacterial conjugation and mutation using mutagens. Chemical carcinogenesis in rat cell biopsy, normal and cancer cells, PCR (Visit to Cancer Institute/ Veterinary Research Center).

SUGGESTED READINGS

1. Gasque, E, 1992. A Manual of Laboratory experiments in Cell Biology. University of Wisconsin, Brown.
2. Hall, D and S. Kawkins, 1975. A Laboratory Manual of Molecular Cell Biology, English University, London.
3. Durairaj, G, 1998. A Laboratory Manual in Genetics. Emerald, Chennai.

ZO 2821 – IMMUNOLOGY AND BIOPHYSICS LAB COURSE

SEMESTER : II CREDIT : 03
CATEGORY : MC (P) NO. OF HOURS / WEEK : 04

Objective: To provide hands-on training on techniques to explore the immune system of biological importance.

Immunology

Unit I

Dissection of primary and secondary immune organs from mice: Preparation of single cell suspension from bone marrow and spleen (spleenocytes) of mice - Cell counting and viability testing of the spleenocytes prepared.

Unit II

Preparation and study of phagocytosis by splenic/peritoneal macrophages.

Raising polyclonal antibody in mice, serum collection and estimating antibody titre in serum by following methods: Ouchterlony (double diffusion) assay for Antigen -antibody specificity and titre -ELISA

Unit III

Antibody purification from the serum collected from immunized mice: affinity purification/ chromatography-Immuno-electrophoresis,.

Demonstration of Western blotting: a. Protein estimation by Lowry's method /Bradford's method - SDS-PAGE- Immunoblot analysis.

Precipitation and immunodiffusion (Ouchterlony).

Biophysics

UNIT IV SEPARATION TECHNIQUES

Separation of amino acids using radiant and ascending chromatography –polymerisation of gel from using PAGE
Fractionation of serum proteins using SDS

UNIT V MEASUREMENTS

Measurement of viscosity of different liquids using drop weight method
Measurement of surface tension on different liquids using burette method

SUGGESTED READINGS

1. Rajan, S. and Selvi Christy, R. 2001. Experimental procedure in Life sciences, Anjanaa book house, 1st edition, Chennai.
2. Sail bose, 1982. Elementary biophysics, Vijaya printers, Madurai.
3. Das, D, 1996. Biophysics and Biophysical Chemistry for Medical and Biology Students, Academic, Calcutta.
4. Bose, S, 2000. Elementary Biophysics, Jyothi. Maduari
5. Palanichamy, S and M. Shanmugavelu, 1991. Principles of Biophysics. Palani Paramount.

6. Lehninger, A. L. 2006. Biochemistry, Freeman, New York.

ZO 2957-CHRONOBIOLOGY AND ANIMAL BEHAVIOUR

SEMESTER : II

CREDITS

: 03

UNIT I : INTRODUCTION TO CHRONOBIOLOGY

Chronobiology in 21st century; Evolution of biological timing system; Clocks, genes and evolution; Adaptive functional significance of biological clocks. Studying biological clocks; Perception of natural zeitgeber signals; Geophysical environment - Seasons; proximate and ultimate factors.

UNIT II : DIVERSITY AND COMPLEXITY OF THE CLOCK SYSTEM

Organization of circadian system in multicellular animals; Concept of central and peripheral clock system; Circadian pacemaker system in invertebrates with particular reference to *Drosophila*; Molecular Biology of the circadian pacemaker system, Photoreception and photo- transduction; The physiological clock and measurement of day length; Molecular bases of seasonality; The relevance of biological clocks for human welfare - Clock function (dysfunction); Human health and diseases - Chronopharmacology, chronomedicine, chronotherapy.

UNIT III : EVOLUTION OF BEHAVIOUR

Genetics and behavior - Natural selection, Mendel's laws, genetic variation, heritability of behavior, environmental influences upon behavior, juvenile and innate behavior, survival value and fitness, evolutionary strategies, sexual selection, altruism, social organization.

UNIT IV : MECHANISM OF BEHAVIOUR

Animal perception - sensory receptor, nervous system, hormones, sensory process and perception. Animal and the environment - coordination, spatial orientation, homeostasis. Animal learning - conditioning and learning, biological aspects of learning, cognitive aspects of learning.

UNIT V : UNDERSTANDING COMPLEX BEHAVIOUR

Instincts and learning, displacement activities, ritualization and communication, decision making in animals - complex behavior of honey bees, evolutionary optimality, mechanisms of decision making, languages and mental representation, intelligence, tool use and culture, animal awareness and emotion.

SUGGESTED READINGS

1. David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.
2. Davis E Davis, 1970. Integral Animal Behaviour, Mac Millan Company, London, 118pp.
3. Harjindra Singh, 1990. A Text Book of Animal Behaviour, Anomol Publications, 293pp.
4. Hoshang S. Gundevia and Hare Govind Singh, 1996. Animal Behaviour, S. Chand & Co, 280pp.
5. Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004, Chronobiology Biological Timekeeping: Sinauer Associates, Inc. Publishers, Sunderland, MA, USA.
6. Manning, A and M.S Dawkins, An Introduction to Animal Behaviour, Cambridge University Press, UK
7. Saunders, D.S., C.G.H. Steel, X., Afopoulou (ed.) R.D. Lewis. (3rd Ed) 2002. Insect Clocks Baren and Noble Inc. New York, USA
8. Shukla, J. P 2010. Fundamentals of Animal Behaviour, Atlantic, 587pp.
9. Vinod Kumar, 2002. Biological Rhythms: Narosa Publishing House, Delhi/ Springer- Verlag, Germany.

ZO 2958 – BIOPHYSICS AND RADIATION BIOLOGY

SEMESTER	:	II	CREDIT	:	03
CATEGORY	:	ES	NO. OF HOURS / WEEK	:	04

Objective : To impart knowledge on the basic principles of biophysics and radiation biology.

UNIT I: PHYSICAL LAWS IN LIVING SYSTEMS

Diffusion- fick's law-Diffusion constant- Plasmolysis- Haemolysis and Cyclosis Laws of osmosis- surface tension- viscosity.

UNIT II: RADIOACTIVITY AND PHOTO ELECTRIC EFFECT

Principles of radioactivity- Isotopes- Geiger muller counter - X-ray diffraction Electron Spin Resonance-Medical and Biological uses of X-rays- NMR and Ultrasound- Photoelectric effect-Lasers and their applications- Microscopy.

UNIT III: SEPARATION TECHNIQUES

Chromatography -TLC and HPLC- Principles of Electrophoresis PAGE and Immunoelectrophoresis- Thermography and scanning .

UNIT IV: TYPES AND BIOLOGICAL EFFECTS OF RADIATION

Different types of radiation- Direct and Indirect Effects of Radiation -Measurement of radiation levels and limits- Possible implications in Radiotherapy .

UNIT V: HERITABLE EFFECTS AND CARCINOGENESIS

Chromosomal and Chromatid Aberrations - Point Mutations-Chromosomal and Multifractional diseases-Genetic risk assessment-Doubling Dose -Muataion component-Initiation, promotion, progression and dose response for Radiation Induced Cancers.

SUGGESTED READINGS

1. Das, D, 1996. Biophysics and Biophysical Chemistry for Medical and Biology students by, Presidency College, Calcutta, Academic, Calcutta.
2. Bose, S, 1982. Elementary Biophysiscs, Jyoth , Madurai.
3. Casey, E.J, 1962. Biophysics Concepts and Mechanism. Affiliated East-West Press, New Delhi.
4. Palanichamy, S and M. Shanmugavelu, 1991. Principles of Biophysics. Palani Paramount.
5. Prasad, K.N., *CRC Handbook of Radiobiology*, CRC Press, Florida
6. Eric J Hall, Amato J Giaccia *Radiobiology for the Radiologist* Lippincott
7. Williams & Wilkins (Sixth Edition)
8. A.H.W. Nias *An Introduction to Radiobiology* John Wiley and sons
9. Alison P Casarette *Radiation Biology* Prentice Hall Inc