

DEPARTMENT OF ADVANCED ZOOLOGY
AND BIOTECHNOLOGY
B.Sc. Advanced Zoology and Biotechnology
U.G. PROGRAMME
SYLLABUS

Effective from the Academic Year 2016-2017



Loyola College (Autonomous)

Chennai- 600 034



B.Sc Advanced Zoology and Biotechnology

Restructured CBCS curriculum with effective from June, 2016

Sl. No	Sub. Code	Title of the paper
1	16UZO1MC01	INVERTEBRATA
2	16UZO1MC02	INVERTEBRATA LAB COURSE
3	16UZO1MC03	ECONOMIC ENTOMOLOGY
4	16UPB1AL01	BASICS OF PLANT BIOLOGY
5	16UPB1AL02	ALLIED PRACTICAL –I
6	16UZO2MC01	CHORDATA
7	16UZO2MC02	CHORDATA LAB COURSE
8	16UZO2MC03	FUNDAMENTALS OF BIOTECHNOLOGY
9	16UPB2AL01	APPLIED MICROBIOLOGY
10	16UPB2AL02	ALLIED PRACTICAL –II
11	16UZO3MC01	ANIMAL PHYSIOLOGY AND BIOCHEMISTRY
12	16UZO3MC02	ANIMAL PHYSIOLOGY & BIOCHEMISTRY LAB
13	16UZO3MC03	DEVELOPMENTAL BIOLOGY
14	16UZO3MC04	ORGANIC EVOLUTION
15	16UCH3AL03	GENERAL CHEMISTRY FOR BIOLOGY – I
16	16UCH3AL04	CHEMISTRY PRACTICAL FOR BIOLOGY – I
17	16UZO4MC01	ENVIRONMENTAL BIOLOGY
18	16UZO4MC02	ENVIRONMENTAL BIOLOGY LAB COURSE
19	16UZO4ES01	ESSENTIALS OF MARINE BIOLOGY
20	16UZO4ES02	ESSENTIALS OF MARINE BIOLOGY LAB COURSE
21	16UZO4ES03	BIOPHYSICS AND BIostatISTICS
22	16UZO4ES04	BIOPHYSICS AND BIostatISTICS LAB COURSE
23	16UCH4AL03	GENERAL CHEMISTRY FOR



		BIOLOGY – II
24	16UCH4AL04	CHEMISTRY PRACTICAL FOR BIOLOGY – II
25	16UZO5MC01	MOLECULAR CELL BIOLOGY
26	16UZO5MC02	MOLECULAR GENETICS
27	16UZO5MC03	ANIMAL BIOTECHNOLOGY
28	16UZO5MC04	IMMUNOLOGY
29	16UZO5MC05	MOLECULAR BIOLOGY, GENETICS & BIOTECH
30	16UZO5ES01	MEDICAL LABORATORY TECHNIQUES
31	16UZO5ES02	MEDICAL LABORATORY TECHNIQUES LAB
32	16UZO5ES03	BIO INSTRUMENTATION SCIENCE
33	16UZO5ES04	BIO INSTRUMENTATION LAB COURSE
34	16UZO5SK01	ECONOMIC ZOOLOGY: DAIRY FARMING
35	16UZO6MC01	ENVIRONMENTAL BIOTECHNOLOGY
36	16UZO6MC02	ENVIRONMENTAL TOXICOLOGY
37	16UZO6MC03	ENVIRONMENTAL BIOTECHNOLOGY AND TOXI
38	16UZO6MC04	WILDLIFE CONSERVATION சூழல் காப்பு
39	16UZO6MC05	BEHAVIOR BIOLOGY AND WILDLIFE LAB
40	16UZO6MC06	REPRODUCTIVE BIOLOGY AND ENDOCRINOLOGY
41	16UZO6MS01	BIOINFORMATICS
42	16UZO6MS02	BIOINFORMATICS LAB COURSE



16UZO1MC01 – INVERTEBRATA

SEMESTER I	CREDITS 4
CATEGORY MC	NO.OF HOURS/ WEEK 4

OBJECTIVE:

To impart the knowledge on the origin of metazoa from protozoa together with symmetry, metamerism and coelom formation leading to the origin of chordates and vertebrates.

UNIT I : Protozoa And Porifera

General characteristics and classification upto classes. Study of *Euglena* and *Paramecium*. Life cycle of *Plasmodium vivax* and *Entamoeba histolytica*. Porifera upto classes: canal system and reproduction in Sponges.

UNIT II: Cnidaria, Coelenterata And Ctenophora

General characteristics and classification upto classes. Metagenesis in *Obelia*. Polymorphism in Cnidaria. Corals and coral reefs.

UNIT III : Platyhelminthes And Nematelminthes

General characteristics and classification upto classes. Life cycle and pathogenicity of *Taenia solium*, *Ascaris lumbricoides*, *Wuchereria bancrofti* and parasitic adaptations.

UNIT IV : Annelida And Arthropoda

General characteristics and classification upto classes. Evolution coelom and Metamerism. Life cycle of Earthworm and Leech. Metamorphosis in insects. Social life in insects. Life cycle of Prawn and Cockroach.

UNIT V : Mollusca And Echinodermata

General characteristics and classification upto classes. Torsion in Gastropoda and Pearl formation. Life cycle of Sepia. Water vascular system, larval forms of Echinodermata and Chordates affinities.



Text books

1. A Manual of Zoology –EkambaranathaIyer (2000) 10th edition, Vishwanath Publication.
2. Invertebrate Zoology – VeerbalaRastogi. (or) Dhami&Dhami

Reference Books

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science

16UZ01MC02 - INVERTEBRATA LAB COURSE

SEMESTER I	CREDITS	2
CATEGORY MC (P)	NO.OF HOURS/ WEEK	2

OBJECTIVE:

To observe the anatomy and structural modifications in invertebrates and to develop dissection skill.

UNIT I : Major Dissection

Cockroach: Digestive system, Circulatory system, Nervous system, Reproductive system -Pila: Nervous system - Leech / Earthworm: Nervous System, Reproductive system -Prawn: Nervous system (including Appendages).

UNIT II : Minor Dissection

Earthworm: Viscera, Lateral hearts

Pila: Digestive system (Including radula)

Freshwater Mussel: Digestive system

UNIT III : Mounting

Earthworm: Body setae; Pineal setae

Pila: Radula Freshwater muscle: Pedal ganglia



UNIT IV : Mounting

Cockroach: Salivary apparatus, Mouth parts - Honey Bee, House fly and Mosquito mouth parts

UNIT V :Spotters

Representatives from each phylum based on structural organisation and phylogeny –record

Text books

1. Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut.
2. EkambaranathaIyyar and T.N.Ananthkrishnan, 1995 A manual of Zoology Vol.I (Part 1,2) S.Viswanathan, Chennai.
3. Barnes, 1995 Invertebrate Zoology, W.B.Saunders, Philadelphia.

16UZO1MC03 -ECONOMIC ENTOMOLOGY

SEMESTER I	CREDITS	3
CATEGORY MC	NO.OF HOURS/ WEEK	3

OBJECTIVE: To study the economic importance of insects and insect pest management.

UNIT I: Introduction To Insects

Outline classification of Class Insecta, Causes of insects assuming pest status, methods of collection, mounting and preservation of insects.

UNIT II: Agricultural Entomology

Most common insect pests of rice and their control: rice thrips, brown plant hopper and rice ear head bug. Insects pests of stored grains and their preventive and curative methods: internal and external feeder, scavenger. Locusts in control.

UNIT III: Medical And Veterinary Entomology



Insects in relation to public health and their control: mosquito, housefly, eye fly, sand fly, bed bug, flea and head louse. Most common insect pests of domestic animals and their control: stable fly, shaft louse and head maggot.

UNIT IV: Apiculture And Sericulture

Apiculture: Introduction, types of honey bees, hive, apiary, selection of bees and location for apiary, Newton's bee hive, enemies and diseases of honey bees. Sericulture; Introduction, types of silkworm, silkworm races, life history of mulberry silkworm, features of sericulture industry, pests and diseases of silkworm.

UNIT V: Pest Management

Formulation and classification of insecticides, biological control of insect pests, Integrated Pest Management.

Text Books

1. David, B and Ananthkrishnan, T. N. 2006. General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd., New Delhi, India.
2. Vasanthraj David, B. and Ramamurthy, VV. 2012. Elements of Economic Entomology, Seventh edition, Namrutha publications, Chennai.
3. Pruthi, H.S. 1969. Text book on Agricultural Entomology, I.C.A.R. Publication, New Delhi.
4. Awasthi, V.B. 2012. Introduction to General and Applied Entomology, third edition, Scientific publishers, India.

Reference Books

1. Abishek Shukla, D. 2009. A Hand Book of Economic Entomology, Vedams e Books, New Delhi.
2. Ministry of Agriculture, Government of India, 1995. Manual on Integrated Pest Management in Rice & Cotton.
3. John William S. 1995. Management of Natural Wealth, Loyola College Publications, Chennai.



16UPB1AL01 PB – BASICS OF PLANT BIOLOGY

SEMESTER	I	CREDITS	2
CATEGORY	AL	NO.OF HOURS/ WEEK	4

OBJECTIVES:

1. To provide information on the diversity of plants and their significance.
2. To provide suitable knowledge on the taxonomy of angiosperms, their economic importance and anatomy.
3. To provide details on the physiology, reproduction and lifecycle of various plant forms.

Unit I: Plant Diversity (1 + 10 + 1)

Structure and reproduction (No developmental studies)

Algae : *Ectocarpus*

Fungi : *Puccinia*

Bryophytes : *Funaria*

Pteridophytes : *Selaginella*

Gymnosperms : *Cycas*

Unit II: Taxonomy And Economic Botany (1 + 10 + 1)

Detailed studies of the following families: *Annonaceae*, *Rutaceae*, *Cucurbitaceae*, *Lamiaceae*, *Euphorbiaceae* and *Poaceae*.

Economic Botany: Common name, binomial, family, the morphology of the useful parts and uses of – vegetables (beet root, potato) - fruits (banana, papaya) – cereals (rice, wheat) - pulses (green gram, pigeon pea) – edible oil yielding plants (sesame oil, coconut oil) - fibre yielding plants (cotton, jute) – medicinal plants (vinca, asafoetida) – narcotic plants (tobacco, cannabis) – timber yielding plants (teak, sal) – spices (cardamom, cloves) – condiments (ginger, turmeric) – essential oils (sandalwood oil, eucalyptus oil) – beverages: alcoholic (wine, beer) and non-alcoholic (tea, coffee).



Unit III: Anatomy (1 + 10 + 1)

Classification of tissues - Characteristics and classifications of meristems. Anatomy of root, stem and leaf (monocot and dicot). Normal secondary growth in dicot stem. Stomatal types: Anomocytic, anisocytic, paracytic and grass type. Excretory system: Hydathodes, salt glands, nectaries; cavities, lithocysts and laticifers.

Unit IV: Embryology (1 + 10 + 1)

Microsporangium, microsporogenesis and male gametophyte. Megasporangium, megasporogenesis and female gametophyte. Fertilization – double fertilization and triple fusion. Endosperm types: Nucellar, cellular, helobial and ruminate. Embryogenesis: Embryo development in dicotyledons (*Capsella*).

Unit V: Plant Physiology (1 + 10 + 1)

Absorption of water - Transpiration - Absorption and translocation of solutes – active & passive uptake. Photosynthesis - light reaction - Calvin cycle. Respiration - Glycolysis, Krebs' cycle - electron transport system. Role of growth hormones – auxins, gibberellins and cytokinins - their applications.

Text Books

1. Mitra, J. N., Mitra, D. and Chowdhri, S. K. 1990. Studies in Botany Vol II. Moulick Library, Calcutta.
2. Narayanaswami, R. V., Rao, K. N. and Raman, A. 1996. Outlines of Botany – S. Viswanathan Publishers, Chennai.
3. Devlin, O.P. (1974) Plant Physiology, Prentice-Hall, India.
4. Jain, V.K. (2005) Textbook of Plant Physiology. S. Chand and Company Ltd. New Delhi.
5. Kochhar S. L. Economic Botany in the tropics (Fourth edition). Macmillan Publishers India Ltd., Delhi.



BOOKS FOR REFERENCE

1. Pandey, B.B. 1995. Taxonomy of Angiosperms, S. Chand and Co. Ltd. New Delhi.
2. Pandey, B.B. 1978. Plant Anatomy, S. Chand and Co. Ltd. New Delhi.
3. Singh, V., Pandey, P.C. and Jain, D.K. 1998. Anatomy of seed plants. Rastogi Pub. Meerut, India.
4. Tayal, M.S. 1987. Plant Anatomy. Rastogi Pub. Meerut, India.
5. Bhojwani and Bhatnagar. 1985. Embryology of Angiosperms, Vikas Publications.
6. Pandey, B.P. 1980. Economic Botany. S. Chand & Co., New Delhi.
7. Datta, S.C. 2010. Plant Physiology. New Age International Publishers. New Delhi

16UPB1A102 -ALLIED PRACTICAL I

SEMESTER I	CREDITS	1
CATEGORY AL	NO.OF HOURS/ WEEK	2

OBJECTIVE:

1. To provide Practical knowledge about the diversity of plants and their significance.
2. Microscopic study of plants mentioned in theory syllabus.
3. Study of families mentioned in the theory syllabus.
4. Economic Botany.
5. Anatomy of stem, root and leaf in dicots and monocots.
6. Observation of slides on microsporogenesis, megasporogenesis and embryo.
7. Transpiration pull.



8. Potato osmoscope.
9. Wilmott's bubbler on photosynthesis using different light and carbon dioxide concentration
10. Separation of photosynthetic pigments using paper chromatography.

16UZO2MC01 –CHORDATA

SEMESTER	II	CREDITS	4
CATEGORY	MC	NO.OF HOURS/ WEEK	4

OBJECTIVE :

To study the origin, diversity and evolution of chordates with their characteristic features and affinities with nonchordates.

UNIT I :General Characters And Classification of Phylum Chordata

Origin of Chordata, Differences between nonchordates and chordates, General characters, Affinities and Systematic position of Hemichordata (Balanoglossus), Urochordata (Ascidian), Cephalochordata (Amphioxus).

UNIT II :Prochordates And Agnatha

Characteristics of subphylum vertebrata, Classification of Vertebrata upto Class level, General characters and affinities of Prochordates (Petromyzon), Agnatha - Pisces (Scoliodon sorrah) General characters and classification, Origin of fishes, Affinities of Dipnoi - Types of scales and fins - Accessory respiratory organs - Air bladder - Parental care - Migration - Economic importance.

UNIT III :Amphibia

General characters and classification - Origin of amphibia - Type study - Rana hexadactyla - Adaptive features of Anura, Urodela and Apoda - Neoteny in Urodela - Parental care in Amphibia.



UNIT IV :Reptilia

General characters and classification - Type study - Calotesversicolor (endoskeleton of Varanus instead of Calotes)
- Origin of reptiles and effects of terrestrialisation, Extinct reptiles

Snakes of India - Poison apparatus and biting mechanism of poisonous snakes - Skull in reptiles as basis of classification

UNIT V :Aves And Mammalia

Aves: General characters and classification - Type study - Columba livia - Origin of birds, Flight adaptations, Migration.
Mammalia: General characters and classification - Type study - RABBIT - Adaptive radiation in mammals - Egg laying mammals, Marsupials, Flying mammals, Aquatic mammals, Dentition in mammals.

Text Books

1. Ayyar, E.K. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p.
2. Jordan, E.K. and P.S. Verma, 1995. Chordate Zoology and Elements of Animal Physiology, 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp.
3. Nigam, H.C., 1983. Zoology of Chordates, Vishal Publications, jalandhar - 144 008, 942.

Reference Books

1. Hickman, C.P. Jr., F.M.Hickman and L.S. Roberts, 1984. Integrated Principles of Zoology, 7th Edition, Times Merror/Mosby College Publication. St. Louis. 1065 pp.
2. Newman, H.H., 1981. The Phylum Chordata, Satish Book Enterprise, Agra - 282 003, 477 pp.
3. Parker and Haswell, 1964. Text Book of Zoology, Vol II (Chordata), A.Z.T,B.S. Publishers and Distributors, New Delhi - 110 051, 952 pp



4. Waterman, Allyn J. et al., 1971. Chordate Structure and Function, Mac Millan & Co., New York, 587 pp.

16UZ02MC02 - CHORDATA LAB COURSE

SEMESTER II	CREDITS 2
CATEGORY MC (L)	NO.OF HOURS/ WEEK 2

OBJECTIVE :

To study the origin, diversity and evolution of chordates with their characteristic features and affinities with nonchordates.

UNIT I :Dissections

Frog / Fish : External features, Digestive system, Arterial system, Venous system, 5th Cranial nerve, 9th and 10th cranial nerves, Male and female urinogenital system.

UNIT II :Mounting

Fish: Placoid and Ctenoid scales, Frog: Hyoid apparatus and Brain.

UNIT III :Osteology

Frog: Skull and lower jaw, Vertebral column, Pectoral girdle, Pelvic girdle, Forelimb, Hind limb. Chelonia- Anapsid skull, Pigeon - skull and lower jaw, synsacrum.

UNIT IV :Specimens And Slides

Hemichordata :Balanoglossus, Tornaria larva. Urochordata : Ascidian, Ascidian larva. Cephalochordata : Amphioxus, Amphioxus - T.S. through pharynx. Specimens : Doliolum, Salpa, Petromyzon, Ammocoetus larva, Scoliodonsorrakowah, Narcine, Rhinobatus, Protopterus, Catla, Clarias, Anabas, Hippocampus, Tetradon, Cynoglossus, Pterois, Echeneis, Bufomelanostictus, Hyla, Rhacophorus, Amblystoma, Axolotl larva, Proteus, Ichthyophis, Hemidactylus, Chamaeleon, Draco, Mabuya, Varanus, Cobra, Krait, Russell's viper, Echiscarinatus,



Testudoelegans, Carapace, Plastron, King fisher, Parrot, Owl, Hornbill, Wood pecker, Armadillo, Bat.

UNIT V :Embryology

Stages in the development of Amphioxus, Frog and Chick-Placenta in shark and mammals.

Text Books

1. Lal S S, 2009. Practical Zoology Vertebrate, RajpalAnd Sons Publishing, 484pp.
2. Verma P. S, 2000. A Manual Of Practical Zoology: Chordates, S. Chand Limited, 627pp.

Reference Books

1. Robert William Hegner, 2015. Practical Zoology, BiblioLife, 522pp.
2. Young, J,Z., 1972. The life of vertebrates. Oxford Uni. London.

16UZO2MC03 - FUNDAMENTALS OF BIOTECHNOLOGY

SEMESTER	II	CREDITS	3
CATEGORY	MC	NO.OF HOURS/ WEEK	3

OBJECTIVE:

To outline the basics of Biotechnology - scope and importance and to understand the interdisciplinary activity.

UNIT I : Introduction to Biotechnology

Definition - interdisciplinary activity- scope and importance, Biotechnology global scenario - International safety guidelines - Patent law and intellectual property rights.

UNIT II : Principles of Tissue Culture

Culture media - Primary culture and cell lines - Organ culture.Industrial application of animal tissue culture.



UNIT III : Fundamentals of R-Dna Technology

Restriction enzymes: classification - Nomenclature and activity - Restriction mapping of DNA; Plasmids, Cosmids and transposons. Molecular cloning - construction of genomic libraries - Indirect cloning - cDNA preparation and uses of DNA probes.

UNIT IV : Biochemical Engineering

Basic concepts of fermentation- bioreactor design- biosensors.

UNIT V :Agriculture And Aquaculture Biotechnology

Applications in agriculture: micropropagation of biomass – nitrogen fixation – GMO's. Applications in aquaculture: improved diagnostics- hormones and feeds- genetic manipulation. Cryopreservation – Transgenic fish - Nutritional quality.

TEXT BOOKS

1. Ignacimuthu S, 2008. Basic Biotechnology. Tata McGraw-Hill, New Delhi.
2. Ranga, M.M., 2003. Animal Biotechnology, Agrobios, New Delhi.
3. Lohar, P.S., 2005. Biotechnology, MJP, Chennai.
4. Satyanarayana, U., 2005. Biotechnology, Books and Allied, Kolkata.
5. Ramawatet al., 2009 Comprehensive Biotechnology, S.Chand&Compy, New Delhi.



16UPB2AL01 APPLIED MICROBIOLOGY

SEMESTER	II	CREDITS	2
CATEGORY	AL	NO.OF HOURS/ WEEK	4

OBJECTIVES:

- To provide information on the classification, growth, morphology and genetics of microbes and the recent advances in the field of microbiology.
- To understand the fundamentals of the fermentation process, strain improvement and culture.

To understand the use of different microorganisms for manufacture of a variety of industrial products.

Unit I: INTRODUCTION (1 + 10 + 1)

Classification of microbes - A general account of characteristics and classification of bacteria, fungi, Mycoplasma and viruses.

Unit II: MORPHOLOGY, PHYSIOLOGY AND GENETICS OF BACTERIA (1 + 10 + 1)

Bacterial morphology, physiology: Structure of bacterial cell – capsule, cell wall, plasma membrane, Structure and function of flagella, fimbriae and pili – Microbial growth and its measurements – Pure cultures and their maintenance – Nutritional requirement and types of media. Nature of genetic material in bacteria – Replication and gene expression – gene regulation (*lac* operon), Reproduction: transformation, transduction and conjugation in bacteria.

Unit III: FERMENTATION (1 + 10 + 1)

Fermentor – Basic functions – body construction – aerators, agitators – asepsis – containment – valves and steam traps – Substrates for industrial fermentation – strain improvement – an outline on fermentation and product recovery.



Unit IV: INDUSTRIAL MICROBIOLOGY (1 + 10 + 1)

Microbial enzymes (Amylase), Organic acid (Citric acid), fermented products (cheese production), beverages (wine), General account on biofertilizers, biopesticides, biopolymers, biosensors, antibiotics (penicillin), vitamins.

Unit V: Environmental Microbiology (1 + 10 + 1)

Bioremediation – Domestic sewage and waste water treatment – Biodegradation of xenobiotics – Biomineralization – Biomining and bioleaching – Biofuels.

TEXT BOOKS

1. Dubey, R. C. and Maheshwari, D.K. 2005. A text book of Microbiology. S. Chand & Co. Ltd., New Delhi.
2. Powar, C.B. and Dagainawala, 1991. General Microbiology Vol. I and II – Himalaya Publishing House, Bombay.
3. Pelczar, Chan and Kreig, 1993. Microbiology – 5th Edition, Tata McGraw-Hill & Co. Ltd. New Delhi.
4. Crueger, F. and Anneliese Crueger, 2000. Biotechnology: Industrial Microbiology Panima publishing Coporation New Delhi
5. Adams, M.R. and Moss, M.O. 1995. Food Microbiology New Age International Publishers New Delhi
6. Casida, L.E. Jr. 1996. Industrial Microbiology New Age International Publishers New Delhi

BOOKS FOR REFERENCE

1. Joanne, M. Willey, Linda M. Sherwood and Christopher, J. Woolverton, 2008. Microbiology – McGraw – Hill International Edition (Seventh edition).
2. Daniel Lim, 1998. Microbiology (2nd edition) WCB/McGraw-Hill.
3. Tortora, Funke and Case, 2006. Microbiology- An Introduction. Pearson Education.



4. Alexander N. Glazer and Hiroshi Nikaido, 1994. Microbial Biotechnology: Fundamentals of Applied microbiology. W.H. Freeman and Co., New York.

16UPB2AL02– ALLIED PRACTICAL –II

SEMESTER	II	CREDITS	1
CATEGORY	AL	NO.OF HOURS/ WEEK	2

OBJECTIVE:

To provide practical knowledge about microbes and the recent advances in the field of microbiology.

1. Sterilization – Preparation of culture media – nutrient broth and agar - Potato dextrose agar.
2. Permanent slides of bacteria, fungus, algae – morphological features.
3. Pour plate, spread plate and Streak plate techniques – serial dilution.
4. Hanging drop method.
5. Antibiotic sensitivity assay
6. Staining method – Gram staining technique.
7. Demonstration of Fermentor operation.
8. Ethanol production and estimation.
9. Wine fermentation
10. Citric acid production
11. Glutamic acid production
12. Biofertilizers – Isolation of *Rhizobium*, VAM



16UZO3MC01 ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

SEMESTER	III	CREDITS	4
CATEGORY	MC	NO.OF HOURS/ WEEK	4

OBJECTIVE: To enlighten the functions of organ systems in animals and man towards homoeostasis.

UNIT I : NUTRITION AND DIGESTION

Nutrition-Food requirements-Carbohydrates, Proteins, Fats, Minerals, and Vitamins. Digestive-enzymes and their role in digestion— Metabolism-metabolic pathways with reference to carbohydrates

UNIT II : RESPIRATION, EXCRETION AND CIRCULATION

Respiration-Respiratory pigments-and functions. Transport of gases [CO₂+O₂]- Respiratory quotient.

Kind of Excretory products –mechanism of urine formation in mammals, hormonal regulation of Osmoconformers- Osmoregulator Excretion. Circulation:-Types, Composition, Properties and Functions of blood -Human-cardiac cycle-cardiac rhythm –origin of heartbeat -regulation of heart.

UNIT III : NERVOUS SYSTEM AND ENDOCRINE SYSTEM

Nervous tissue-Neuron -Structure, types of neurons. Nerve Impulse-Synapse- Synaptic transmission of impulses-Neurotransmitters. Receptors-Photoreceptor- mammalian eye - Endocrine glands - structure, secretions and functions of Endocrine glands of vertebrates-pituitary, Hypothalamus, thyroids, parathyroid, Adrenal, Thymus, Islet of Langerhans, sex organs- Hormones of insects and crustaceans.

UNIT IV : METABOLIC PATHWAYS

Glycogenesis - Glycogenolysis – gluconeogenesis – metabolic pathway of glucose – glycolysis – production of ATP in aerobic



pathway – Kreb’s cycle – electron transport chain- oxidative phosphorylation – hormonal control of carbohydrate metabolism and regulation of blood glucose level.

UNITV : ENZYME KINETICS

Enzymes:classificationandnomenclature ofenzymes– physico-chemical-properties of enzymes-enzymekinetics-mechanismof enzyme action-factors affecting enzyme activity.

TEXT BOOKS

1. Sambasivaiah, Kamalakararao and Augustinechellappa. 1990. A Textbook of Animal Physiology and Ecology, S.Chand & co., Ltd., New Delhi-110055.
2. William S. Hoar, 1976. General and Comparative Physiology, Prentice Hall of India Pvt. Ltd., New Delhi-110
3. Prosser, C.L. Brown. 1985. Comparative Animal Physiology, Satish Book Enterprise, Agra-282003.
4. Devasena, T. 2010. Enzymology, Oxford University press, New Delhi.
5. Singh, H.R and Kumar, N. 2007. Animal physiology and biochemistry, Vishal publishing company, Jalandhar.
6. Sreekumar, S. 2010. Basic physiology, PHI learning private ltd., New Delhi.

REFERENCE BOOKS

1. Stryer, L. 1999. Biochemistry IV Edition. Freeman Company, New York.
2. Lehninger, 1992. Biochemistry worth Publications Inc., CBS Publication, New Delhi
3. Talwar G. P and L.M. Srivastava, 2003 Text Book of Biochemistry and Human
4. Hoar, S.W. 1976. General and comparative physiology, Prentice Hall.



5. Parameswaran, Ananthakrishnan, T. N. and Ananthasubramaniam, K.S. 1975. Outlines of Animal Physiology, S. Viswanathan, Chennai.
6. Prosser, O.L. and F.A. Brown 1961: Comparative animal physiology, W.B. Saunders, London.

16UZ03MC02 - ANIMAL PHYSIOLOGY AND BIOCHEMISTRY LAB COURSE

Semester	III	Credits	2
Category	MC (L)	No.of hours/ week	2

OBJECTIVE: To illustrate the function of organs and organ systems in different animals..

UNIT I : DIGESTIVE ENZYMES

Survey of digestive enzymes in Cockroach, Ptyalin activity in relation to temperature and pH in human saliva.

UNIT II : OXYGEN CONSUMPTION

Estimation of oxygen consumption in an aquatic and a terrestrial animal. Estimation of total protein, fat and carbohydrate

UNIT III : QUALITATIVE DETECTION OF EXCRETORY PRODUCTS

Influence of temperature on the ciliary activity of freshwater mussel gill and calculation of Q 10.

UNIT IV : HAEMATOLOGY

Blood - total and differential counts.

UNIT V : Recording of heart beat, muscle twitch and reflexes in frog.



TEXT BOOKS

1. Bishop, M.L., Fody, E.P., Schoeff, L.E. 2009. Clinical chemistry: principles, procedure, correlations. Wolters Kluwer, Inida.
2. Burtis, C.A. and Ashwood, E.R. 2008. Tietz Fundamentals of clinical chemistry, Elsevier, Philadelphia.
3. Tortora, G.J and Drrickson, B.H. 2008. Principles of anatomy and physiology, 12th edition , John Wiley and sons, New Jersey.

REFERENCE BOOKS

1. Hoar, S.W. 1976: General and comparative physiology, Prentice Hall.
2. Prosser, O.L. and F.A. Brown 1961: Comparative animal physiology, W.B. Saunders, London.
3. Woods, D.W. 1968: Principles of Animal physiology. Edward Arnold, London

16UZO3MC03 - DEVELOPMENTAL BIOLOGY

SEMESTER	III	CREDITS	3
CATEGORY	MC	NO.OF HOURS/ WEEK	3

OBJECTIVE:

This course will introduce learners to the field of developmental biology and help them to understand the mechanisms involved in the process of development of a single fertilized zygote into a complete organism. It also places emphasis on the role of genetics and environment on development.

UNIT I : BASIC CONCEPTS OF DEVELOPMENT

History of developmental biology; Cell differentiation, commitment and aging; Cell specification and its types; Concept of organizers and inductors; Oogenesis and Spermatogenesis.



UNIT II : FERTILIZATION AND MORPHOGENESIS

Fertilization in sea urchin and mammals; Cleavage patterns and planes; morphogens - movement and gradients; Types of morphogenetic cell movements - invagination, involution, ingression, delamination and epiboly; Gastrulation in sea urchin, frog, chick and mammals; fate maps

UNIT III : ORGANOGENESIS

Development of Eye, Ear, Brain and Heart and Limb in chick; development of the placenta and extra embryonic membranes in chick; Axis formation (anterior-posterior and dorsal-ventral axis) and genetic control of pattern formation and morphogenesis in *Drosophila* sp.

UNIT IV : REGENERATION

Regeneration: types, regeneration in hydra, limb regeneration in salamander and pattern formation in regeneration blastema; liver regeneration; regeneration and aging; Stem cells - types of stem cells, role in regeneration and development.

UNIT V : DEVELOPMENTAL ISSUES

Congenital malformation - causes and examples; environmental disruption of normal development by teratogenic agents and endocrine disruptors; Multiple births, conjoined twins; Types of assisted reproductive techniques and procedure of in vitro fertilization and ART.

TEXT BOOKS

1. Gilbert S.F. 2010. Developmental Biology, Sinauer Associates, Massachusetts, USA.
2. Lewis Wolpert 2007. Principles of development, 3rd edition, Oxford University Press, New Delhi.
3. Subramoniam, T. 2003. Developmental Biology, Narosa Publishing House, New Delhi.
4. Verma, P.S., Agarwal, V. K. 2010. Chordate Embryology: Developmental Biology, S. Chand & Company, New Delhi.



REFERENCE BOOKS

1. Balinsky, B.I. 1970. Introduction to Embryology, Philadelphia & London.
2. Berril, N.J.1971. Developmental Biology, McGraw Hill, New York.
3. Carlson, Bruce, M. 2009. Human embryology and Developmental Biology, Elsevier, Philadelphia.
4. Russ Hodge 2010. Developmental Biology, Facts on File, Inc., New York, USA.

16UZO3MC04 – ORGANICEVOLUTION

SEMESTER	III	CREDITS	3
CATEGORY	MC	NO.OF HOURS/ WEEK	3

OBJECTIVE: To Explore the process and products of evolution.

UNIT I : INTRODUCTION

Inorganic and organic evolution-History of evolutionary thought, Primordial earth and primeval atmosphere, Chemical origin of life: Synthesis of organic molecules, Urey-Miller experiment, Origin of prokaryotes and eukaryotes.

UNIT II : CAUSAL FACTORS

Lamarckism - Neo Lamarckism - Darwinism - Neo Darwinism and modern synthetic theory - DeVrie's Mutation theory – modern concepts of mutation - Mutation and their role in evolution - Animal colouration and Mimicry

UNIT III : ADAPTIVE RADIATION AND SPECIATION

Isolating mechanisms - Modes of speciation-Hybridization is an evolutionary catalyst- Law of Adaptive Radiation- Adaptive radiation in reptiles and mammals - Convergence and parallelism - Evolutionary constancy.



UNIT IV : EVIDENCES AND PALAEOLOGY

Morphological, physiological and biochemical, embryological, Taxonomical and geographical evidences -Palaeontological evidences – evolutionary genomics. Types of rocks - Geological time scale – Nature of fossils- Dating of fossils - Fossil records of man and fossil records of horse.

UNIT V :MAN AND NATURAL SELECTION

Natural selection in action in man- level of selection- Eugenics, Euphenics and Euthenics- Adaptation- Human Genome Project – Evolution and ethics.

TEXT BOOKS

1. Colbert, E.H. Morales, M. and Minkoff, E.C. 2011. Colbert's Evolution of The Vertebrates: A History of the Backboned Animals Through Time, Wiley, India.
2. Lull, R.S. 2010. Organic evolution, The Macmillan, New York.
3. Michael J. Benton, M.J.2004. Vertebrate Palaeontology, Wiley-Blackwell.

REFERENCE BOOKS

1. Dobzhansky T. Ayala F.I.T. Stebeinns G.L. Valentini J.W. 1973 Evolution - Surjeet publication New Delhi.
2. Moody, P.A. 1962. Introduction of evolution, Harper and Brothers, New Delhi.



**16UCH3AL03 - GENERAL CHEMISTRY FOR
BIOLOGY-I**

SEMESTER	III	CREDITS	2
CATEGORY	AL	NO.OF HOURS/ WEEK	4

OBJECTIVE

To enable the students understand the concepts of chemistry.

Unit I: HANDLING OF CHEMICALS AND DATA ANALYSIS (1+13+1 h)

- 1.1 Storage and handling of chemicals: Handling of acids, ethers, toxic and poisonous chemicals. Antidotes, first aid procedure.
- 1.2 Errors in chemical analysis: Accuracy, precision. Types of error-absolute and relative errors. Methods of eliminating and minimizing errors.
- 1.3 Separation techniques: Solvent extraction. Principle of adsorption and partition chromatography, paper chromatography, thin layer chromatography, column chromatography and their applications.

Unit II: CHEMICAL BONDING

(1+13+1 h)

- 2.1 Ionic Bond: Characteristics of ionic compounds, Structure of NaCl and CsCl, Factors influencing the formation of ionic bond.
- 2.2 Covalent Bond: Characteristics on covalent compounds. Structure of CH₄, NH₃, H₂O based on hybridisation.
- 2.3 Coordinate Bond: Nature of coordinate bond. Coordination complexes - Werner's theory. Isomerism in square planar and octahedral complexes. Structure and functions of chlorophyll and hemoglobin.
- 2.4 Hydrogen Bond: Types, theory and importance of hydrogen bonding. Hydrogen bonding in carboxylic acids, alcohol, amides, polyamides, DNA and RNA.
- 2.5 Stabilizing forces in protein and DNA, van der Waal's



forces, dipole-dipole and dipole-induced dipole interactions.

Unit III: VOLUMETRIC ANALYSIS (1+8+1 h)

- 3.1 Methods of expressing concentration: normality, molarity, molality, ppm, ppb.
- 3.2 Primary and secondary standards: preparation of standard solutions
- 3.3 Principle of volumetric analysis: end point and equivalence point.
- 3.4 Strong and weak acids and bases - Ionic product of water, pH, pK_a, pK_b. Buffer solutions, Henderson-Hasselbalch equation and its significance.

Unit IV: KINETICS AND CATALYSIS (1+8+1 h)

- 4.1 Chemical Kinetics: Rate, rate constant, rate law, order and molecularity. Derivation of rate expression for the first order reaction.
- 4.2 Catalysis-Homogeneous and heterogeneous catalysis.

Unit V: CHEMISTRY OF BIOMOLECULES (1+8+1 h)

- 5.1 Fats – Occurrence and composition. Hydrolysis of fats.
- 5.2 Vitamins – Source, provitamin, properties and classification. Structure and function of vitamin A, C, D, K and E
- 5.3 Hormones – Thyroxin, adrenaline and sex hormones (structure and functions only)

TEXT BOOKS

1. R. Gopalan, S. Sundaram, *Allied Chemistry*, Sultan Chand & Sons (P) Ltd, 4th edn., 2006.
2. U. N. Dash, *Analytical Chemistry: Theory and Practice*, Sultan Chand and sons Educational Publishers, New Delhi, 2011.
3. U. Sathyanarayana, *Biochemistry*, Books and allied (P) Ltd, 4th edn., 2013.
4. B.R.Puri and L.R.Sharma, M.S. Pathania, *Principles of physical chemistry*, Vishal Publication Co., 46th edn., 2013.



BOOKS FOR REFERENCE

1. D.A. Skoog, D.M. West, F.J. Holler, *Analytical Chemistry: An Introduction*, Saunders college publishing, 5thedn., 1998.
2. B.R. Puri, L. R. Sharma, K. C. Kalia, *Principles of Inorganic Chemistry*, ShobanLalNaginChand and Co., 2014.
3. G.C. Hill, J.S. Holman, *Chemistry in Context*, ELBS, 1998.
4. W.R. Kneen, M.J.W. Rogers, P. Simpson, *Chemistry – Facts, patterns and principles*, ELBS, 1999.

16UCH3AL04 - CHEMISTRY PRACTICAL FOR BIOLOGY-I

SEMESTER III CREDITS 1

CATEGORY AL NO.OF HOURS/ WEEK 2

OBJECTIVE

To understand the principle and carry out the qualitative organic analysis systematically.

ORGANIC ANALYSIS

- a) Detection of nitrogen, sulphur and halogens
- b) Tests for aromaticity
- c) Tests for saturation
- d) Identification of chemical nature (acidic/basic/neutral) and the following functional groups
 - i) Carboxylic acid
 - ii) Phenols
 - iii) Aldehydes
 - iv) Ketones
 - v) Carbohydrates
 - vi) Primary amines
 - vii) Amides

BOOKS FOR STUDY

1. V.Venkateswaran, R.Veerawamy and A.R.Kulandaivelu, *Basic Principles of Practical Chemistry*, 2ndedn., S.Chand Publications, New Delhi, 2004.



2. N.S. Gnanapragasam, G. Ramamurthy, *Organic chemistry – Lab manual*, S. Viswanathan Co. Pvt. Ltd., 2002.
3. Raj K.Bansal, *Laboratory Manual of Organic Chemistry*, 4thedn., New AgePublishers, 2001.
4. J.N. Gurtu and R. Kapoor, *Advanced Experimental Chemistry (Organic)*, S. Chand and Co., 1987.

16UZO4MC01- ENVIRONMENTAL BIOLOGY

SEMESTER	IV	CREDITS	4
CATEGORY	MC	NO.OF HOURS/ WEEK	4

OBJECTIVE: To generate up-to-date knowledge on environmental conservation and management through a comprehensive understanding of the components of ecosystem, biological cycles, habitat ecology, resource ecology, pollution and its management.

UNIT I : ECOSYSTEM

Basic concept of Environmental Biology, Scope and Environmental Science, Fundamentals of Ecology, Definition, Subdivisions. Ecosystems: concept of ecosystems, energy flow in ecosystems, Nutritional Flux. Development and evolution of the ecosystems. Natural and Man-made ecosystem, with examples. Energyflow - Trophic structure and levels - Pyramids, food chain and web - ecological efficiencies, and productivity and its measurement. Ecological niche and ecosystem stability.

UNIT II : POPULATION AND BIOLOGICAL CYCLES

Structure and distribution - Growth curves - Groups, natality, Mortality - Density indices, Life study tables - factors affecting population growth - Carrying capacity. Population regulation and human population control. Complete and incomplete biogeochemical cycles - Sedimentary cycle - Recycle pathway of elements - Cycling of non - essential and organic nutrients.



UNIT III : ENVIRONMENTAL STRESSES AND MANAGEMENT

Global climatic pattern, global warming, atmospheric ozone, acid and nitrogendeposition, coping with climatic variations. Major classes of contaminants. Uptake, biotransformation, elimination and accumulation of toxicants. Factors influencing bioaccumulation from food and trophic transfer. Pesticides and other chemical in agriculture, industry and hygiene and their disposal. Impact of chemicals on biodiversity. Bioindicator and biomarkers of environmental health. Biodegradation and bioremediation of chemicals.

UNIT IV : MANAGEMENT OF ECOSYSTEMS AND BIODIVERSITY

Remote sensing as a tool: physical basis - information extraction – role in ecological research, Environmental auditing, Energy audit, Environmental impact assessment, Sustainable development. Biotechnological principles and environmental management. Case study - River management in India, Biodiversity crisis – habitat degradation poaching of wild life. - Socio economic and political causes of loss of biodiversity. - In situ and ex situ conservation of biodiversity - Value of biodiversity. - Hot spots of Biodiversity.

UNIT V : AGENCIES OF ENVIRONMENTAL CONSERVATION

Green peace movement - Chipko Movement - nuclear disarmament, Role of government agencies: Central and State Pollution Control Boards - Ministry of Environment and Forests – National Biodiversity Authority - National Environment. Awareness Programme, NGOs, Natural Disaster Management, Legislations for environmental Protection, Biovillages – sustainable utilization and development, Environmental ethics.

TEXT BOOKS

1. Asthana, D.K. and Meera, A. 2009. A text book of environmental studies, S. Chand , New Delhi.



2. Sanyal, K. Kundu, M. and Rana, s. 2009. Ecology and environment, Books and allied, Kolkata.
3. Grant, W.E. and Swannack, T.M., 2008, Ecological Modelling, Blackwell.

REFERENCE BOOKS

1. Odum E.P.1983. Basic Ecology, Saunders, New York
2. Wilkinson, D.M., 2007, Fundamental Processes in Ecology: An Earth system Approach, Oxford University Press, UK.
3. Saha, t.K. 2010. Ecology dan Environmental bilogy, Books and Allied, Kolkata.

16UZO4MC02 - ENVIRONMENTAL BIOLOGY LAB COURSE

SEMESTER	IV	CREDITS	2
CATEGORY	MC	NO.OF HOURS/ WEEK	2

OBJECTIVE: To provide a method for assessing biotic factors, abiotic factors and the organisms in the environment.

UNIT I: ESTIMATION OF ABIOTIC FACTORS

Estimation of dissolved Oxygen, Dissolved carbon-di-oxide, Determination of alkalinity in water samples, Determination of salinity of water samples, Determination of bicarbonate and carbonates.

UNIT II: MOUNTING TECHNIQUES

Collection, isolation, identification and mounting of marine and freshwater plankton.

UNIT III: ADAPTATION AND ANIMAL ASSOCIATIONS

Study of sandy shore fauna.

Study of rocky shore fauna.



Study of animal Association.

UNIT IV: INSTITUTIONAL VISIT AND FIELD WORK

Study of pond as an ecosystem- Field trip to lakes, pond and different shores. Collection fauna from sea shore. Visit to environmental biology labs, Research Institutes and Effluent treatment plants.

UNIT V: COLLECTION OF MICROARTHROPODS

Study of different soil microarthoropods - Extraction and identification of soil micro arthropods through Tullgren's funnel method and Ladell's Floating Method.

TEXT BOOKS

1. Abhijit Dutta, 2009. Experimental biology: A Laboratory Science, Narosa, New Delhi.
2. Micheal, P, 1984. Ecological Methods for field visit and laboratory investigation. Tata McGraw Hill, New Delhi.
3. APHA, 1992. Standard Methods for the examination of water and waste water, American Public Health association, Washington D.C.

REFERENCE BOOKS

1. Eugenia, 2008. Environmental Biotechnology and cleavers Bioprocesses, London.
2. Ramesh, R & M, Anbu 1996. Chemical methods for environmental Analysis of water and sediment. Macmillan India Limited, Chennai.



16UZO4ES01 - ESSENTIALS OF MARINE BIOLOGY

SEMESTER	IV	CREDITS	2
CATEGORY	ES	NO.OF HOURS/ WEEK	4

OBJECTIVE:To understand and learn the environment and biological processes of marine environment.

UNIT I : MARINE ECOLOGY

Marine environment, ecological factors light, temperature, salinity, pressure Classification of marine environment pelagic environment, planktonic and nektonic adaptations, benthic environment intertidal, interstitial and deepsea adaptation. Other coastal environments coral reefs, estuaries, mangroves, seagrass beds, kelp forests polar seas and hydrothermal vents

UNIT II : PHYSICAL OCEANOGRAPHY

Physical Properties of Seawater- density, viscosity, surface tension, conductivity and their relationship, temperature distribution in the sea-heat budget, UV radiation Dynamics of the ocean-general surface circulation, Waves, Currents and Tides

UNIT III : CHEMICAL OCEANOGRAPHY

Chemical composition of seawater- ionic, major and minor constituents, constancy- ionic compositions and factors affecting constancy- major and minor elements, trace elements-their importance, distribution. Chemistry of seawater constituents- concept of chlorinity and salinity - methods of measurements

UNIT IV : BIOLOGICAL OCEANOGRAPHY

Sea as a biological environment- Plankton- classification based on size, mode of life and habitat. Phytoplankton and Zooplankton - methods of collection, estimation of standing crop-wet and dry weight estimation-plankton volume settling and displacement methods.Oxidation as carbon (as organic matter).



UNIT V : OCEAN MANAGEMENT

Role of National and international agencies and organizations in ocean management-FAO, UNEP, DOD, WOCE, WHOI, IOI Malta, IMO INMARSAT- IUCN, SCAR, SCOR, Marpol, Traffic. Ocean policy (India) - research and management.

TEXT BOOKS

1. Bertness, M.D, S. D. Gaines and M.K. Hay 2000. Marine Community Ecology Sinauer Associates.
2. Grant Gross, M., 1993 Oceanography: A view of the earth (sixth edition). Prentice Hall Inc. New Jersey.
3. Thurman, Harold., 2001 Introduction to Oceanography, Prentice Hall Inc. New Jersey.

REFERENCE BOOKS

1. Pickard, G.L. and W.J. Emery 1995. Descriptive Physical Oceanography. Pergamon Press, London.
2. Riley, J.P. and Skirrow, 1975-1984. Chemical Oceanography Vols. 1 to 8. Academic Press, London
3. Gage. J.D. and P.A. Tyler, 1991. Deep Sea Biology, Cambridge University Press, Cambridge



**16UZO4ES02 - ESSENTIALS OF MARINE BIOLOGY
LAB COURSE**

SEMESTER	IV	CREDITS	2
CATEGORY	ES	NO.OF HOURS/ WEEK	2

OBJECTIVE: To enlighten the functions of organ systems in animals and man towards homeostasis.

UNIT I :IDENTIFICATION OF PLANKTON

phytoplankton and zooplankton (diatoms, dinoflagellates, hydromedusae, copepods, pteropods, chaetognatha, thalassaceae and planktonic larvae) - Identification of locally available macroalgae, sea grass and holophytes including mangrove plants.

UNIT II : FIELD SURVEY

Field collection - submission of 10 herbarium sheets - Extraction and quantification of plant pigments - Determination of primary production using light and dark bottle techniques.

UNIT III : POPULATION STUDIES

Population analysis of Cerithideacingulata, Uca sp.: Quadrant and Transect method.

UNIT IV : COMMUNITY STUDIES

Collection and identification of animal and community studies of different environments

Pelagic, Muddy shore, Sandy shore, Rocky shore, Interstitial, Oyster bed community, Phytal faunal community (Seaweed and seagrass), Fouling and boring organisms, Assessment of biodiversity of any one of the above communities.

UNIT V : FIELD STUDY

Preparation of a Field Report.

TEXT BOOKS

1. Bertness, M.D, S. D. Gaines and M.K. Hay 2000. Marine Community Ecology Sinauer Associates.



2. Grant Gross, M., 1993 Oceanography: A view of the earth (sixth edition). Prentice Hall Inc. New Jersey.
3. Thurman, Harold., 2001 Introduction to Oceanography, Prentice Hall Inc. New Jersey.

REFERENCE BOOKS

1. Pickard, G.L. and W.J. Emery 1995. Descriptive Physical Oceanography. Pergamon Press, London.
2. Riley, J.P. and Skirrow, 1975-1984. Chemical Oceanography Vols. 1 to 8. Academic Press, London
3. Gage. J.D. and P.A. Tyler, 1991. Deep Sea Biology, Cambridge University Press, Cambridge

16UZO4ES03 - BIOPHYSICS AND BIOSTATISTICS

SEMESTER	IV	CREDITS	2
CATEGORY	ES	NO.OF HOURS/ WEEK	4

OBJECTIVES: To enlighten statistical applications in biological sciences and to elaborate principles of physics in biology.

UNIT I: BIOPHYSICAL PRINCIPLES

Physical laws in living system: diffusion – Fick’s law – diffusion constant - (Plasmolysis & Haemolysis) – Osmosis – Osmotic pressure – Donnan’s equilibrium - Principles of viscosity – Brownian movement – surface tension – turgor pressure – centrifugal and centripetal force – centrifuges.

UNIT II: APPLICATIONS OF BIOPHYSICS

Radioactive isotopes – Radiation- Geiger-Muller counter- biological impacts – Autoradiography

Medical and biological uses of X-rays – NMR- Ultrasound - Laser and their applications – Colorimetric - Principles of electrophoresis



UNIT III: COLLECTION OF DATA:

Definition of statistical population and sample in biological studies - Variables: qualitative and quantitative - discrete and continuous - Derived variables – rates ratios, percentages and indices - Units of measurement – abbreviations of common units of measurements – expression of very large of small numbers as an index of ten.

UNIT IV: CLASSIFICATION AND PRESENTATION OF DATA

Types of Classification: Qualitative and quantitative - Qualitative classification: Chronological, geographical etc. and continuous - frequency distributions - Diagrammatic and graphical representations of data – Bar diagrams (Simple, multiple and subdivided) – Pie diagram – Cartogram- Frequency diagram: histograms- frequency polygon - frequency curve line graphs.

UNIT V: DESCRIPTIVE & INFERENCE STATISTICS

Measure of central tendency: Arithmetic mean- median-mode-geometric mean- harmonic mean - Measures of dispersion: Standard deviation – Standard error- Coefficient of variance- skewness and kurtosis. Test of significance: Chi-square test for goodness of fit – Student t test.

TEXT BOOKS

1. Das, D., 1996. Biophysics and Biophysical Chemistry for Medical and Biology students, Academic Calcutta.
2. Gurumani, N., 2005. An introduction to Biostatistics, MJP, Chennai
3. Gurumani, N., 2006. Research methodology for biological sciences, MJP, Chennai



4. Subramanian, M.A., 2005. Biophysics – Principles and Techniques, MJP, Chennai.

16UZO4ES04 - BIOPHYSICS AND BIostatISTICS LAB COURSE

SEMESTER	IV	CREDITS	2
CATEGORY	ES	NO.OF HOURS/ WEEK	2

OBJECTIVE: To indicate the merger of biological research with various fields of biophysics and biostatistics.

BIOPHYSICS

UNIT I: SEPARATION TECHNIQUES

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

UNIT II: MEASUREMENTS

Measurement of viscosity of different liquids using drop weight method

Measurement of surface tension on different liquids using burette method

UNIT III: MEASURE OF CENTRAL TENDENCY

Measure of central tendency using leaf: Arithmetic mean- median-mode-geometric mean- Measures of dispersion: Standard deviation – Standard error-

UNIT IV: MEASUREMENTS

Test of significance: Chi-square test for goodness of fit – Student t test

ANOVA - Height and weight comparison, BMI index calculation.

UNIT V: STATISTICAL SOFTWARE

Hands on training of SPSS and Primer.



TEXT BOOKS

1. Palanichamy, S and M. Shanmugavelu, 1991. Principles of Biophysics. Palani Paramount.
2. Gurumani, N., 2006. Research methodology for biological sciences, MJP, Chennai
3. Subramanian, M.A., 2005. Biophysics – Principles and Techniques, MJP, Chennai.
4. Das, D, 1996. Biophysics and Biophysical Chemistry for Medical and Biology Students, Academic, Calcutta.

REFERENCE BOOKS

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. Bose, S, 2000. Elementary Biophysics, Jyothi. Maduari
4. Lehninger, A. L. 2006. Biochemistry, Freeman, New York.
5. Gurumani, N., 2005. An introduction to Biostatistics, MJP, Chennai

16UCH4AL03 - GENERAL CHEMISTRY FOR BIOLOGY-II

SEMESTER	IV	CREDITS	2
CATEGORY	AL	NO.OF HOURS/ WEEK	4

OBJECTIVE

1. To understand the chemistry of biomolecules and natural products.
2. To understand the concepts of agricultural chemistry.

Unit I: PROTEINS AND ENZYMES

- 1.1 Amino acids: Classification, preparation and properties, zwitter ions, isoelectric point, peptide linkage and peptide synthesis.
- 1.2 Proteins: Classification based on structure and functions,



primary and secondary structure, N-terminal analysis, denaturation and renaturation, test for protein- Ninhydrin Test, Biuret Test.

- 1.3 Enzymes: Classification, factors affecting enzyme activity, mechanism of enzyme action, kinetics of enzyme reaction. Michaelis-Menten equation (no derivation), types of enzyme inhibition.

Unit II: LIPIDS (1+8+1 h)

- 2.1 Types and functions of lipids (fatty acids, glycerides, complex lipids and non-glycerides), fats and oils (rancidity, saponification, hydrogenation of oils), waxes, phospholipids (lecithins, cephalins, plasmalogens)
- 2.2 Steroids: structure and functions cholesterol, types and functions of plasma lipoproteins. Bile salts, steroid hormones.

Unit III: NUCLEIC ACIDS (1+10+1 h)

- 3.1 Components of nucleic acids, structure of purine and pyrimidine bases, structure of DNA and RNA.
- 3.2 Hydrogen bonding in nitrogenous bases in DNA, properties and types of DNA and RNA, differences between DNA and RNA.
- 3.3 Replication, translation and transcription of DNA, regulatory metabolism, mutation, genetic engineering, codon.

Unit IV: CARBOHYDRATES (1+10+1 h)

- 4.1 Classification and functions of carbohydrates. Structure of glucose and fructose, interconversions, mutarotation. Differences between reducing and non-reducing sugars. Test for carbohydrates.
- 4.2 Structure of sucrose, inversion of cane sugar.
- 4.3 Glycolysis, TCA cycle, relationship between glycolysis and respiration, photosynthesis.

Unit V: NATURAL PRODUCTS AND AGRICULTURAL CHEMISTRY (1+12+1 h)

- 5.1 Alkaloids: Classification, isolation and biological importance (mention of papaverine, nicotine, coniine).
- 5.2 Terpenes: isoprene rule, classification, extraction and



biological importance (mention of Camphor, Citral, and Pinene).

- 5.3 Flavones and flavonoids: Structure, isolation and importance.
- 5.4 Types of soil, soil analysis, fertilizers— role of macro and micro nutrients, NPK fertilizers, urea, superphosphate of lime and potassium nitrate.
- 5.5 Insecticides [dichlorodiphenyltrichloroethane (DDT) and benzenehexachloride (BHC)], herbicides [2,4-Dichlorophenoxyacetic acid (2,4-D) and 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)], fungicides (bordeaux mixture, lime-sulphur) – structure and uses.

BOOKS FOR STUDY

1. G.P. Talwar, L.M. Srivatsava and K.D. Moudgil, *Text book of Biochemistry and Human Biology*, Printice-Hall of India Pvt. Ltd. New Delhi, 2003.
2. J.L. Jain, *Biochemistry*, S. Chand & Co., 2004
3. A. Lehninger, D. L. Nelson, M. Cox and M. M. Cox, *Principles of Biochemistry*, MPS Publishers, New York, 2009.
4. A.V.S.S. Rama Rao, *Text Book of Biochemistry*, 9th edn., U B S Publishers, 2008.
5. Gurudeep R. Chatwall, *Organic chemistry of natural products*, Vol-I&II, Himalaya publishing House Pvt.Ltd, Mumbai, 1981.

BOOKS FOR REFERENCE

1. I.T. Palmer, P. Bonner, *Enzymes: Biochemistry, Biotechnology, Clinical Chemistry*, 2nd edn., First East West Press Pvt Ltd., New Delhi 2008.
2. J.M. Herg, J.L. Tymoczko, L. Stryer, 2002. *Biochemistry*, 5th edn., WH-Freeman and Co, New York.
3. Keshav Trehan, *Biochemistry*, Wiley Eastern Ltd, 1987.
4. E.J. Wood, W.R. Piekerling, *Introducing Biochemistry*, ELBS, 1984.
5. K.H. Buchel, *Chemistry of Pesticides*, John Wiley & Sons, New York, 1983.



**16UCH4AL04 - CHEMISTRY PRACTICAL FOR
BIOLOGY-II**

SEMESTER	IV	CREDITS	1
CATEGORY	AL	NO.OF HOURS/ WEEK	2

OBJECTIVES

1. To understand the concepts of quantitative analysis
2. To understand the separation technique in the analysis of biologically important compounds

EXPERIMENTS

1. Estimation of ascorbic acid using iodimetric method.
2. Estimation of glucose using benedict's method.
3. Estimation of acetic acid in vinegar.
4. Estimation of glycine.
5. Determination of hardness of water.
6. Determination of strength of H_2O_2 .
7. Estimation of calcium in milk.
8. Determination of iodine value of oil.
9. Determination of saponification value of oil.
10. Determination of available chlorine in bleaching powder.
11. Determination of available iodine in table salt.
12. Determination of available CO_2 in baking powder.

DEMONSTRATION EXPERIMENTS:

1. Column chromatography of leaf and flower extract.
2. TLC – Separation of triglycerides.
3. Paper Chromatography – Separation of amino acids.
4. Determination of pH of soil, water.
5. Tests for carbohydrates and amino acids

BOOKS FOR STUDY

1. R. Veeraswamy, V. Venkateswaran and A. R. Kulandaivelu, *Basic principles of practical Chemistry*, Sultan Chand & Sons, 2ndedn., 2015.
2. N.S. Gnanaprasagam, G. Ramamurthy, *Organic chemistry-Labmanual*, S.ViswanathanCo.Pvt. Ltd., 2002.
3. J.N. Gurtu and R. Kapoor, *Advanced experimental chemistry*, S. Chand and Co., 1987.
4. R.Mukhopadhyay, P.Chatterjee, *Advanced practical chemistry*, 3rdedn., Books and allied P.Ltd., 2007.



16UZ05MC01 - MOLECULAR CELL BIOLOGY

SEMESTER	V	CREDITS	4
CATEGORY	MC	NO.OF HOURS/ WEEK	4

OBJECTIVE: To emphasize cell as the structural and functional unit and to elaborate heredity and variations.

UNIT I : INTRODUCTION

General account of cell- Cellular building blocks- basic structure and organization- origin of single cell to multicellular organism- cell theory.

UNIT II : TOOLS AND TECHNIQUES

Microscopy- Light, Phase contrast, Dark field, Fluorescence and Electron microscopes – Cytological study of living and dead cells, Microtechniques (vital staining) – Molecular techniques: cell fractionation- homogenization and centrifugation- isolation of cellular components. Tissue culture.

UNIT III : CELL STRUCTURE AND CELLULAR COMPONENTS

Comparison of cell structure of prokaryotes and eukaryotes. Biomembrane – various membrane models- transport mechanism- endoplasmic reticulum – golgi complex– ribosomes – cilia & flagella –centrioles. Lysosomes– Mitochondria– oxidative phosphorylation– Biogenesis. Peroxisomes- glyoxisomes, Interphase nucleus, chromosomes –kinds of chromosomes. Cell Cycle –cell division: meiosis and mitosis – cell birth, lineage and cell death.

UNIT IV : MOLECULAR BIOLOGY

Nucleic acids– DNA structure and RNA Structure – DNA replication, repair and recombination. DNA transcription and bio synthesis of protein. Cell signaling, Hormones and their receptors, cell surface receptor, signal transduction pathways, second messengers, regulation of signaling pathways.



UNIT V :ADVANCED STUDIES IN MOLECULAR BIOLOGY

Cancer biology: Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis. Stem cell therapy– Nuclear transplantation.

TEXT BOOKS

1. Ajoy Paul, 2011. Text book of cell and Molecular biology, Books and Allied, Kolkata.
2. Lodish, H., Berk, A., Matsudaira, P., Kaiser, C.A. 2007. Molecular cell biology, what freeman, New York.
3. Schulz, W.A. 2005. Molecular biology of human cancer, Springer.

REFERENCE BOOKS

1. Watson, J.D., Baker. T. A., Bell,P.S., Gann, A., Levine, M., Losick, R. 2004. Molecular biology of the gene. Benjamin cummings, New York.
2. Becker, W. M., Kleinsmith, L.J., Hardin, J. 2000. The world of the cell. Benjamin, New York.
3. De Robertis, E.D.F. & De Robertis, E.M.F., 1981. Cell and Molecular Biology, Saunders International, Philadelphia.



16UZO5MC02 – MOLECULAR GENETICS

SEMESTER	V	CREDITS	4
CATEGORY	MC	NO.OF HOURS/ WEEK	4

OBJECTIVE: To understand the activities of the cell in the genetic and in the molecular level and it helps the students in understanding the maintenance and alteration of the cellular activities.

UNIT I: MOLECULAR GENETICS OF THE CELL

Mendelian Genetics - Linkage and crossing over - Extranuclear inheritance patterns - Quantitative inheritance - Population Genetics and Evolution.

UNIT II : CHROMOSOMAL VARIATIONS AND MAPPING

Chromosomal variation in Number & Structure – Euploidy, Non-disjunction & Aneuploidy, Polyploidy, Position Effect, and Centromeric & Non-centromeric breaks in chromosomes, chromosomal rearrangements, Chromosomal aberrations & evolution. Chromosome Mapping - Haploid mapping, Diploid mapping - Oncogenesis: Development and causes of cancer, Types of cancer, Oncogenes: Retro viral, proto, tumour suppressor gene.

UNIT III : DNA RECOMBINATION & MUTATION

DNA repair mechanisms; Mutagenesis, Mutations, and Mutants-Types of Mutations, Biochemical Basis of Mutants, Mutagenesis, Mutational Hot Spots, Reversion.; Transposable elements (Insertion sequence and transposons, Integrons and Antibiotic Resistance cassettes; Bacterial Genetics (Conjugation, Transformation, Generalized transduction, Specialized Transduction).

UNIT IV : GENE REGULATION MECHANISMS

General aspects of Regulation, The lactose system and the operon model, The Galactose operon, The Arabinose operon,



The Tryptophan operon, Relative positions of Promoters and Operators, Feedback Inhibition.

UNIT V: MEMBRANE BIOLOGY AND SIGNAL TRANSDUCTION

Membrane organization; membrane proteins - Transport across cell membranes (passive and active) - Internalization of macromolecules and particles -Signal molecules, receptors and second messengers.

TEXT BOOKS

1. Cell Biology. Organelle structure and function, David E Sadava, Jones Bartlett Publishers-1993.
2. Lewin B. 2008. Genes IX. Jones and Bartlett publishers
3. Verma P.S and Agarwal V.K. 2006. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company Ltd

REFERENCE BOOKS

1. Cooper M 1995. The cell molecular approach, ASM Press.
2. Principle of cell and molecular biology 2nd edition – Lewis J Kleinsmith, Valerie M Kish-1995. DeRobertis, EDP, E.M.F Robertis, 7th edition 1980. Cell and molecular biology, Saunders Company.
3. Harvey Lodish, Baltimore. Arnold Berk et al 1995. 3rd edition. Molecular cell biology.



16UZO5MC03 - ANIMAL BIOTECHNOLOGY

SEMESTER	V	CREDITS	4
CATEGORY	MC	NO.OF HOURS/ WEEK	4

OBJECTIVE: To study the influence of biotechnology in the field of animal sciences and to create awareness about the applied aspects of animal biotechnology.

UNIT I : ANIMAL CELL, TISSUE AND ORGAN CULTURE

History of animal cell and organ culture- requirements of animal cell, tissue and organ culture –characteristics of animal cell growth in culture- culture media- natural media-synthetic media- cultivation of animal cell in bioreactors-organ culture techniques-stem cells and applications, technological uses of animal cell culture.

UNIT II :ANIMAL CELLS AND GENE TRANSFER SYSTEM

Methods of transfection - liposomes –viral mediated – electroporation –biolistic –direct DNA injection – micro injection – DNA micro arrays – gene expression synthesis for animal cells.

UNIT III: TRANSGENIC ANIMAL TECHNOLOGY

Concept of transgene and transgenesis – transgenic mammals-knock out mice, sheep, transgenic fishes,- animals as bio reactor , molecular farming . application of molecular markers – important of live stocks.

UNIT IV: ANIMAL BIOTECH AND HEALTH CARE

Production of Hybridoma and microclonal antibodies, human live insulin, RFLP, RAPD, DNA finger printing – Human genome project, DNA diagnostic systems-Gene therapy

UNIT V: ANIMAL BIOTECH AND SOCIETY

Socio ethical problem due to animal genetic engineering – recent trends in animal biotechnology – ethical implications.



TEXT BOOKS

1. Ignacimuthu, S. 2008. Basic biotechnology, Tata McGraw hill, New Delhi.
2. Ranga, M.M. 2003. Animal biotechnology, Agrobios, New Dehi.
3. Ruby, R.C. 2012. A text book of biotechnology , S. Chand company, New Delhi.
4. Sasidhara, R. 2011. Animal biotechnology, MJP publishers.

REFERENCE BOOKS

1. Jayanta, K.P. and Saroj, S.G. 2009. Oxford University press, New Delhi.
2. Peters, p. 2009. Biotechnology – A guide to genetic engineering, WMC brown publisher, UK.
3. Ramawat, K.G et al. 2009. Comprehensive biotechnology, S. Chand company, New Delhi.
4. Veer BalaRastogi, 2007. Molecular biology, KedarNath Ram Nath, Delhi.



16UZO5MC04 – IMMUNOLOGY

SEMESTER	V	CREDITS	4
CATEGORY	MC	NO.OF HOURS/ WEEK	4

OBJECTIVE: To emphasize the importance of immune system in protecting the body.

UNIT I : INTRODUCTION

General concepts of the immune system. Innate and adaptive immunity; Inflammation - general properties - Structure, properties and functions of the immune cells & organs: Hematopoiesis, T and B-lymphocytes, NK cells; Monocytes and macrophages; Neutrophils, eosinophils, and basophils - Mast cells and dendritic cells. Thymus and bone marrow; Lymph nodes, thymus and bursa of Fabricius, lymph node, spleen, Peyer's patches and Kupffer cells, spleen, MALT, GALT and CALT.

UNIT II: ANTIGEN AND ANTIBODIES

Antigens and haptens: Properties (foreignness, molecular size, heterogeneity). B and T cell epitopes. T-dependent and T-independent antigens. Major histocompatibility gene complex: Organization of MHC. Structure and cellular distribution of HLA antigens.

Antibodies: Structure, function and properties of the antibodies; Different classes and biological activities of antibodies; Antibody as B cell receptor, antigenic determinants on antibodies (isotype, allotype and idiotype). Genesis of antibody variability. Hybridoma technology, monoclonal antibodies and abzymes -Introduction to antibody engineering.

UNIT III : CELL MEDIATED IMMUNITY

Cell types (CTLs, NK cells, macrophages and TDTH cells), effectors mechanisms and effectors molecules of cell mediated reactions. Assessment of cell-mediated cytotoxicity. Cytokines - properties and functions of inter lukin (IL). Regulation and modulation of immune response: A general account.



Adjuvants, tolerance, immunopotential and immunosuppression. Hypersensitivity: Types and mechanism of hypersensitive reactions.

UNIT IV : AUTOIMMUNITY

Mechanisms of induction of organ specific (Hashimoto's thyroiditis, autoimmune anemias, Goodpasture's syndrome, IDDM), and systemic autoimmune diseases. Therapeutic approach. Transplantation immunology: Types of grafts, immunologic basis of graft rejection, immunosuppressive therapy and transplants to immunologically privileged sites. Immunity and tumors: tumor antigens (TSTA and TAA), immune response to tumors. Tumor evasion of the immune system. Immunotherapy for tumors.

UNIT V: CLINICAL IMMUNOLOGY

Immunity against viral, bacterial and parasitic infections - Immunological basis of hypersensitivity - Graft rejections. Vaccines: Types and uses - Immunization schedule for children - Prevention of post natal diseases: tetanus, diphtheria, whooping cough, cholera, yellow fever, measles and AIDS.

TEXT BOOKS

1. Roitt, M and Peter J. Delves, 2005. Essential immunology, 10th Edition, Blackwell, USA.
2. Richard A. Goldsby, Thomas j. Kindt, Barbara A. Osborne, Janis Kuby, 2003. Immunology, W.H. Freeman, NY.
3. Raj Khanna, 2011. Immunology, Oxford University press, New Delhi.

REFERENCE BOOKS

1. Abul K Abbas, Andrew K. Litchman and Jorden S. Pober, 2003. Cellular and Molecular Immunology, 3rd Edition, W.B. Saunders, Philadelphia
2. Clark. John wiley and Sons, W. The Experimental Foundations of Modern Immunology, New York.



3. Lichtman, A. and Pober, W.B. Cellular and Molecular Immunology by Saunders Company, Philadelphia.

**16UZ05MC05 - MOLECULAR BIOLOGY, GENETICS
AND BIOTECHNOLOGY LAB COURSE**

SEMESTER	V	CREDITS	2
CATEGORY	MC (L)	NO.OF HOURS/ WEEK	2

OBJECTIVE: To provide hands on training in cellular and molecular techniques and correlate functional significance and inter dependence of Cytogenetics..

UNIT I : TECHNIQUES IN CELL BIOLOGY

Micrometry- Stage and Ocular micrometer - Mounting of buccal epithelium and observing living cells using vital staining. Mendelian traits in man, law of independent assortment, Counting of RBC and WBC using Haemocytometer (Demonstration only), Culturing of Drosophila.

UNIT II : MOUNTING TECHNIQUE

Mitosis in Onion root tip squash preparations, Meiosis in grasshopper testis squash, Human ABO blood grouping & Rh typing.

UNIT III: MOLECULAR TECHNIQUES

Isolation of genomic DNA of Eukaryotes/ Bacteria (Plasmid), Quantification of human DNA, Estimation of DNA – Polyrylamine method (Demonstration)

UNIT IV : CHROMOSOME AND KARYOTYPING

Karyotyping– identification of chromosome abnormalities, Mounting of the giant chromosomes of Chironomous larva (salivary gland)



UNIT V : RESTRICTION DIGESTIONS AND AGAROSE GEL ELECTROPHORESIS

DNA / RNA/ Plasmid Isolation/Extraction method, Agar plates for bacterial plasmid clone selection with ampicilling and GUS, Acrylamide gel electrophoresis for SSR/microsatellite methods.

TEXT BOOKS

1. Durairaj, G. 1998. Laboratory manual in genetics, Emerald publishers.
2. Gowenlock, R. 2001. Varkey's Practical clinical biochemistry, CBS press, New Delhi.
3. Mukhopadhyay, S.N. 2007. Experimental process biotechnology protocols, Viva book, New Delhi.
4. Yadav, P.R., and Tyagi, R. 2005. Experimental biotechnology discovery, New Delhi.

REFERENCE BOOKS

1. Old and Primerose, 2001. Principles of Gene Manipulation techniques, Blackwell ScienceMarimuthu, p. 1995. Practical genelies, IBMS.
2. Edward Gasque, 1992. A manual of laboratory experiments in cell biology University of Wisconsin, Brown, Wisconsin.

16UZO5ES01 - MEDICAL LABORATORY TECHNIQUES

SEMESTER	V	CREDITS	3
CATEGORY	ES	NO.OF HOURS/ WEEK	4

OBJECTIVE: To study the basis of medical laboratory techniques.

UNIT I : HAEMATOLOGY

Composition of blood and their function- collection of blood & lab procedure-haemopoiesis- types of anaemia- mechanism of



blood coagulation- Blood pressure - bleeding time- clotting time- determination of hemoglobin-erythrocyte sedimentations rate- packed cell volume- Total count of RBC & WBC- Differential count WBC- blood grouping and typing- haemostasis- bleeding disorder of man - Haemolytic disease of newborn, Platelet count, reticulocytes count, Absolute Eosinophil count.

UNIT II : LABORATORY SAFETY AND HUMAN HEALTH AND HYGIENE

Laboratory safety – toxic chemicals and biohazards waste biosafety level- good laboratory practice – hygiene and health issue – physiology effect of alcohol- alcoholism – abuse of alcohol – treatment of chronic abuse alcohol – effect of tobacco – smoking habits – junk food – overcoming environment influences.

UNIT III :MEDICAL MICROBIOLOGY AND INSTRUMENTATION TECHNIQUES

Definition and scope of microbiology- structure and function of cells - parasites - Entamoeba-Plasmodium-Leishmania and Trypanosome- hospital epidemiology-medical ethics.

Computer tomography (CT scan) – Magnetic Resonance imaging – flowcytometry – treadmill test – PET – SPECT.

UNIT IV : PHYSIOLOGY

Cardiovascular system –Cardiac cycle-Blood Pressure and Pulse –blood pressure- regulation of heart rate, cardiac shock. Heart sounds, Electrocardiogram –significance – ultra sonography – ultrasonic diagnostic methods – computed tomography.

UNIT V :DIAGNOSTIC PATHOLOGY

Handling and labeling of histology specimens - Tissue processing - processing of histological tissues for paraffin embedding, block preparation. Microtomes– types of microtome- sectioning, staining –staining methods- vital staining - mounting- problems encountered during section



cutting and remedies - Frozen section techniques- freezing microtome.

TEXT BOOKS

1. Godker, P. B. and Darshan, P, Godker, 2011. Text book of medical Laboratory Technology, Mumbai.
2. Guyton and Hall, 2000. Text Book of medical Physiology, 10th edition, Elseiner, New Delhi.
3. Mukerjee, K.L, 1999. Medical Laboratory Technology- Vol,I,II,III. Tata MC GrawHill, New Delhi.
4. Sood, R, 2009. Medical Laboratory technology, Methods and interpretation

REFERENCE BOOKS

1. Manoharan,A, and Sethuraman, 2003. Essential of Clinical Heamatology, Jeypee brothers, New Delhi.
2. Richard, A, McPherson, Mathew, R, Pincus, 2007. Clinical and management by laboratory methods, Elsevier, Philadelphia

**16UZ05ES02 - MEDICAL LABORATORY
TECHNIQUES LAB COURSE**

SEMESTER	V	CREDITS	1
CATEGORY	ES (P)	NO.OF HOURS/ WEEK	2

OBJECTIVE: To impart hands on training for identifying blood cell abnormalities for the diagnosis of disease. To provide skills necessary to perform blood cell count and evaluation of blood elements within stated limits of accuracy.

UNIT I : BASICS OF LABORATORY TECHNIQUES

Microscope handling, collection of blood, Blood Pressure, Pulse rate, hemocytometer, cellcounter.



UNIT II : HAEMATOLOGY

Clotting time, Bleeding time, Haemoglobin estimation, Erythrocyte Sedimentation Rate, packed cell volume, platelet count.

UNIT III : HAEMOGRAM

Differential count, Total Red Blood cell count, Total White blood cell count, Eosinophilic count, Reticulocyte count.

UNIT IV : QUALITATIVE AND QUANTITATIVE ESTIMATION

Qualitative Test - Protein, Carbohydrate and Lipid.

UNIT V : FIELD VISIT

Field visit to different hospitals- report submission- clinical laboratory visit & Demonstration.

TEXT BOOKS

1. Godkar, P.B. and D.B. Godkar, 2006. Medical Laboratory Technology, Bhalani, NewDelhi.
2. Mukerjee, K.L. and S. Ghosh, 2010. Medical Laboratory Technology, Volume II, McGraw Hill, New Delhi.17.

REFERENCE BOOKS

1. Cheesbrough, M, 2006, Medical Laboratory Manual for Tropical Countries Vol. I and II, Cambridge University Press; UK
2. Ochei, J. and A. Kolhatkar, 2000. Medical Laboratory Science, Theory and Practice, McGraw Hill, New Delhi.
3. Sood, R., 2006. Medical Laboratory methods and Interpretation, Jaypee, New Delhi



16UZO5ES03 - BIOINSTRUMENTATION SCIENCE

SEMESTER	V	CREDITS	3
CATEGORY	ES	NO.OF HOURS/ WEEK	4

OBJECTIVE: To learn various instrumentation and analytical techniques employed for understanding biological molecules and processes.

UNIT I: INTRODUCTION TO LABORATORY PRACTICES

Guide lines for good laboratory practices; Laboratory symbols; Cleaning and sterilization of labware and reagents; handling and care of laboratory animals; Laminar flow hood: types and use; Chemical balance: types and working mechanism; Concepts of molecular weight, atomic weight, preparation of solutions of a particular molarity and percentage; Buffers: definition and preparation of buffers, pH meter; Safety and ethical issues in laboratory settings

UNIT II : CELLULAR TECHNIQUES

Microscopy - Light microscope, SEM, TEM, Atomic force and scanning tunneling electron microscope; Cryopreservation - principle and procedure; Fluorescence activated cell sorting; X-ray crystallography

UNIT III : SEPARATION TECHNIQUES

Centrifugation - working principle and types of centrifugation; Spectrophotometry; Mass spectrometry; Chromatography - principle and types of chromatography

UNIT IV : MEDICAL INSTRUMENTATION

ESR measurement, haemoglobin measurement, blood pressure, blood flow, ECG, cardiac pacemakers; X-ray imaging, CT scan and NMR imaging; Ultrasound imaging; medical applications of laser; Biosensors - glucose biosensor, alcohol biosensor, artificial retina, environmental biosensors, cantilever -based biosensors, DNA biosensor



UNIT V : MOLECULAR ANALYSIS

Isolation of DNA, RNA and proteins; Electrophoresis of DNA and proteins; Polymerase chain reaction; ELISA; Immunofluorescence; Fluorescent in situ hybridization; Southern and Western blotting.

TEXT BOOKS

1. Khandpur, R.S, 2004. Biomedical instrumentation, Tata McGraw Hill, New Delhi.
2. Wilson, K.M. and Walker, J.M. 2010. Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, UK.
3. Cooper GM.2000.The Cell: A Molecular Approach. 2nd edition, Sinauer Associates, Sunderland (MA), USA.

REFERENCE BOOKS

1. Cottenill R.M.J. 2002. Biophysics: An introduction, John Wiley & Sons, UK.
2. Das D. 1996.Biophysics and Biophysical Chemistry for Medical and Biology students, Academic Calcutta.
3. Joseph Sambrook and David Russell 2001. Molecular Cloning: A Laboratory Manual, Cold Spring Harbour Press, USA.



16UZ05ES04 - BIOINSTRUMENTATION SCIENCE LAB COURSE

SEMESTER	V	CREDITS	1
CATEGORY	ES (L)	NO.OF HOURS/ WEEK	2

OBJECTIVE: To enable the learner to understand the basic concepts and use of certain bioinstrumentation and bioanalytical techniques.

UNIT I : BASIC INSTRUMENTS

Use of the chemical balance, micropipettes and centrifuges. Preparation of phosphate buffer of varying pH using pH meter.

UNIT II : BLOTTING TECHNIQUES

ESR measurement by Westergren method. Estimation of glucose concentration by colorimetry.

UNIT III: SEPARATION TECHNIQUES

Separation of amino acids by paper chromatography, Separation of plant pigments by column chromatography.

UNIT IV: ISOLATION METHODS

Isolation of casein protein from milk, SDS-PAGE of protein sample.

UNIT V : DEMONSTRATION

Demonstration of the working of PCR thermocycler and HPLC system, Visit to a bioinstrumentation lab/facility and submission of the observation report.

TEXT BOOKS

1. Khandpur, R.S, 2004. Biomedical instrumentation, Tata McGraw Hill, New Delhi.
2. Wilson, K.M. and Walker, J.M. 2010. Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, UK.



3. Cooper GM.2000.The Cell: A Molecular Approach. 2nd edition,Sinauer Associates, Sunderland (MA), USA.

REFERENCE BOOKS

1. Cottenill R.M.J. 2002. Biophysics: An introduction, John Wiley & Sons, UK.
2. Das D. 1996.Biophysics and Biophysical Chemistry for Medical and Biology students, Academic Calcutta.
3. Joseph Sambrook and David Russell 2001. Molecular Cloning: A Laboratory Manual, Cold Spring Harbour Press, USA.

16UZ05SK01 - ECONOMIC ZOOLOGY: DAIRY FARMING, POULTRY AND FISHERY FARMING

SEMESTER	V	CREDITS	4
CATEGORY	SK	NO.OF HOURS/ WEEK	6

OBJECTIVE: To study the importance and application of poultry and dairy for the betterment of human livelihood, and to provide practical knowledge on poultry and dairy farming.

UNIT I : POULTRY INDUSTRY

Poultry industry in India - Poultry for sustainable food production and livelihood - Commercial poultry farming - Nutritive value of egg and meat- Broiler management (Definition; Housing and equipment; Brooding, feeding and health cover of broilers; Record keeping; Broiler integration) - Layer management (Brooder; Grower and layer management; Culling of layers; Marketing of eggs and meat).

UNIT II : QUAIL AND TURKEY

Quail and Turkey management (Management; Feeding; Health cover; Marketing Strategy) – Backyard Poultry Farming in India: Management- Women in backyard poultry farming.



UNIT III :DAIRY FARMING

Dairyfarming - Breeds of dairy cattle's – Draft breeds – Dairy breeds – Dual purpose breeds – exotic breeds – breeding – Cross breeds – artificial insemination programme – Dairy cattle management – housing – water supply – cattle nutrition feeding standards – breeding and cattle improvement programmes in India – bacterial , viral and fungal diseases of cattle.

UNIT IV : DAIRY TECHNOLOGY

Dairy Technology - Composition of milk – milk and milk spoilage – pasteurization – Milk production in India – Processing of milk products (cream – butter – ghee – ice cream – khoa – butter milk) – Public health importance of milk

UNIT V :CULTURE OF ALGAE, PRAWNS AND MOLLUSC

An introduction to cultivable species of marine shrimps and their biology – *Penaeusindicus*, *P. monodon* and *P. vannamei*, Phyto and Zoo-plankton cultures. Traditional methods of fish and prawn culture –Important freshwater molluscan fisheries including edible oyster and pearl oysters and induced breeding in shrimps. Economic values.

UNIT VI :FRESHWATER AND MARINE AQUACULTURE

Culture of carps- Nursery rearing and stocking ponds – composite fish culture, Preparation of ponds– different methods for the eradication of weed fishes, predators, aquatic insects and aquatic weeds, stocking and post stocking management, harvesting. Induced breeding in fish. Polyculture Composite fish farming. Management of water and soil quality. Harvesting and Marketing.

TEXT BOOKS

1. Eckles C.H. and E.L. Anthony, 2001 Dairy Cattle and milk production, Biotech.



2. John William S. 2003. Poultry for Sustainable Food production and Livelihood. Loyola Publication, Chennai.
3. Jhingran , V. G. 1982. Fish and fisheries of India, Hindustan publications, India.
4. Shailendra Ghosh, 2009. Fisheries and aquaculture management, Adhyayan, New Delhi.
5. Gupta, S.M., 2010. Text book of fishery, Ann Backer, Mumbai.
6. Sukumar, D.E. 2002 Outline of Dairy Technology, Oxford Uni, New Delhi.

REFERENCE BOOKS

1. Banerjee G.C., 1992. Poultry, Oxford and IBH, New Delhi.
2. ICAR, 1997. Handbook of Animal Husbandary– The Indian Council of Agricultural Research, New Delhi
3. Prabakaran, R. 1998. Commercial Chicken production. published by P. Saranya, Chennai.
4. Hanifa, M.A. 2011. Aquatic resources and aquaculture, Dominant, New Delhi.

16UZO6MC01 - ENVIRONMENTAL BIOTECHNOLOGY

SEMESTER	VI	CREDITS	5
CATEGORY	MC	NO.OF HOURS/ WEEK	5

OBJECTIVE: To describe and discuss the application and role of biotechnology in conceiving and protecting the environment. To understand the commercial aspects of Environmental Biotechnology. homeostasis.

UNIT I : INTRODUCTION

Important areas of Environmental Biotechnology – Waste treatment – Biomass as source of energy - waste as renewable source of energy, Biocomposition of wastes, sources of wastes (Industrial, agricultural, forestry, municipal source) Biomass



Concretion; Production of SCP, Non biological Process, Direct Combustion – hog fuel ; Dialysis, classification, Biological Process, Energy manifestation, Aerobic & Anaerobic Digestion. Biotechnology of the marine environment.

UNIT II : BIO-ENERGY

Energy plantations – petro plants, algal hydrocarbons, bioethanol production, Biogas –Biogas technology in India, Advantages of Biogas plants, Biogas production, Anaerobic Digestion, Solubilization, Acidogenesis, Methanogenesis, Methanogases . Biohydrogen fuel and its advantages.

UNIT III : BIO-REMEDIATION

In situ Bioremediation, Ex situ Bioremediation, Solid phase system, scenery based system, Bioremediation of Industrialists of hydrocarbons, Bioremediation of Industrialists in paper and pulp industry, Bioremediation of heavy metals – metal biosorption technology , Bioremediation of coal wastes through VAM fungi, Bio remediation of Xenobiotics

UNIT IV : DEGRADATION OF WASTES AND MICROBES

Definition of xenobiotics, Gene manipulation of pesticides degrading microorganisms, Bio Augmentation, Biofiltration, Microorganisms used in biofilters, Mechanism of biofiltration microbial denitrification, Bioleaching, microorganisms used in bioleaching – Direct and indirect leaching method, copper leaching, uranium leaching, gold leaching, silica leaching, Ecological Impacts of GMMS (Genetically modified Microorganisms)

UNIT V : BIOREACTORS AND ENVIRONMENTAL ENGINEERING

Design of Bioreactors: Reactors types, Batch reactors, Continues reactions - Uses of Bio Reactors.

TEXT BOOKS

1. Allan Scragg, 2010. Environmental Biotechnology, Oxford University Press.



2. Bhatia, S.C. 2011. Hand Book of Environmental Biotechnology, Atlantic Publishers Ltd. New Delhi.
3. Eugemia et al, 2008. Environmental Biotechnology and cleaner Bio Process, Tylor& Francis London, UK.

REFERENCE BOOKS

1. Ahmed, N. F.M. Qureshi and Q.Y. Khan. 2001. Industrial Environmental Biotechnology, Horizon Press.
2. Ramesh, K.V. 2005. Environmental Microbiology, MJP Publishers, Chennai.
3. Rema, L. P. 2006, Applied Biotechnology, MJP Publishers, Chennai.

16UZO6MC02 - ENVIRONMENTAL TOXICOLOGY

SEMESTER	VI	CREDITS	5
CATEGORY	MC	NO.OF HOURS/ WEEK	5

OBJECTIVE: To learn the principles, application and management of environmental toxicology. To get anexhaustive knowledge of toxic effects with Special reference to human.

UNIT I : INTRODUCTION TO TOXICOLOGY

Definition, history, scope & sub-divisions of toxicology.Dose-effect and dose-response relationship- cute toxicity, chronic toxicity reversible & irreversible effects.Classification of toxic agents, natural toxins, animal toxins, plant toxins, food toxins, genetic poisons and chemical toxins.

UNIT II :FACTORS AFFECTING TOXICITY

Species and strain, age, sex, nutritional status, hormones, environmental factors, circadian rhythms.Absorption and distribution of toxicants-portals of entry-skin, gastro intestinal tract, gills and respiratory system.

UNIT III :ECOTOXICOLOGY



Examples of ecotoxicology, Scientific approach to ecotoxicology, Entry, movement, and fate of pollutants in ecosystems. Air pollution- Classification and properties of air pollutants, Behaviour and fate of air pollutants, photochemical smog, Acid Rain, health effects of air pollution. Water pollution- Origin of Wastewater, Domestic Water Pollution, Industrial water pollution, Agricultural water pollution, Toxic water pollutants and their health effects, Groundwater pollution, marine pollution

UNIT IV : BIO-DISTRIBUTION

Biomagnification biotransformation of xenobiotics- brief introduction to Phase-I and Phase-II reactions. Reactions of toxins with target molecules- Covalent binding, Non-covalent binding, Hydrogen abstraction, Electron transfer, Enzymatic reactions. Elimination of toxicants-renal, hepatic, DMES, pulmonary systems, milk, egg and foetus.

UNIT V :RADIOACTIVE POLLUTION

Sources of exposure to radiation, Biological effects of radiation, Famous accidents of radioactive pollution. Noise pollution- Sources of noise pollution, Industrial noise pollution, domestic noise pollution, traffic noise, other sources of noise pollution, Effects of noise pollution in man. Solid waste pollution- Sources and classification, Public health aspects. Soil and land pollution- Heavy metal contamination, Industrial soil pollutants, agricultural soil pollution, petroleum products as soil pollutants.

Text books

Rose, J. 2003. Environmental toxicology, CRC Press, 414 pp.

Arumugam, N. and T. Selva Mohan. 2015. Toxicology, Saras publications, 456 pp.

REFERENCE BOOKS

1. Strunk, W. Jr. and E.B. White. 2000. Elements of Style, 4th edition, Longman.
2. Francis, B.M. 1994. Toxic Substances in the Environment,. John Wiley and Sons.



**16UZO6MC03 - ENVIRONMENTAL BIOTECHNOLOGY
AND TOXICOLOGY LAB**

Semester	VI	Credits	2
Category	MC (P)	No.of hours/ week	2

UNIT I : ESTIMATION METHODS

Analysis and estimation of critical pollutants :Estimation of Ammonia (NH₃), Estimation of Hydrogen sulphide (H₂S)

UNIT II : ENVIRONMENTAL DETERMINANTS

Estimation of BOD, Estimation of COD

UNIT III : RESIDUE ANALYSIS

Pesticide residues in sea water and selected beverages, Petroleum hydrocarbons in sea water

UNIT IV : XENOBIOTICS

Heavy metals (Cu, Cd, Pb, Hg) in seawater, sediments & animal tissues, Preparation of solution (Standard, Normal, Molar) for toxicological studies

UNIT V :TOXICITY TESTING

Methodology of toxicity testing – acute and chronic tests (demonstration), Use of LC₅₀ values – sub lethal effects of critical pollutants on fish and Shellfish.

TEXT BOOKS

1. Allan SCragg, 2010. Environmental Biotechnology, Oxford University Press.
2. Eugemia et al, 2008. Environmental Biotechnology and cleaner Bio Process, Tylor& Francis London, UK.



REFERENCE BOOKS

1. Elements of Style, 4th edition, W. Strunk, Jr. and E.B. White, Longman, 2000 .
2. Toxic Substances in the Environment, B.M. Francis. John Wiley and Sons, 1994.
3. Huxley College of Environmental Studies, Western Washington University, 1998 - Environmental toxicology – 16 pp.

16UZ06MC04 - WILDLIFE CONSERVATION BIOLOGY

SEMESTER VI	CREDITS	5
CATEGORY MC	NO. OF HOURS/ WEEK	5

OBJECTIVE: To impart knowledge on Protection of natural habitats of organisms through controlled exploitation and maintenance of rare species in protected areas such as national parks, sanctuaries etc.,

UNIT I : BIODIVERSITY EXTINCTION AND CONSERVATION APPROACHES

Perspectives and Expressions. Identification and prioritization of Ecologically sensitive area (ESA). Coarse filter and fine filter approaches. Regional and National approaches for biodiversity conservation.

UNIT II : THEORY AND ANALYSIS OF CONSERVATION OF POPULATIONS

Stochastic perturbations - Environmental, Demographic, spatial and genetic stochasticity. Population viability analysis- conceptual foundation, uses of PVA models. Management Decisions for small populations using PVA models. Minimum viable populations & recovery strategies for threatened species



UNIT III : NATIONAL AND INTERNATIONAL EFFORTS FOR CONSERVATION

International agreements for conserving marine life, Convention on wetlands of International Importance (Ramsar convention), Conservation of Natural Resources. Overview of conservation of Forest & Grassland resources. CITES, IUCN, CBD National Forest Policy, 1988, National Wildlife Action Plan, 2002, Wildlife Protection Act, 1972, National and State Biodiversity Action Plans and other Forests and Environmental Acts.

UNIT IV : WILDLIFE IN INDIA

Wildlife wealth of India & threatened wildlife, Reasons for wildlife depletion in India, Wildlife conservation approaches and limitations. Wild life Habitat : Characteristic, Fauna and Adaptation with special reference to Tropical forest. Protected Area concept : National Parks, Sanctuaries and Biosphere Reserves, cores and Buffers, Nodes and corridors. Community Reserve and conservation Reserves

UNIT V : MANAGEMENT OF WILDLIFE

Distribution, status. Habitat utilization pattern, threats to survival of Slender Loris, Musk deer, Great Indian Bustard, Olive Ridley turtle. Wild life Trade & legislation, Assessment, documentation, Prevention of trade, Wild life laws and ethics.

REFERENCE BOOKS

1. Caughley. G and Sinclair, A.R.E 1994 Wildlife ecology and management. Blackwell Science.
2. Woodroffe R, Thirgood, S. and Rabinowitz A. 2005. People and Wildlife, Conflict or Co existence? Cambridge University.



16UZO6MC05 - BEHAVIOR BIOLOGY AND WILDLIFE LAB COURSE

SEMESTER	VI	CREDITS	2
CATEGORY	MC (P)	NO.OF HOURS/ WEEK	2

OBJECTIVE :To impart knowledge on the methods of analyzing and experimenting animal behavioural elements and conservation of wildlife.

UNIT I : SURVEY AND INVENTORY

Census Techniques, Usage of GPS, Marking boundary of an area using GPS, Geo referencing of an image file to create vector image (Q GIS), Overlaying GPS points over vector image and construction of GPS (Q GIS), Map reading, Recording angle of animal citation, Population estimation by block counting, Identification of indirect signs, Line Transect Method, Pug mark tracing and sex identification, Construction of transect lines and sampling.

UNIT II : FOREST ECOLOGY

Estimation of Vegetation in an area, Identification of various forest types, Estimation of tree height, Estimation of log volume, Calculation of canopy volume.

UNIT III : IDENTIFICATION OF INVERTEBRATES

Invertebrate sampling protocols, Identification of important Insects, Identification of important butterflies.

UNIT IV : IDENTIFICATION OF VERTEBRATES

Identification of fishes, Identification of feeding habit of fish based on position of mouth. Identification of amphibians, Identification of reptiles, Identification of birds, Identification of Nest and nesting behavior in Birds. Identification of feet and beak modification in birds. Identification of birds and animals based on call / cry/ roar or sound. Identification of Mammals.



Identification of individual elephants based on morphology.
Identification of fecal parasites.

UNIT V : ANIMAL BEHAVIOUR

Foraging behaviour in ants - Orientation and cues, Quantifying aggressive behaviour in ants, Predatory behaviour in fish, Focal behavioural sampling - Behavioural repertoire, Time activity budgeting, Evolutionary significance of Isozyme analysis, Pattern of evolution from museum study.

TEXT BOOKS

1. Gilas R H Jr.(ed.), 1984. Wildlife Management Techniques, 3rd ed. The Wildlife Society, Washington D.C., Nataraj Publishers, Dehra Dun, p 547.
2. Rodgers W A, 1991. Techniques for Wildlife Census in India - A Field Manual: Technical Manual - T M - 2. WII.
3. Saharia V B, 1982. Wildlife of India, Nataraj Publishers, Dehra Dun.
4. Teague R D (ed.), 1987. A Manual of Wildlife Conservation (The Wildlife Society, Washington D.C.). Nataraj Publishers, Dehra Dun, p 206.

REFERENCE BOOKS

5. Bookhout T.A 1996. Research and Management techniques for wildlife and habitats, Fifth Edition. The Wildlife society, Allen Press
6. Sutherland, W.J 2000. The conservation handbook: Research, Management and Policy. Blackwell Science.
7. Dasmann R F, 1964. Wildlife Biology, John Wiley & Sons, New York, p 231.
8. Robinson W L and Eric G Bolen, 1984. Wildlife Ecology and Management, Maxmillan Publishing Company, New York, p 478.



16UZO6MC06 - REPRODUCTIVE BIOLOGY AND ENDOCRINOLOGY

SEMESTER	VI	CREDITS	5
CATEGORY	MC	NO.OF HOURS/ WEEK	5

OBJECTIVE : To make the students to learn the objectives and scope of comparative reproduction and endocrinology, anatomy, morphology and histology of endocrine tissues of vertebrates, endocrine organs and their functions.

UNIT I INTRODUCTION TO REPRODUCTION

General introduction to reproduction - Reproductive Systems - Female Reproductive System. Male Reproductive System Sexual Development - Sexual Differentiation and Development - Puberty - Menstrual Cycle

UNIT-II: ENDOCRINOLOGY

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

UNIT-III:PITUITARY AND THYROID GLANDS

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

UNIT-IV: PANCREAS AND ADRENAL GLANDS

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

UNIT V: VERTEBRATE REPRODUCTIVE ENDOCRINOLOGY

Structure of mammalian testis and ovary - male and female sex accessory organs -hormones of testis and ovary-estrous and



menstrual cycle-hormones of pregnancy -parturition –hormonal control of lactation. Hormonal control of metamorphosis in an anuran amphibian.

TEXT BOOKS

1. Haris,G.W.andB.T.Donovan.1968.The PituitaryGland.S.Chandand Co.,
2. Bentley, P.J.1985.Comparative vertebrate endocrinology, Second Edition, Cambridge University Press. Cambridge.
3. MacHadley.1992. Endocrinology, 3rd Edition. Prentice-HallInc. A Simon & Schuster Company, Englewood Cliffs, NewJersey. USA.
4. Ingleton, P.M. and J.T. Bangara. 1986. Fundamentals of comparative vertebrate endocrinology, Kluwer Academic Publishers.

REFERENCE BOOKS

5. Turner, C.D. and J.T. Bangara. 1986. General endocrinology. Saunders
6. International Student edition.ToppanCompanyLimited.Tokyo.
7. Barrington, E.J.W. 1985. An introduction to general and comparative endocrinology. Claredon Press Oxford.



16UZO6MS01 – BIOINFORMATICS

SEMESTER	VI	CREDITS	3
CATEGORY	MS	NO.OF HOURS/ WEEK	4

OBJECTIVE : To study the sequences of biological origin, their deposition and tools for retrieving and interpreting data for simulations.

UNIT I : BIOLOGICAL DATA BASES

Introduction to data types and Source, Classification and Presentation of Data. Quality of data, private and public data sources. General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum), database management System.

UNIT II : DATA STORAGE AND RETRIEVAL

Flat files, relational, object oriented databases and controlled vocabularies. File Format (Genbank, DDBJ, FASTA, PDB, SwissProt). Introduction to Metadata and search; Indices, Boolean, Fuzzy, Neighboring search. The challenges of data exchange and integration. Ontologies, interchange languages and standardization efforts. General Introduction to XML, UMLS, CORBA, PYTHON and OMG/LIFESCIENCE.

UNIT III : SEQUENCE ALIGNMENTS

Introduction to Sequences, alignments and Dynamic Programming; Local alignment and Global alignment (algorithm and example), Pairwise alignment (BLAST and FASTA Algorithm) and multiple sequence alignment (Clustal W algorithm), Phylogenetic Analysis, Tree evaluation, Hidden Markov Model..



UNIT IV : GENE IDENTIFICATION, PREDICTION, EXPRESSION AND MICROARRAYS

Basis of gene prediction, pattern recognition, Gene prediction methods, Gene prediction tools, DNA Microarrays, Gene Expression profiles, Tools for microarray Analysis, Applications of Microarray Technology.

UNIT V : PROTEIN STRUCTURE VISUALIZATION AND DRUG DISCOVERY

Protein Structure Databases, Visualization, Pharmacogenetics, Pharmacogenomics, Analysis of Single Nucleotide Polymorphism, Drug Discovery Technologies and Strategies, Drug Design Approaches, Computer aided Drug Designing Methods.

TEXT BOOKS

1. Baldi, P. and S. Brunak, 1988. Bioinformatics: A Machine Learning Approach, MIT Press.
2. Harshawardhan, P.B. 2007. Bioinformatics - Principles and Applications - Tata McGraw Hill, New Delhi.
3. Mount, D. W., 2001. Bioinformatics - Sequence and genome analysis. Cold Spring Harbor.
4. Rastogi, S. C. 2003, Bioinformatics (Concepts, Skills and Applications) CBS, New Delhi.
5. Setubal, J. and J. Meidanis, 1997, Introduction to Computational Molecular Biology, PWS, Boston.
6. Stephen A. K. and Womble, D.D., 2003, Introduction to Bioinformatics: A Theoretical and Practical Approach, Humana Press, New Jersey.
7. Zhumur, G and Bibekanand, M. 2008. Bioinformatics (principles and applications) Oxford University press, New Delhi.

REFERENCE BOOKS

1. Cynthia, G. and Jambeck, P. 2001. Developing Bioinformatics Computer Skills, Shroff, Mumbai.



2. Dan Gusfield, 1997. Algorithms on Strings Trees and Sequences, Cambridge Univ. London.
3. James D. Tisdall, J.D. 2001. Beginning Perl for Bioinformatics, Shroff, Mumbai
4. David, M. 2001, Bioinformatics: Sequence and Genome Analysis Cold spring harbor laboratory Press.
5. Gibas C and P. Jambeck, 2000, Developing Bioinformatics Skills, O' Reilly and Associates, California.
6. Rashidi, H. and Lukas K. Buehler, 1999, Bioinformatics Basics Applications in Biological Scienceand Medicine, CRC press.

16UZO6MS02 - BIOINFORMATICS LAB COURSE

SEMESTER	VI	CREDITS	1
CATEGORY	MS	NO.OF HOURS/ WEEK	2

OBJECTIVE : To learn the structure and organisation of databases and tools available for analysis and interpretation.

UNIT I : INTRODUCTION TO DATA BASE

NCBI, GenBank, Entrez, PUBMED, OMIM : Gene Map, Morbid Map, Gene on a chromosome Map, BLAST, Sequence Analysis, Graphical Display, Text Display. EMBL : Sequence Alignment, Dynamic Programming, Pairwise Alignment – Needleman and Wunch (Global), Pairwise Alignment – Smith and Waterman (Local), Multiple Sequence Alignment (Online).

UNIT II : DNA DATA BANK OF JAPAN (DDBJ)

Nucleic Acid Sequence Data Banks, Sequence Similarity Searching Tool (FASTA), Working with FASTP.



UNIT III : PROTEIN SEQUENCE DATABANK SWISS-PROT

SWISS 2DPAGE, Exploring Swiss-prot 2D PAGE Database, Protein Information Resource

UNIT IV : ONLINE BIOINFORMATICS TOOL

Primer Design, Sequence file format conversion, Phylip, Phylogenetic Tree, Tree Prediction

UNIT V : MULTIPLE SEQUENCE ALIGNMENT – CLUSTALX

Platform Availability, Collecting sequence, Loading sequence, Alignment, Creating Trees, NJ Plot, Understanding Tree. Molecular Visualization : Homology modeling of structure , Molecular Visualization Tools, Platform Availability, Standard Installation, Viewing molecule, atom, bonds and ribbons.

TEXT BOOKS

1. Krawetz, S.A. and Womble, D.D. 2003. Introduction to Bioinformatics: A Theoretical and Practical Approach, Humana, New Jersey.
2. Rastogi, S. C. 2003. Bioinformatics (Concepts, Skills and Applications) CBS, New Delhi.
3. Rajadurai, M. 2010. Bioinformatics : A Practical Manual, PBS Books, 158pp.

REFERENCE BOOKS

1. Lesk, A. M. 2005. Introduction to bioinformatics, Oxford University, USA.
2. Setubal, J. and J. Meidanis, 1997. Introduction to Computational Molecular Biology PWS, Boston.



ADVANCED ZOOLOGY ALLIED OFFER TO OTHER DEPARTMENTS

16UZO1AL01 ANIMAL DIVERSITY

SEMESTER	I	CREDITS	4
CATEGORY	AR	NO.OF HOURS/ WEEK	4

OBJECTIVE: To observe the organization, functional morphology and diversity of representative invertebrates and chordates.

UNIT I : PROTOZOAN PARASITES

Structure, organization and life history of *Entamoebahistoltyica* and *Plasmodium vivax*, *Obeliageniculata*.

UNIT II : NEMATODE PARASITES

Structure, organization and life history of *Taeniasolium*, Nematode parasites of man – *Ascaris* and *Hirudinaria*.

UNIT III : ECHINODERMATA AND MOLLUSCA

Structure, organization and life history of *Penaesusindicus*, *Pilaglobosa* and Star fish.

UNIT IV : AMPHIBIA, RETILIA AND AVES

Organization of Frog, Calotes, Pigeon and Rat.

UNIT V : EMBRYOLOGY

Types of chordate eggs, extra embryonic membranes and their functions in chick, placentation in mammals.

Text Books

1. Ekambaranatha Ayyar and T.N. Ananthkrishnan, 2008. A manual of Zoology Vol.I & II (Part 1,2) S. Viswanathan, Chennai.
2. Barnes, R.D 2001. Invertebrate Zoology, W.B. Saunders.



3. Verma, P.S., Agarwal, V.K and Tyagi B.S. 1995. Chordate embryology, S.Chand, New Delhi.
4. Berril, N.J. 1971. Developmental Biology, McGraw Hill, New York.

16UZ01AL02 ANIMAL DIVERSITY LAB COURSE

SEMESTER	I	CREDITS	2
CATEGORY	AR (P)	NO.OF HOURS/ WEEK	2

OBJECTIVE: To observe the organization, functional morphology and diversity of representative invertebrates and chordates

UNIT I :MAJOR DISSECTION

Cockroach: Digestive system, Nervous system. Freshwater mussel /Pilaglobosa: Digestive system Prawn: Nervous system. Frog: Arterial system and venous system

UNIT II :MINOR DISSECTION

Earthworm: Lateral hearts. Cockroach: Reproductive system

UNIT III :MOUNTING

Cockroach: Mouth parts and salivary apparatus. Earthworm: Body setae. Prawn: Appendages (Cephalic, thoracic and abdomen). Frog: Hyoid apparatus and brain.

UNIT IV :SPOTTERS – INVERTEBRATE

Representatives from each phylum based on structural organization and phylogeny.

UNIT V :SPOTTERS – VERTEBRATE

Representatives from each phylum based on structural organization and phylogeny.

TEXT BOOKS

1. Lai, S.S. 2005. A Text Book of Practical Zoology: Invertebrate, Rastogi, Meerut.



2. EkambaranathaAyyar and T.N.Ananthakrishnan, 2008 A manual of Zoology Vol.I& II (Part 1,2) S.Viswanathan, Chennai.
3. Barnes, R.D 2001 Invertebrate Zoology, W.B.Saunders, London.

16UZO2AL01 AGRICULTURAL ENTOMOLOGY

SEMESTER	II	CREDITS	4
CATEGORY	AR	NO.OF HOURS/ WEEK	4

OBJECTIVE: To impart knowledge on insect pests and plant protection to sustain green revolution.

UNIT I : AN OUTLINE CLASSIFICATION OF INSECTS

Causes for insect assuming pest status and methods of collection, preservation and mounting of insect pests.

UNIT II : INSECT VECTORS OF PLANT DISEASES

Insect pests of stored grains their preventive and curative methods – Locust and its control.

UNIT III : COMMON INSECT PESTS

Most common insect pests of the following plants and their control measures: Paddy, Sugarcane, Groundnut, Coconut and Cotton.

UNIT IV : APICULTURE

Introduction, types of honey bees, hive, apiary, selection of bees for apiary, Newton's bee hive, enemies of honey bees, diseases of honey bees and conclusion. Sericulture: introduction, types of silk worms, silk worm races, life history of mulberry silk worm, features of sericulture industry, pests of silk worm, diseases of silk worm and conclusion.



UNIT V : PEST MANAGEMENT

Elementary knowledge of insecticide, Biological control of Insect pests and Integrated Pest Management.

Text Books

1. Vasanthraj David, B and T. N. Ananthakrishnan, 2004. General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd., New Delhi, Page 1-1184.
2. Vasanthraj David, B. 2001. Elements of Economic Entomology, Popular book Depot, Chennai.5. Ramawatet al., 2009 Comprehensive Biotechnology, S.Chand&Compny, New Delhi.

Reference Books

1. AbishekShukla, D. 2009. A Hand Book of Economic Entomology, Vedams e Books, New Delhi.
2. Ministry of Agriculture, Government of India, 1995. Manual on Integrated Pest Management in Rice & Cotton.
3. John William S. 1995. Management of Natural Wealth, Loyola College Publications, Chennai.

16UZO2AL02 AGRICULTURAL ENTOMOLOGY LAB COURSE

SEMESTER	II	CREDITS	2
CATEGORY	AR (P)	NO.OF HOURS/ WEEK	2

OBJECTIVE:To impart knowledge on plant protection from insect pests.

UNIT I : COLLECTION, PRESERVATION AND MOUNTING

Methods of collection, preservation and mounting of insects.



UNIT II : SURVEY AND IDENTIFICATION

Survey and identification of economically important pests of Paddy, sugarcane, cotton, groundnut and coconut.

UNIT III : LIFE CYCLE OF INSECT

Study of life cycle of Hemimetabolous and Holometabolous insects (at least one example each) – Study of parasitic and predatory insects (at least one example each) in relation to biological control.

UNIT IV : SERICULTURE

Study of silkworm rearing and bee keeping- insecticide formulation and IPM approaches.

UNIT V :Field trip to institutions of Agriculture and Record.

Text Books

1. Vasanthraj David, B and T. N. Ananthakrishnan, 2004. General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd., New Delhi, Page 1-1184.
2. Vasanthraj David, B. 2001. Elements of Economic Entomology, Popular book Depot, Chennai.
3. Pruthi, H.S. 1969. Text book on Agricultural Entomology, I.C.A.R. Publication, New Delhi.

Reference Books

1. AbishekShukla, D. 2009. A Hand Book of Economic Entomology, Vedams e Books, New Delhi.
2. Ministry of Agriculture, Government of India, 1995. Manual on Integrated Pest Management in Rice & Cotton.
3. John William S. 1995. Management of Natural Wealth, Loyola College Publications, Chennai.



16UZ04AL01 BIOINFORMATICS

SEMESTER	II	CREDITS	2
CATEGORY	AR (P)	NO.OF HOURS/ WEEK	2

OBJECTIVE: *To provide biologically important predictions from annotated data and transformation of these data for genome / gene / DNA analyses.*

UNIT I: INTRODUCTION TO BIOINFORMATICS

History of Bioinformatics and Pharmaceutical Industry - Bioinformatics in Business – scope of Bioinformatics, Tools and techniques of bioinformatics.

UNIT II: COMPUTATIONAL MOLECULAR BIOLOGY

Data mining and Sequence Analysis - Database Similarity Searches - Practical Aspects of Multiple Sequence Alignment - Phylogenetic Analysis – Recent trend in bioinformatics.

UNIT III: INTERNET AND BIOINFORMATICS

Data mining in Bioinformatics- Knowledge discovery - Problems faced in Bioinformatics -Human Genome Project - Influence areas - Bioinformatics in India

UNIT IV: BIOLOGICAL DATABASE AND THEIR MANAGEMENT

Database concepts - Introduction of SQL - Biological Database - Sequence Database- DNA sequence data bases, specialized database, secondary protein sequence data bases –and composite protein sequence data bases.



UNIT V: DATABASE AND TOOLS

Predictive Methods Using Nucleic acid and Protein Sequences
Submitting DNA Sequences to the Database - Internet & Data
mining - Programming in C.

TEXT BOOKS

1. Rastogi, S. C. 2003, Bioinformatics (Concepts, Skills and Applications) CBS, New Delhi.
2. Setubal, J. and J. Meidanis, 1997, Introduction to Computational Molecular Biology, PWS, Boston.
3. Stephen A. K. and Womble, D.D., 2003, Introduction to Bioinformatics: A Theoretical and Practical Approach, Humana Press, New Jersey.
4. Zhumur, G and Bibekanand, M. 2008. Bioinformatics (principles and applications) Oxford University press, New Delhi.

REFERENCE BOOKS

1. David, M. 2001, Bioinformatics: Sequence and Genome Analysis Cold spring harbor laboratory Press.
2. Gibas C and P. Jambeck, 2000, Developing Bioinformatics Skills, O' Reilly and Associates, California.
3. Rashidi, H. and Lukas K. Buehler, 1999, Bioinformatics Basics Applications in Biological Science and Medicine, CRC press.