

MOTHER TERESA WOMEN'S UNIVERSITY
KODAIKANAL-624102

M. V. MUTHIAH GOVERNMENT ARTS COLLEGE (W),
DINDIGUL - 1.

M.Sc. ZOOLOGY

CBCS – SYLLABUS 2018 – 2019 ONWARDS

MOTHER TERESA WOMEN'S UNIVERSITY KODAIKANAL.
M. V. MUTHIAH GOVERNMENT ARTS COLLEGE (W), DINDIGUL - 1.
M. Sc. ZOOLOGY

Course Structure for the Major Zoology under CBCS: 2018 – 19 onwards

Sl.no	Sub code	course	Title of the paper	Hrs	credits	In. marks	Ex. marks	Total
I-SEMESTER								
1.	PZOT11	Core - I	Animal Biodiversity-I	5	5	25	75	100
	PZOT12	Core-II	Animal Biodiversity-II	5	5	25	75	100
2.	PZOT13	Core - III	Cell and Molecular Biology	5	5	25	75	100
4.	PZOP11	Practical-I	Invertebrata & Chordata, Cell and Molecular Biology, Lab	5	5	25	75	100
5.	PZOE11	Elective - I	Choice 1.Entomology / Choice-2.Wild life Biology	5	5	25	75	100
			TOTAL	25	25			500
II –SEMESTER								
	PZOT21	Core - IV	Biochemistry	5	5	25	75	100
6.	PZOT22	Core - V	Microbiology and Immunology	5	5	25	75	100
7.	PZOT23	Core - VI	Molecular Genetics	5	5	25	75	100
9.	PZOP22	Practical-II	Biochemistry, Microbiology & Immunology and Genetics - - Lab	5	5	25	75	100
10	PZOE22	Elective-II	Choice.1.Aquaculture / Choice.2 Pollution ecology	5	5	25	75	100
			TOTAL	25	25			500
SEMESTER – III								
11	PZOT31	Core – VII	Animal physiology	5	5	25	75	100
	PZOT32	Core - VIII	Developmental Biology & Evolution	5	5	25	75	100
13	PZOT33	Core – IX	Environmental Biology	5	5	25	75	100
14	PZOP30	Practical-III	Animal Physiology, Developmental Biology and Environmental Biology - Lab	5	5	25	100	100
15	PZOE33	Elective - III	Choice 1.Biotechnology / choice. 2.Bioinformatics	5	5	25	75	100
			TOTAL	25	25			500
SEMESTER – IV								
16.	PZOT41	Core – X	Research methodology	5	5	25	75	100
17.	PZOT42	Core –XI	Biostatistics and Biophysics	5	5	25	75	100
18.	PZOP41	Project	Project	5	5	25	75	100
			TOTAL	15	15			300
			Grand Total	90	90			1800

Regulations:

1. Course Objectives

To enable the students

- To understand the importance of biology in our day today life.
- To acquire functional knowledge about microbes, animals and human.
- To develop practical and applied knowledge in zoology and
- To get an exposure to the advanced zoology research field.
- **2. Qualification for Admission:**
 - Candidate should have passed a UG - B.Sc Zoology or equivalent life science degree.
 - Candidate should have secured at least 50%.
 - A relaxation of 5-10% in the total percentage will be given to SC, ST candidates.
 - Candidates sponsored by industries/hospitals/Clinical laboratories may be considered for admission.

3. Duration of the course:

The students will undergo the prescribed course of study for a period of not less than two academic years (Four semesters).

4. Medium of Instruction: English

5. Subject of Study: As given in Appendix A

6. Scheme of Examination: As given in Course Structure and Scheme of Examination Appendix B

7. Eligibility of the degree:

- i. Candidates will be eligible if they complete the course with the required credits and pass in the prescribed examinations.
8. The candidate requires 75% of attendance to attend the semester exam.
9. The internal marks would be divided as 5 for assignment 5 for seminar and 15 for written tests. One or two seminars/assignments can be given and an average of them can be considered.
11. The passing minimum is 50 percent (both in internal and external separately) in each paper.
12. The candidate has to undergo a project individually.
13. To complete the course the students should gain the prescribed credits i.e. 90 credits.

Core –The candidate has to study 14 cores including practical and gain the respective credits. (14 * 5 credits each = 70 credits).

Elective- Each candidate has to study three electives and gain the respective credits. (3 * 5 credits each = 15 credits).

Project – The candidate has to undergo one project in the fourth semester and gain 5 credits.

Core-I-Animal Diversity I – INVERTEBRATA

Semester – I

5 Hours/week

Sub code –PZOT11 -

Credits 5

Objectives

Students will be able to identify and understand the basics of animal biology with a comparative knowledge on the organization in various animal groups

UNIT-I : Broad classification of the Animal Kingdom - Principles involved. Protozoa Feeding, Reproduction and Parasitic Protozoa Economic importance of Protozoa Origin and evolution of Metazoa - theories. Mesozoa Porifera Interrelationship between different classes, Marine sponges. Freshwater sponges. Skeleton Sponges.

UNIT-II : Cnidaria Origin and evolution, Polymorphism and Reproduction in cnidaria . Corals and Coral reeves Origin of Bilateria Importance of Rhabdocoela as a stem group. Origin and evolutionary trends in coelom formation. Platyhelminthes Functional morphology and adaptive biology for parasitic mode of life.

UNIT-III : Annelida Archannelida. Interrelationship between different classes of Annelida. Annelida: Type study—Earth worm, External morphology, setae, nephridia, nerves system and reproductive system – Metamerism in Annelids. Arthropoda: Type study-Marine Prawn – external morphology, appendages, digestive and excretory systems, reproductive system and development—Affinities of Peripatus. Economic importance of Crustaceans Phylogeny of Arthropoda.

UNIT-IV : Mollusca: Type study- Pila – external morphology, digestive system, respiratory system, osphridium only. –Cephalopods as an advanced Mollusc. Echinodermata: Type study – Star fish, external morphology, pedicellaria, Water vascular system only. Larval forms of Echinodermata. Phylogeny of Echinoderms.

UNIT-V : Minor Phyla Structural peculiarities and affinities of Ctenophora, Nemertinea, Rotifera, Pogonophora, Phoronida and Lophophorates. Invertebrate fossils: Trilobites, Brachiopoda, Cephalopoda and Echinodermata.

References Books:

1. Barnes RD (1982) Invertebrate Zoology.4th edition, Holt Saunders International Edition.
2. E.L.Jordan and P.S. Verma 2009 Invertebrate Zoology, S.Chand & Company Ltd, New Delhi.

3. Gardinar, M.S. 1972 Biology of the Invertebrates, McGraw - Hill Book Co., New York.
4. Invertebrate Zoology – E.L. Jordon and P.S. Verma (2005) S.Chand & co. New Delhi
5. Invertebrate Zoology – P.S. Dhami and J.K. Dhami. (2003) R.Cahnd & Co. New Delhi.
6. Invertebrate Zoology – R.L.Kotpal, (2005) Rastogi Publications, Meerat.
7. A Manual of Zoology- M.Ekambaranatha Iyer and T.N.Ananthakrishnan (2003) Viswanathan Publications, Chennai.

Core-II-Animal Diversity II – CHORDATES

Semester – I

5 Hours/week

Sub code –PZOT12 -

Credits 5

Unit I

Overview Taxonomy- Principles of Taxonomy. Nomenclature: Binomial, taxonomic keys. Outline classification of Chordates up to order level with example. Prochordata, Pisces and Amphibia Concept of Prochordata – Hemichordata- Balanoglossus,

UNIT II

Urochordata- Ascidians, Cephalochordata – Amphioxus - Salient features and Functions. Affinity of cephalochordata - Origin and Adaptive radiation of bony fishes. Amphibia - Adaptive radiation from water to land.

Unit III

Reptilia, Aves and Mammals Classification of class Reptilia, Aves and Mammals up to orders. Salient features with examples - Adaptive radiation of reptiles. Reptilia -Type study – Calotes, external morphology, Urinogenetal system and nervous system. Poisonous and non-poisonous Snakes,-identification and biting mechanism.

Unit IV

Adaptive Radiation: Aves- Birds as glorified reptiles, adaptive radiation in birds. Aves- Type study – Pigeon; external morphology, respiratory system, pectoral and pelvic girdles only. Flight adaptation, beak and feet modification in birds, -Migration of birds, - Flightless birds, -Fossil bird Archaeopteryx and its evolutionary importance.

Unit V

Mammalia - Classification of Mammals with examples, external morphology, nervous system and reproductive system. Dentition in mammals, Stomach in ruminants, Aquatic mammals and economic importance of vertebrates.

References

- 1.E.L.Jordan and P.S. Verma 2011 Chordate Zoology, S.Chand & Company Ltd, New Delhi.
2. Route and Solanki 2002.Learning Prochordata- Mammalia –Theory and Practice Dominant Pub. & Distributors, New Delhi
3. T.N. Ranganathan 1996.Chordata Zoology, Rainbow printers, Palayamkottai.
4. Colbert, E. H. (1955) Evolution of the Vertebrates. John Wiley and Sons Inc. New York.
5. Young, J.Z. (1950) Life of vertebrates. Clarendo Press, Oxford

Core-III- CELL AND MOLECULAR BIOLOGY

Semester – I
Sub code –PZOT13

5 Hours /week
Credits 5

Objectives

Students can understand the structure and functions of cell organelles. To understand the importance of the cell. To realize the significance of life, know about chromosome organization, expression & regulation.

UNIT- I

Cell theory, protoplasm theory, prokaryotic and eukaryotic cell differentiation, Cell Cycle and regulations. Cell division: mitosis, meiosis and their significance. Cytoplasm: Physical and biological properties of cytoplasmic matrix. Plasma membrane: Chemical composition, structure and functions.

UNIT- II

Structure and function: Ribosome and Golgi bodies: ultrastructure, types and function. Lysosome: Chemical composition, Polymorphism and Functions. Endoplasmic reticulum and plastids. Ultrastructure, types and functions, Mitochondria: ultra structure and functions. Micro bodies peroxisomes and glyoxisomes.

UNIT III

Structure and function: ultra-structure of nuclear membrane. Nucleolus, Nucleoplasm and Chromatic fibres. Microtubes, microfilaments – Cilia and Flagella. Signal Transduction

Pathways: organisation signals, receptors. Ion channel coupled receptors – secondary messengers. Amplifiers, Integrators and signal hypothesis.

UNIT -IV

Organization of Genome: Nucleic Acid: DNA as genetic material (direct and indirect evidences) – Structure and types of DNA and RNA. Eukaryotic Chromosome: Chromosome structure and organization Giant and Lampbrush chromosomes. -C-value paradox DNA – repetitive DNA – Junk DNA. Mutations and DNA damage: physical, chemical and biological agents – mutation types –molecular basis of spontaneous and induced mutations. Environmental mutagenesis and toxicity testing: AMES test.

UNIT V

DNA replication – semi conservative and rolling circle. Enzymes involved in replications: types and their functions. Transcription and Translation: RNA polymerase – types, properties and functions – Transcription process in prokaryotes and Eukaryotes – RNA processing, capping, polyadenylation, splicing, introns and exons. Regulation of gene expression- *lac* operon and *trp* operon, Regulation of gene expression in eukaryotes.

Reference Books:

- De Roberties E.D.P and E.M.F.De Roberties 2011. Cell and Molecular Biology. 8th edition. B.I. Publicatons Pvt. Ltd., India.
- Paul, A. 2009. Cell and Molecular Biology, Books and Allied (P) ltd, India.
- Power, C.B. 2009 Cell Biology Himalayan Publishing House, New Delhi.
- Prakash S.L. 2007.Cell and Molecular Biology. M.J.P. publishers, Chennai
- Allison LA. 2007. Fundamental Molecular Biology. Blackwell Publishing Ltd., USA.
- David Freifelder, 1998, Molecular Biology, II Ed. Narosha Publishing House, New Delhi
- Lewis, Keleinsmith and ValerisM.Kish 1988, Principles of cell biology, Harper and Row Publications, New York.
- Prakash S.Lohar, 1965, Cell and Molecular Biology, MJP Publishers, Chennai.
- Gupta, M.L. and Jangir, M.L., 2003, Cell Biology Fundamentals and Application, Student Edition, Jothpur.
- Gupta PK (2009) Cell and Molecular Biology. Rastogi Publications, Meerut.
- Karp G (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition, John Wiley & Sons Ltd. New York.
- Alberts B, Johnson A, Lewis J, Raff M, Roberts K and Walter P (2009) Essential Cell Biology. Garland Science, New York.

PRACTICAL-I-ANIMAL DIVERSITY I & II AND CELL AND MOLECULAR BIOLOGY

SEMESTER I

Hours 5/week

Credits: 5

Sub code-PZOP11

1. Taxonomy:

Identification and Classification of at least 20 representative animals belonging to major classes of Invertebrate phyla and phylum Chordata by studying their salient features.

2. Mounting:

Earth worm – *setae*, Prawn -appendages, Teleost Fish – Placoid, Cycloid/Ctenoid scales, Honey bee - Stinging apparatus and Mouth parts. Mosquito – mouth parts

3. Spotters:

Invertebrate any four Larval forms ; Minor Phyla - *Chaetognatha*, *Phoronida*, and *Sipunculida*.
Phoronida

Diagrammatic representation

1. Nervous system of Cockroach, Prawn, *Pila globosa*
2. Nervous System of Rat , Cat Fish
3. Major Organs ; Rat-heart, pancreas, liver, kidney and gonads

CELL AND MOLECULAR BIOLOGY

1. Micrometry - Measuring the Diameter of Microscopic Cells Using Ocular and Stage micrometer
2. Preparation of squamous epithelium/Human Buccal Smear- to observe Barr body
3. Study of Mitosis in the Cells of Onion Root Tip
4. Observing the Giant/polytene chromosomes in the salivary glands of larva of *Chironomus* sp.
5. Isolation of mutant colonies by Gradient plate method.
6. Isolation of mutant colonies by Replica plate method.
7. Description of -Bacterial transformation, Conjugation experiment, Complementation test, Phage isolation .

Spotters: Epithelial Tissues (Ciliated, Columnar, Glandular and Squamous epithelium), Smear of Frog's Blood, Muscles (Cardiac, Striated and Non - Striated) and Nerve cell.

ELECTIVE – I- ENTOMOLOGY

Semester – I
Sub code- PZOE11

5 Hours /week
Credits 5

Objectives

On the successful completion of the course, students will be able to classify the insects and will be able to identify the different insects. Learn the Beneficial aspects of Insects and Hazards of pests and their control measures

UNIT- I

Taxonomy- Basics of Insect Classification, Classification up to Order Level, Key Characteristics with South Indian Examples.

UNIT- II

External anatomy and Growth:

External Anatomy of a Typical Insect - Exoskeleton, Head, Thorax, and Abdomen. Mouth Parts of Insects, Different Types of Larvae and Pupae - Growth and Metamorphosis of Insects

UNIT-III

Physiology of Insects - Digestive System, Excretory System, Respiratory System, Circulatory System, Nervous System and Sense organs, Reproductive System of a typical insect. Endocrine System and Pheromones in ants

UNIT-IV

Ecology of Insects - Abiotic Factors Affecting Insects - Temperature, Moisture, Air-currents, Diapause, Light, Food, Habitat - Terrestrial and aquatic. Protection, Competition, Parental Care, Trophylaxis, Commensalism, Captives, Food Storage, Natural Enemies, Insects and Plant associations. Brief note on social insects.

UNIT-V

Agricultural Entomology: Insect Pest of Crops and their control measures: Paddy, Groundnut, Coconut, Cotton. Sugarcane, Brinjal, Lady's finger, Pests of Stored grains. Pest Control: Prophylactic, Mechanical, Chemical and Biological Control measures. Integrated Pest Management.

Reference Books:

Tembhare, D.B., 2012, Modern Entomology, Tembhare, D.B., 2012, Modern Entomology, Himalaya Publishing House, Mumbai.

Ambrose Dunston P., 2004, The Insects: Structure, Function and Biodiversity, Kalyani Publishers, Ludhiana.

David, B.V. 2002 Elements of Economic Entomology. Popular Book Depot, Madras

Chapman, R.F., 1998, The Insects: Structure and Function, Cambridge University Press.

Nayar, K.K., T.N. Ananthakrishnan, and B.V. David, 1986, General and Applied Entomology, Tata McGraw Hill Publishing House, New Delhi.

Wigglesworth, V.B., 1979, Principles of Insect Physiology, 9th Ed. Chapman & Hall, London.

Snodgrass, R.E., 1985, The Principles of Insect Morphology, McGraw Hill & Co., New York.

Vasantharaj David, B. and Kumaraswami, T., 1982, Elements of Economic Entomology, Popular Book Depot, Chennai.

ELECTIVE -II- WILDLIFE BIOLOGY

Semester – I
Sub code-PZOE11

5 Hours / week
Credits 5

Objectives

To acquaint and gain knowledge about wild life data, functional significance control and protective measures.

Unit- I:

Wild life resources of India- Types of wild life- Habitats- values of life, Hotspots in India, Wild Life depletion-causes, IUCN-Red data book, Red list categories, Extinct, Critically endangered, endangered, vulnerable. Endemic fauna of India.

Unit – II:

Evaluation of wild life: Basic survey technique vegetative analyses: Quadrant and Transect animal population estimation: Direct count (block count, transect methods, Point counts, visual encounter) survey & water hole survey, Indirect count, cell count, track & signs, pellet count, pugmarks, camera trap, DNA finger printing, aerial photography & videography.

Unit – III:

Human – animal interactions: human- animal conflicts- causes and remedial measures- migration of animals- elephants and tiger; Predator- prey interactions; Exotic Species conflict.

Unit – IV:

Wild life management: Basic concept – Wild life protection act 1972, The Wild life (Protection) Rules, 1981- IUCN, CITES, NBIA, IBA-Protected areas, National Forest policy, 1988-Indian Forest Act, 1927 (Forest conservation Act and Rules, 1980)

Unit –V:

Wild life conservation Principles of conservation, major approaches to management, Conservation/management strategy-*in-situ* and *ex-situ* conservation .Case studies in India- Project tiger, Asian elephant project, Project Crocodile, Project Gir-lion, Project Rhino.

Reference Books:

- Chadha, S.K.**, 2010, Conserving wildlife in India.
Singh, S K, 2005, Text Book of Wildlife Management.
Dhyani, S.N., Wildlife Management. (BNHS, Mumbai).
Gee, E.P., 2000. The wildlife of India. (Harper Collins Publ., India)
Hosetti, B.B., 2003. Wildlife management in India.
Khati, A.S., 2004. Indian national parks and sanctuaries: A living portrait of wild India. **Mojupuria, T.C.** (Ed.), 1986. Wildlife Wealth of India
Ranga, M.M., 2002. Wildlife: Management and conservation. (Agrobios, India).
Saharia, V.B., 1982. Wildlife in India. (Natraj Publ., DehraDun).

CORE-IV-BIOCHEMISTRY

Semester – II
Sub code –PZOT21

Hours 5/week
Credits 5

Objectives

On the successful completion of the course the students will get an over all understanding of Biomolecules, their structure and classifications, enzyme kinetics and metabolic reactions in a living system.

UNIT I

Atom, Molecules & chemical bonds properties of H₂O, acid and buffer. Carbohydrates – Occurrence, chemical properties, stereo and optical isomerism, structure and classification. Metabolism and its regulation – Glycolysis, TCA cycle, Oxidative phosphorylation, pentose phosphate pathway and gluconeogenesis, ATP synthesis, Photosynthesis, Glycogenolysis.

UNIT II

Lipids – occurrence, chemical properties and classification-biosynthesis of fatty acids triglycerides, phospholipids and cholesterol – Oxidation of fatty acids, Vitamins – classifications, derivatives, hormones – Types functions & disorders.

UNIT III

Amino acids and Proteins – Amino acids: structure, classification and chemical properties, structure of peptide bond – protein: classification, amino acid composition. Protein structure – Primary structure, secondary structure – alpha helix and beta pleated structure, tertiary and quaternary structure. Protein metabolism and degradation: A.A oxidation & Urea cycle. Ramachandran plot.

UNIT IV

Nucleic acids – DNA & RNA – structure of purine and pyrimidine bases, nucleotides and nucleotide biosynthesis, its regulation & degradation of purine and pyrimidine nucleotides – Biosynthesis of deoxyribonucleotides.

UNIT V

Enzymes – Nomenclature and Classification – protein enzymes, coenzymes, prosthetic groups, cofactors, isoenzymes, ribozymes, abzymes: chemical properties of enzymes: types of specificity – absolute, group, stereochemical and geometrical; factors influencing enzyme activity – temperature, pH, concentration of enzyme, substrate and effect of ions; enzyme kinetics, types of enzyme inhibition – reversible, competitive, non-competitive, uncompetitive, irreversible inhibition; allosteric enzymes.

REFERENCES

1. Nelson D.L and Cox M.M. 2006. Lehninger Principles of Biochemistry, 4th edition, Macmillan worth Publishers.
2. Murray R.K, Granner D.K and Rodwell V.M. 2006. Harper's Illustrated Biochemistry, 27th Edition, The McGraw-Hill companies, Inc.
3. Berg J.M, Tymoczko J.L and Stryer W.H. 2007. Biochemistry, Freeman and Company, USA
4. Principles of Biochemistry Third Edition International Student Version Chapter 13 Biochemical Signaling Copyright © 2008 by John Wiley & Sons, Inc. Donald Voet • Judith G. Voet • Charlotte W. Pratt
5. U. Satyanarayana, Biochemistry, Books and Allied (P) Ltd., Calcutta, Latest Edition.

6. Deb, A.C. 2011. Fundamentals of Biochemistry, 10th Edition, New Central Book Agency Pvt Ltd., Kolkata.
7. Jain, J.L., Sunjay Jain and Nitin Jain. 2010. Fundamentals of Biochemistry, Fifth Edition, Chand and Company Ltd, NewDelhi.
- Nelson, D.L., and M.M.Cox, 2010, Lehninger Principles of Biochemistry, 5th edition, Worth Publishers, New York.

CORE-V-MICROBIOLOGY AND IMMUNOLOGY

Semester II
Sub code-PZOT22

Hours 5/week
Credits 5

Objectives

Students will be able to know the history ,development of Microbiology and fundamental knowledge about microbes. Understand and explore the world of microorganisms in different spheres of life. The students can have an understanding about the microbial diseases and the role of immune system against the infectious disease.

UNIT- I

History and scope of microbiology, Bacteria -Taxonomy, Structure, Bacterial culture - batch culture, measurement of microbial growth and growth curve, factors affecting growth, Sterilization techniques, culture media. Types of Media and Conditions for Culturing; and culture techniques Viruses -Taxonomy, Structure and Life Cycle of Viruses-T4 Phage and HIV; Viroids and Prions.

UNIT- II

Applied Microbiology –Sewage Treatment, Biofertilizer (Rhizobium, Azolla) Production of Penicillin and SCP. **Medical microbiology:** Biology, infective process and control measures of Bacterial air borne disease -Tuberculosis, food borne - Botulism, waterborne – Cholera, Typhoid. Viral - influenza, AIDS, Hepatitis, Polio. Insect borne dengue, direct contact- rabies. Microbial resistance to drugs. Prevention of drug resistance

UNIT III

History of Immunology, Overview of Immunology - Non specific, Specific, Active,Passive, Cellular and humoral immunity, Primary and secondary lymphoid organs, Cells of the Immune system, Haematopoiesis, T Cell and B cell differentiation. Antigen-antibody reaction and their assays - properties of Ag - Ab reaction

Unit IV

Major Histocompatibility Complex - MHC antigens, HLA system, clinical significance and MHC restriction phenomenon. Hypersensitivity reactions - Type I, II, III & IV. Cytokines - Properties, classes, cytokine receptors and cytokine related diseases. Complement system - components, complement activation pathways, function and biological consequences of activation.

Unit . V

Immunity to infection - Epidemiology, immune response and immune evasion to - Viral (Hepatitis - B), Bacterial (Leprosy, Tuberculosis) Protozoans (Malaria). Immuno deficiency diseases- Primary immune deficiencies - Defects in lymphoid lineage, myeloid lineage and complement systems, Secondary immune deficiencies-AIDS and other acquired deficiencies. Auto immunity - factors behind auto immune diseases, Organ specific and Systemic Auto immune disorders and their treatments.

REFERENCE BOOKS:

- Dubey RC and Maheswari DK (2011) Textbook of Microbiology. S. Chand & Co.
Kannan, I., 2011, Immunology, MJP publishers, Chennai
Pelczar M *et al.* (2010) Microbiology. Tata-McGraw Hill.
Rao C.V., (2008). Immunology – A Text Book. Narosa Publishing House, New Delhi.
Atlas RM (2007) Principles of Microbiology. 2nd edition, McGraw-Hill.
Coico, R., Sunshine, G., Benjamini, E., 2003 Immunology: A Short Course, VIth edition. Wiley-Blackwell, New York
Goldsby, R.A., Kindt, T.J., Osborne, B.A., Kuby, J. 2002. Immunology, Vth edition, W.H. Freeman and Company, New York.
Ananda narayanan, T. and Jayram Paniker, C.K., 2000, Textbook of Microbiology, 6th Ed.Orient Longman Ltd., Chennai.
Richard A. Goldsby and Kind T.J., (2000). Kuby Immunology. W. H Freeman and company, New York
Nandhini Shetty. 1993. Immunology – Introductory Text Book, Wiley Eastern Limited, New Delhi.
Powar, C.B.and Dagainawala. H.F., 1982, General Microbiology Volume I &II, Himalayas Publishing House, Mumbai.

CORE-VI- MOLECULAR GENETICS

Semester – II
Sub code-PZOT23

Hours 5/week
Credits 5

Objectives

Students will be able to understand the principles of genetics, inheritance, sex determination, chromosomal anomalies. To study the mechanism of heredity at molecular level.

Unit I:

Historical Background of Genetics: Mendel's Study of Heredity: Monohybrid Crosses (pea plant), Mendel's laws of Dominance and Segregation, Dihybrid Crosses (pea plant), Mendel's laws of Independent Assortment (guinea pig). Incomplete Dominance (flower color in snapdragons and Punnett's gametic check board method). Multiple Allelic Inheritance: Blood group inheritance in Humans and Inheritance of coat colour in rabbits.

Unit II:

Linkage and Sex Linkage – Coupling and repulsion hypothesis. Linkage in maize and *Drosophila*, Linkage groups, Complete linkage, incomplete linkage, factors affecting linkage. Crossing over – Mechanism of crossing over. Cytological theories of crossing over. Germinal and Somatic crossing over. Interference and Coincidence. Construction of genetic maps (*Drosophila* and Maize).

UNIT III

Physical basis of inheritance – Chromosome theory of inheritance. Karyotype and Idiogram. Sex Linked inheritance: X-Linked Inheritance (eye colour in *Drosophila*, colour blindness and haemophilia in humans), Y-linked inheritance (hairy pinna in males). Extra Chromosomal Inheritance / Cytoplasmic Inheritance – Mitochondrial DNA, Chloroplast, DNA, Kappa particles in *Paramecium*, Sigma factor in *Drosophila*.

UNIT IV

Chromosomal aberrations – Numerical – Euploidy (Monoploidy, Haploidy and Polyploidy) Polyploidy – Autopolyploidy and allopolyploidy. Aneuploidy – Monosomes, Nullisomes & Trisomes. Structural aberrations: Deletions, Duplications, Translocations and Inversions. Evolutionary significance of chromosomal aberrations.

UNIT V

Syndromes: Down, Edward, Turner and Klinefelter Syndromes. Detection of chromosomal anomalies: Pedigree analysis, Prenatal diagnostics (Amniocentesis, Chorionic Villus sampling). Genetic counseling for human welfare.

Reference books:

Verma,P.S and V.K. Agarwal.2016. Genetics, 9th Edition, S.Chand Publications.New Delhi.
D. Peter Snustad, Michael J. Simmons, 2015. Principles of Genetics, 7th Edition, John Wiley & Sons, Inc.
Snustad DP and Simmons MJ (2008) Principles of Genetics. John Wiley & Sons Ltd. New York.
Gardner Eldon, J., D. Peter Snustad. 2006. Principles of Genetics, 8th Edition. John Wiley & Sons
Benjamin Lewin, 2005, Genes VIII, Oxford University Press, New York.
Strickberger Monroe, W., 1996, Genetics, Prentice Hall of India Pvt. Ltd.
John,D., Hawkins, 1996, Genes structure and expression, III Ed. Cambridge Univ. Press.
Jenkins, J.B., 1983, Human Genetics, The Benjamin Cummins Publishing Co

Practical-II

BIOCHEMISTRY , MICROBIOLOGY & IMMUNOLOGY AND GENETICS

Semester II
Sub code-PZOP22

Hours 5/week
Credits 5

BIOCHEMISTRY

1. Qualitative analysis analysis of Carbohydrates, Proteins and Lipids
2. Isolation and identification of aminoacids using paper chromatographic method
3. Determination of pH using pH paper and pHmeter.
4. Quantitative estimation of carbohydrate and Preparation of standard graph for carbohydrate, protein.
5. Determination of glucose level in blood & urine
6. Estimation of Vitamin C

Spotters – Thin Layer Chromatography, Chromatogram, pH-Meter Colorimeter, Spectrophotometer, Models of Hemoglobin and ATP. Centrifuge.

(Study Tour/Field Trip to animal farm, sanctuary, research lab or industrial area should be arranged to equip practical knowledge.)

MICROBIOLOGY AND IMMUNOLOGY

1. Culture Techniques - Culture of Bacteria, Bacterial Growth Curve,
2. Preparation of Smears-Simple Staining and Gram Staining.
3. Microbial population in raw milk and soil
4. Measurement of growth of *Lactobacillus*- Direct cell count method & Viable cell count method Bacterial motility- Methylene Blue Reductase test
5. Hanging drop method

6. Determination of human blood group and Rh typing by haemagglutination test
 7. Detection of the presence of precipitating antibody (IgG) with soluble antigens by precipitin ring test.
 8. Virtual dissection and Display of Lymphoid organs of mice and chicken.
- Spotters:** Autoclave, Petridish, Inoculation loop, Colony counter, Laminar Air Flow Chamber. Antibody structure–model, Immunoelectrophoresis, ELISA reader

GENETICS

1. Recording Mendelian Traits in among students
2. Study of polygenetic inheritance among students using finger print.
3. ABO and Rh Blood Groups and their Genetic Significance –
4. Statistical investigation of continuous variation using seed pods (Mean, Median, Mode, Standard deviation and Standard Error).
5. Identification of Colourblindness among the students using Ishihara's colour chart.
6. Mendelian traits and pedigree analysis in man.

Spotters: Normal Human Karyotype, Down syndrome, Klinefelter's syndrome, Turner's syndrome, Edward Syndromes,

ELECTIVE- III-AQUACULTURE

Semester II
Sub code-PZOE22

Hours 5/week
Credits 5

Objectives

This paper is planned to Gain knowledge in the fish food, feeding habits, investigating the seed production , farm management and method of farming. And this paper also to provide scope for employment opportunities in aquaculture activities.

UNIT-I: Introduction to Aquaculture

Importance of aquaculture, Global scenario, Present status in India - Prospects and scope.**Aquaculture Farms.**Site selection, topography, water availability and supply, soil conditions and quality. Design and layout, structure and construction.

UNIT II: Biology of important cultivable species and their economics

Standard guidance for choosing cultivable species - Seaweeds, Crustaceans (Prawns & Lobsters), Molluses (Clams, Cockles, Mussels and Oysters) and fishesbiological criteria - Environmental

adaptability and compatibility - Economic importance - economics, market values, by-products and availability in adjacent region.

UNIT-III: Survey of seed Resources and Seed & Feed Production

Distribution and abundance of natural seed resources, collection methods and segregation. Artificial seed production - breeding under controlled condition, induced breeding technique, larval rearing, packing and transportation. Live feed - Microalgae, Rotifer and Artemia - their culture. Feed formulation - Conventional and non-conventional ingredients, feed additives, feed attractants and feed formulations.

UNIT-IV: Culture systems

Traditional, Extensive, Semi-intensive and intensive systems, composite fish culture, paddy-cum-fish culture, integrated fish culture, sewage water fish culture, raceway culture, cage, pen and rack culture. Culture system management - pond preparation, production and economics.

UNIT-V: Farm Management

Water quality management - temperature, salinity, pH, O₂, CO₂ levels, nutrients and trace elements. Control of parasites, predators, weeds and diseases in culture ponds. Disease diagnosis - ELISA, Western blotting - DNA based diagnosis of diseases and fish vaccines.

REFERENCE BOOKS

1. Dash, M.C. and Patnik, P.N. 1994. Brackish water culture. Palani Paramount publications, Palani.
2. Paul Raj, S. 1996. Aquaculture for 2000 A.D. Palani Paramount Publications, Palani.
3. Balugut, E.A. 1989. Aquaculture system and practices. A selected review publishing House, New Delhi.
4. Michael, B.N. and Singholka, B. 1985. Freshwater Prawn Farming. A manual of culture of *Macrobrachium rosenbergii*. Daya Publishing House, New Delhi.
5. Raj, S. 1995. Shrimp Farming techniques, Problems and solutions. Palani Paramount Publications, Palani.
6. Pillay, T.V.R. 1990. Aquaculture Principles and Practices. Blackwell Scientific Publications Ltd.
7. Ponnuchammy, R. 1997. Practical Guide to shrimp farming. Palani Paramount Publications, Palani.
8. Post, G.M. 1983. Text Book of Fish Health. TFH Publication.
9. Sinha, V.R.P. and Srinivastava, H.C. 1991. Aquaculture Productivity. Oxford and IBH Publications Co., Ltd., New Delhi.

ELECTIVE –IV-POLLUTION ECOLOGY

Semester II

5 Hours week

Sub code-PZOE22

Credits 5

Objective – To gain knowledge about environmental pollution, its deleterious effects and preventive measures.

Unit -I

Air pollution : sources of air pollution, Types and major sources of air pollutants, Origin and effects of SOX, NOX, CoX, CFC, Hydrocarbon, Photochemical smog, heavy metals, particulates, effects of air pollutants on physico-chemical and biological properties surrounding atmosphere, air born diseases and their effects on health. control of air pollution.

Unit -II

Types and major sources of water pollutants, effects of water pollutants on physico-chemical and biological properties of water bodies, water born diseases with special reference to water pollution. Eutrophication, A brief idea of marine and ground water pollution

Unit -III

Soil pollution : Causes of soil pollution. Effects of soil pollution
Pesticides in soil environment and their effects. Biological magnification, pollution through mining Radioactive and thermal pollution sources and their effects on surrounding environment. Chernobyl disaster. Solid waste disposal and its effects on surrounding environment

Unit -IV

Major sources of noise pollution, effects of noise pollution on health, noise level standard in industrial, commercial, residential and silence zones. Sources and effects of noise pollution, noise standards. Climate change : Causes and effects, Threats to stratospheric ozone, Green house effect, acid rain, climate convention.

Unit -V

Environmental acts for water air and forest conservation. Yamuna action plan, Ganga action plan. Sewage -biological treatment of sewage.

REFERENCE

Singh J.S., Singh S.P. and Gupta S.R., 2006, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.
Sodhi G.S. 2005, Fundamentals of Environmental Chemistry : Narosa Publishing House, New Delhi.

Botkin, D.B and Kodler E.A., 2000, Environmental Studies : The earth as a living planet. John Wiley and Sons Inc. Rao M.N. and H.V.N. Rao, 1989 : Air Pollution, Tata McGraw Hill Publishing Co. Ltd., New Delhi
 Tyler Miller Jr. G. 1990. Living in the Environment. Wadsworth Publishing Company, Belmont California.
 Brady, N.C. 1990. The nature and properties of Soils, Tenth Edition. Mac Millan Publishing Co., New York.
 Odum, E.P., 1983, Basic Ecology. Halt Saundurs, International Edition Japan.
 De, A.K. 1990, Environmental Chemistry, Wiley Eastern Ltd., New Delhi.

CORE-VII-ANIMAL PHYSIOLOGY

Semester III
Sub code-PZOT31

Hours 5/week
Credits 5

Objectives

On the successful completion of the paper, students will be able to understand the structural organization of different systems within body with the functions of different organ systems in animals

Unit I:

Digestive system (Man) : Digestion, absorption, energy balance, BMR with reference to man
Respiratory system (Man): Transport of gases, exchange of gases, respiratory pigments. Hemoglobin as oxygen carrier, respiratory quotient, neural and chemical regulation of respiration in man

Unit II:

Blood and circulation: Blood and its components, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, haemostasis.
Cardiovascular System: Comparative anatomy of heart structure, myogenic heart, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure.

Unit III:

Excretory system (Man): kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, electrolyte balance, acid-base balance, Dialysis
Nervous system (Man): Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture.

Unit IV:

Muscles: Structure and mechanism of Muscle Contraction - Regulation and Energetics of Contraction **Sense organs (Man):** Vision, hearing and tactile response **Physiology of Reproduction:** Human Reproductive Physiology- Reproductive Cycles, Hormonal Control.

Unit V:

Ethology: patterns of behaviour, objectives of behaviour, mechanism of behaviour-**Reflexes:** reflex action, types of reflexes, reflex arch, characteristics of reflexes and complex behaviour-**Orientation:** primary and secondary orientation; kinesis – orthokinesis, klinokinesis; taxis – different kinds of taxis; sun-compass orientation, dark- light reaction. Pheromones in colonial interactions, foraging and mating

Reference Books:

Hall, J.E., 2013, Text Book of Medical Physiology, Elsevier Inc.
Singh, H.R and Neeraj Kumar 2009. Animal Physiology and Biochemistry. Vishal Publishing Co, New Delhi
V.K. Agarwal, 2009, Animal Behaviour (Ethology), S. Chand & Company Ltd, New Delhi.
Hoar W.S 2004. General and Comparative Physiology. Prentice-Hall of India (P) Ltd. New Delhi
Verma, P.S., Agarwal, N.K., Thyagi, B.S., 1980, . Animal Physiology. S.Chand & Co., New Delhi.
. Hoar, W.S., 1987, General and Comparative Physiology, Prentice Hall.
Renganathan, T.S. 2002. A text book of Human Anatomy. VI edn. S. Chand and Company Ltd., New Delhi.
McFerland, 1986, Animal Behaviour – PsychoBiology, Ethology and Evolution, ELBS Longman
Prasad, S., 2004, Animal Behaviour, CBS Publishers and Distributors, New Delhi

CORE –VIII-DEVELOPMENTAL BIOLOGY AND EVOLUTION

Semester –III
Sub code-PZOT32

5 Hours /week
Credits 5

Objectives

- Students will be able to understand the basis of development learn the stages of organ development
- To comprehend the scientific concepts of animal evolution through an understanding of its evidences, its mechanics, process and products.

Unit – I

Introduction : historical perspective, theories- preformation, epigenesis, recapitulation and germplasm, Gametogenesis- Spermatogenesis, oogenesis, fertilization – physiological and biochemical pathway, parthenogenesis. types (natural and artificial) and significance.

Unit - II

Cleavage: salient features, planes of cleavage, patterns of cleavage and factors affecting cleavage. **Gastrulation:** salient features, metabolic and molecular changes during gastrulation, gastrulation in amphioxus. **Fat-map:** construction of fate-map in amphibians – artificial and natural markings.

Unit – III

Organogenesis in Vertebrates –brain, eye, heart, kidney, skin and its derivatives.

Regulation and development : **Placentation:** classification (based on the types of foetal membrane involved, distribution of villi and types of tissues involved) and physiology of placenta. Teratogenesis : Teratogenic agents.

UNIT IV

Introduction: Early ideas of evolution- The nature of evolutionary units; Species concepts- The Biological Species concept and Theories of Evolution. A general theory of speciation and its impacts. Darwinism. Lamarckism. Natural selection I and II. The causes of evolution; Hardy-Weinberg equilibrium: - Genetic drift and Non-random breeding-Reproductive isolating mechanisms:

UNIT V

Models of population growth- Phenetics and cladistics, molecular clock. Ontogeny and phylogeny: Historical perspective; allometry and Species selection. Evolutionary innovations and the origin of higher taxa- Evolution of *Homo sapiens* and molecular biological and immunological evidences for evolution. Impact of DNA bar coding in modern Evolutionary studies.

References:

- 1.Scott F. Gilbert, 2010. Developmental Biology (9th Edn.). Sinauer Associates Inc. Publishers, Massachusetts, USA.

2. Arora M.P. 2009. Embryology, Himalaya Publishing House, New Delhi
3. Jain, P. C., 2007. Elements of Developmental Biology, Vishal Publishing Co.
4. Ballinsky, B. I., 2004. An introduction to Embryology, W. B. Saunders Co., Philadelphia.
5. Bruce, M. Carlson, 2003. Pattern's Foundation of Embryology, 6th Edn., Tata Mc Graw- Hill.
6. Gilbert, S.F., 2003, Developmental Biology, 7th Ed., Sinamer Associates Inc., Publishers, Saunderland, Massachusettes, USA
7. Berril, N. J., 1971. Developmental Biology, Tata Mc Graw-Hill Publ. Co. Ltd., New Delhi.
8. Himanshu Arora and Mohan P. Arora 2013. *A Text Book of Organic Evolution*, third edition. Himalaya Publications, New Delhi.
9. Veer Bala Rastogi, 2012. *Organic Evolution*. Kmrn publications, Meerut.
10. Peter E. Rosenbaum. 2010. Volpe's Understanding Evolution, McGraw-Hill, New York.
11. Dodzhansky, T., Francisco J. Ayala, G.L. Stebbins, James W. Valentine. 1977 Evolution,
12. W.H. Freeman & Company, San Francisco Strickberger, 2000, Evolution, Jones and Barlett Publishers Inc., London.

CORE-IX-ENVIRONMENTAL BIOLOGY

Semester III
Sub code-PZOT33

5 Hours /week
Credits 5

Objectives

Students will be able to understand the concepts and components of ecosystems. Learn about biodiversity and different indices. To evaluate the pollution problems in different environment. To create awareness about the present scenario of the environment.

UNIT I:

Concepts of Ecosystem, Limiting factors, Bio-geo chemical cycles, Types and measurement of primary and secondary productivity, Biotic community – concept and structure, Population ecology – basic concepts, Ecological dominance and Ecological succession. Seasons and trade wind-occurrence, amount of rain fall, monsoon as a factor in Indian ecology.

UNIT II:

Population ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); concept of metapopulation – demes and dispersal, interdemic extinctions, age structured populations. **Species interactions:** Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis. **Community ecology:** Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotone.

UNIT III:

Environmental pollution-Air, Water, Land, Thermal, Radiation and Noise; global environmental change; Biodiversity-status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. **Remote sensing and GIS** – Methods and Applications in environmental management

UNIT IV:

Renewable resources – Biomass, Biogas, Forest, water, air and Solar energy, Non- Renewable resources – Nuclear fuels and Fossil fuels. Wild life conservation, Endangered species, Fisheries Management.

UNIT V:

Biodiversity – Definition, characterization, levels, types and values, Mega diversity countries, Diversity hotspots, IUCN categories of threatened species, biodiversity and sustainable development, Ex-situ and in - situ conservation, gene banks, cryopreservation and DNA bar coding.

REFERENCE BOOKS:

- Chang, K. 2002. Geological Information system. Tata McGraw Hill publishers. New Delhi.
- Stiling, P. 2004. Ecology – Theories and applications. Prentice Hall of India Pvt. Ltd., New Delhi.
- Odum E.P., (1996). Fundamentals of Ecology. 3rd edition, Natraj Publication, Gayathri Offest, New Delhi.
- Verma K.S. and Agarwal P.S., (1986). Principles of Ecology. S. Chand and Co, New Delhi.
- Kumar H.D., (1999). Biodiversity and Sustainable Conservation. Oxford and IBH Publication Co. Pvt. Ltd, New Delhi.
- Sharma B.K., (2001). An Introduction to Environmental Pollution. Krishnan Prakashan Media Pvt. Ltd, Meerut.
- Krishnan N.T. and Santhana kumar G., (1992). Environmental Biology. J.J. Publications, Nagercoil.
- Verma, P.S., Agarwal, N.K., Thyagi, B.S., 1980, . Animal Physiology and Ecology, S.Chand & Co., New Delhi.
- Sharma P.D., (1999). Ecology and Environment. Prakasan media, Shivaraj Road, Meerut. U.P.

PRACTICAL-III
ANIMAL PHYSIOLOGY, DEVELOPMENTAL BIOLOGY AND ENVIRONMENTAL BIOLOGY

Semester III
Sub code-PZOP33

Hours 5/week
Credits 5

Objectives

- Observation of forelimbs and hindlimbs of vertebrates (Frog, Calotes, Bird and Mammal)
- Observation of fossils to study paleontological evidences of evolution. Living fossil: Peripatus, Adaptation in beak and feet of birds Animal fossil: *Physa princepii*
- Observation of leaf insects and stick insects in the museum to study adaptation by cryptic colouration and natural selection.
- Observation of Monarch and Viceroy butterflies to study Batesian mimicry and mullerian mimicry
- Study of polygenetic inheritance among students using finger print.
- Hardy - Weinberg Law & Calculation of Gene Frequency of Dominant and Recessive using two different colour beads.
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ANIMAL PHYSIOLOGY

- Quantitative Estimation of Amylase Activity
 - Oxygen Consumption in Fish related to temperature and salinity
 - Preparation of Haemin crystals.
 - Estimation of Haemoglobin by Sahli's method
 - Total RBC count
 - Total WBC count and Differential count
 - Detection of nitrogenous wastes-Ammonia, Urea and Uric acid
- Spotters:** Haemocytometer, Haemoglobinometer, Sphygmomanometer and Kymograph,

Glucometer.

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DEVELOPMENTAL BIOLOGY

- Temporary mounting of chick blastoderm(24, 48,72 and96 hrs).
- Observation of frog spermatozoa.
- Study of life cycle /early embryogenesis of frog.
- Effect of hormones in amphibian metamorphosis

Spotters

Frog's / Human's sperm

- Frog's Egg, 2-Celled Stage, 4-Celled Stage, 8-Celled Stage, 16 Celled Stage, Yolk Plug Stage, Blastula, Gastrula
- T.S. of Mammalian Testis & Ovary (Mice – slide)
- T.S of testis and ovary of frog and mammal
- Chick Embryo: Primitive Streak, 24 hrs, 48 hrs and 72 hrs Chick Embryo.

ENVIRONMENTAL BIOLOGY

- **Hydrological Studies of Water Samples with Reference to Pollution** - Estimation of Chlorides, Calcium, Total Hardness, Phosphates and Nitrates.
- Determination of pH, DO and BOD
- Collection and Mounting of Phyto and Zoo planktons- any three
- Estimation of primary productivity
- Phytoremediation with plants for dye industry effluents.

Spotters: Secchi Disc, BOD incubator, Wet and Dry bulb Thermometer, , Hygrometer, Rain Gauge, Sandy, Muddy and Rocky Shore Fauna (each five).

Report on Ecological Collection of Fauna representing Different Habitat

(Study Tour/Field Trip to animal farm, sanctuary, research lab or industrial area should be arranged to equip practical knowledge.)

ELECTIVE-V-BIOTECHNOLOGY

Semester III
Sub code-PZOE33

Hours 5/week
Credits 5

Objectives

Students will be able to understand the basic principles of genetic engineering learn the fundamental steps in gene cloning and manipulation and know the popular techniques used in biotechnology.

UNIT- I

Tools and Techniques of Genetic Engineering: Basic Principles of Genetic Engineering; Restriction enzymes, Linkers/Adaptors; Cloning Vectors - Salient Features and Types; Techniques – Strategies of rDNA Technology, Gene Library, Insertion of a Foreign DNA into a Vector; Transfer of rDNA into a Bacterial Cell, Selection & Screening of Recombinants, Recovery of Cells containing rDNA, Expression of Cloned DNA.

UNIT- II

Industrial & Environmental Biotechnology: Fermentation - Types, Fermenter Designs, Upstream and Down Stream Processing; Production of Alcohol, Aminoacids, and Vitamins; Biofuels, Bioremediation, Biodegradation, Biomining & Biosorption.

UNIT-III

Animal biotechnology: Equipments for animal cell culture, Types of tissue culture medium, Primary culture, Stable cell line, Cultivation of Animal Cells in a Bioreactor; Somatic Cell Fusion, Applications of Cell Culture – tPA, Blood Factor VIII and Erythropoietin; Organ Culture; Transgenic Animals and their application; Biosafety and bioethics

UNIT IV

Enzyme Biotechnology: Microbial Production of Enzymes, Immobilisation of Enzymes and its applications. **Agricultural Biotechnology:** -*Agrobacterium* as a natural genetic engineer; Single Cell Protein, Nitrogen fixation- nitrogen fixing organisms, mechanism and genetics of fixation Bio-pesticides Biofertilizers.

UNIT-V

Medical Biotechnology: Production of Antibiotics, Hormones, Vaccines, Interferons, Diagnosis of Diseases MAbs, Molecular Markers in Forensic science- RFLPs, RAPD, AFLP, VNTR and Microsatellites, Diagnosis of diseases, Gene Therapy - Germ Line Gene Therapy & Somatic Cell Line Gene Therapy.

References Books:

- Dubey, R.C., 2008, A Text book of Biotechnology, S.Chand & Co., New Delhi.
Gupta, P.K., 2006, Elements of Biotechnology, Rastogi Publications, Meerut.
Lewin, B., 2002, Gene XI , Oxford University Press, New York.
Brown, T.A. 2006. Gene Cloning & DNA Analysis: An introduction. V edn. Blackwell publishing USA.
Balasubramanian, D., C.F.A. Bryce, K.Dharmalingam, Y.Green, Kunthala Jeyaraman. 2004. Concepts in Biotechnology. Universities (P) ltd. Hyderabad.

Chawla, H.S.2000 Introduction to Biotechnology, Oxford & IBH Publishing Co. Pvt.Ltd.New Delhi.

Crueger, W. and A. Crueger, 2000. Biotechnology: A Text Book of Industrial Microbiology, 2nd edn. Panima Publishing Corporation, New Delhi.

Trehen, K.2002. Biotechnology, New Age International (P) Ltd. New Delhi

ELECTIVE-VI-BIOINFORMATICS

Semester III
Sub code-PZOE33

5 Hours /week
Credits 5

Objectives

Students will be able to learn the basic approaches in structure prediction” –concept and familiarize in applying bioinformatic tools in biomedical research.

Unit I

Internet concepts, Bioinformatics a multidisciplinary approach, Scope and applications of Bioinformatics. Biological databases- Nucleic acid databases (Genbank,DDBJ and EMBL) Protein databases - primary, composite, secondary ;Specialized databases-SGD,TIGR Structural databases -PDB, CATH ModBASE.

Unit II

Sequence similarity search (FASTA and BLAST). Significance of E-value. Introduction to ORF and primer designing. Secondary structure prediction: GOR, Chou –Fasman, Hidden Markov method

Unit III

Multiple sequence alignment (CLUSTAL W), conserved domain search (Motif). Phylogenetic analysis- phylogenetic tree construction (Neighbor Joining method and Maximum parsimony).

Unit IV

Homology modeling - SPDB viewer. Ramachandran plot for evaluation of predicted structure. Data mining for drug designing and docking analysis. Sturcture visualization tool-RASMOL

Unit V

Genomics-scope and applications of structural,comparative and functional genomics,microarray technology.Proteomics scope and applications of structural and functional-2D gel electrophoresis, Mass spectroscopy and MALDI- TOF

Reference Books

Baxevanis, A.D. and Quellette, B.F.F. 2009. Bioinformatics. A practical guide to the analysis of genes and proteins. II edn. Wiley-Intern Science Publication, New York.
Lesk, M.A. 2008. Introduction to Bioinformatics. Oxford Univ. Publishers
Attwood, T.K. and Parry, D.J – Smith, D.J. 2005. Introduction to Bioinformatics. Pearson Education (Singapore) Pvt. Ltd.
Twyman, R.H. 2003. Instant notes on Bioinformatics. Viva Books Pvt. Ltd., NewDelhi
Mount, W. 2005. Bioinformatics sequence and genome analysis. Cold Spring harbour Laboratory Press, New York.

Pevsner, 2009. Bioinformatics and Functional Genomics. Wiley Dreamtech India Ltd., New Delhi.

CORE-X-RESEARCH METHODOLOGY

SEMESTER – IV
Sub code-PZOT41

5Hrs/week
credits 5

Objectives

The students will be able to identify, design and execute research problems on their own search and collect relevant literature from various sources prepare research reports and thesis. Gain theoretical and practical knowledge about bio instruments.

UNIT-I

Concepts of Research in Biological Sciences, Basic and applied research, essential steps in research-Formulating the Research Problem, Extensive Literature Review, Developing the objectives, Preparing the Research Design, Types, Approaches, Methods of Research (Survey, Observation, case study, experimental, historical and comparative methods) , preparation of Manuscript- thesis format. Research ethics-plagiarism, –Research funding promoting agencies-State-TANSCHE, TNSCST, National (ICMR, ICAR, DAE,CSIR, UGC, DST, DBT) - Patent and IPR

UNIT-II

Scientific Documentation and Communication: Project proposal writing, research report writing: thesis and dissertation; preparation of manuscript. Standard of Research journals: peer review- impact factor- citation index. Choice of journals for publication. Information retrieval: archives, databases and search engines: Google, PubMed, Springer, Elsevier), Impact factor, Citation index. online database library: Genbank. Research paper: oral and poster presentation. Synopsis- facing *viva-voce* using LCD. Latex and Science direct. Planning of research: Research proposals, time scheduling of research, available sources and generation of funds and facilities.

UNIT-III

Microscopy (light, compound, SEM, TEM), Confocal Microscopy; Micrometry. Chromatography (paper, TLC. HPLC, GC-MS, FPLC,), electrophoresis-PAGE), sedimentation and centrifugation.

UNIT-IV

Colorimetry, Spectrophotometry and Spectroscopy : Principle instrumentation and applications of colorimetry and spectrophotometry. Spectroscopy : UV – Visible spectroscopy, Nuclear Magnetic Resonance spectroscopy (NMR), Raman Spectroscopy, Mass spectroscopy.

UNIT-V

Radioisotope Detection and Measurement: Dosimetry: Ionization chamber, GM counter, Solid and liquid scintillation counters, Autoradiography – **Assays:** Radio Immuno Assay, Enzyme Linked Immuno Sorbent Assay (ELISA); SDS-PAGE, Agarose Gel Electrophoresis, 2D Gel Electrophoresis, Gel Documentation,

References Books:

- Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications.
- Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An Introduction to Research Methodology, RBSA Publishers.
- Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall.
- Kothari C.R., (2004). Research Methodology. 2nd edition, New Age International Publishers, Martin. M.W. and Schinzinger.R. 2003. Ethics in engineering, III Edition, Tata McGraw-Hill, New Delhi.
- Gurumani, 2006, Research Methodology, MJP Publishers, Chennai.
- Ghatak K.L. 2011. Techniques and Methods in Biology. PHI Learning Pvt. Ltd. New delhi
- Webster, J.G., 2004, Bioinstrumentation, John Wiley & Sons, New Delhi.
- Veerakumari, L. 2009. Bioinstrumentation. MJP Publishers, Chennai.
- Chatwal, G.R and Anand, S.K. 2009. Instrumental Methods of Chemical Analysis. Himalaya Publishing House, New Delhi.
- Gupta A. 2009. Instrumentation and Bio-Analytical Techniques. PragatiPrakashan, Meerut.

CORE XI- BIOSTATISTICS AND BIOPHYSICS

Semester : III

5 Hours/Week

Sub code : PZOT42

Credit :5

Objectives:

1. To develop knowledge handle the instruments for biological research and interrupt the data.
2. To acquire knowledge on applications of statistics in research.
3. To gain knowledge in experimental design and data collection techniques.
4. To develop the technical art of writing research report and presentations.

UNIT -I

Variables in Biology, Collection, classification and tabulation of data. Frequency distribution, Diagrammatic and Graphical presentation of statistical data, Sampling techniques. Measures of Central Tendencies: Mean, Median and Mode; Measures of Deviation: Standard Deviation, Quartile deviation, Mean deviation and Standard Error

UNIT-II

Normal Distribution. Data distribution - Binomial and normal Distribution. Skewness and Kurtosis. Correlation Analysis - types, methods - Scatter plot, Karl Pearson's Correlation Coefficient, Spearman's Rank correlation. Simple regression Analysis - predicting X on Y and Y on X.

UNIT-III

Hypothesis Testing and estimation: H_0 and H_1 , Hypothesis testing, significance level, degrees of freedom. Measures of Relationship: Correlation – Simple, Partial and multiple- Regression analysis. Definitions and applications of Chi-square test, 't' and 'f' test. Analysis of variance (ANOVA)-One way and two way classified data; Application of SPSS in biology.

UNIT IV

Introduction – scope of biophysics.-I, II, III laws of Thermodynamics, Concepts of free energy, Entropy, Enthalpy, biological oxidation reduction reaction – redox potentials in biological system. Molecular structure of water–Non-covalent bonding: Hydrogen bond, electrostatic interaction-Van de Waals forces thermal, solvent properties ionization of water – colligative properties of aqueous solution

UNIT V

Biological significance of Osmosis, Electrical conductivity, Diffusion, Surface tension, Adsorption, Hydrotropic, Precipitation, Viscosity and Colloids, - Donnan Equilibrium in Living

systems. Diffusion – Fick's laws, constant laws–exergonic and endergonic reaction – rate of reactions – energy activation – Arrhenius expression-

Reference Books:

- Arora, P.N and P.K.Malhan 2008. Biostatistics. Himalaya Publications, Mumbai
- Daniel, W.W (2006) Biostatistics-A foundation for analysis in health sciences, John Wiley (Asia) & sons, Singapore.
- Gupta S.P., (2011). Statistical Methods. 40th edition, S.S. Chand Publishers, New Delhi. .
- Zar J.H., (2011). Statistical Analysis.4th Edition, Pearson Education, South Asia.
- Upadhyay, A., Upadhyay, K., and Nath, N., 2004, Biophysical Chemistry, Himalayas Publishing House, Mumbai.
- Subramaniam, M.A., 2002, Biophysics. MJP Publishers, Chennai.
- Daniel, M., 1989, Basic Biophysics for Biologists, Agro-Botanical Publisher, Bikaner, India.
- Freifelder, D., 1976, Biophysical Chemistry Applications to Biochemistry and Molecular Biology, W.H. Freeman & Co., San Francisco.

PROJECT WORK

Semester : IV

Sub code : PZOP41

Credit :5

Learning outcome: Empowering students to carryout individual research projects.

All the candidates of M.Sc (Zoology) are required to undergo a Major project and submit the following:

1. Dissertation/Thesis based on the work done by the student.
2. Soft copy of the project on CD/DVD

Project Evaluation Guidelines.

The project is evaluated on the basis of following heads:

Presentation - 25% of total marks.

Viva - 20% of total marks.

Thesis/ Dissertation - 30% of total marks.