

MASTER OF SCIENCE (ZOOLOGY) – FOURTH SEMESTER

Fourth Semester			
S. No.	Name of Subject	Credits	Total Marks
1	Insect Physiology, Toxicology and Vector Biology	4	100
2	Aquatic Resources and Their Conservation	4	100
3	Genomics	4	100
4	Molecular endocrinology	4	100
5	Practical+ Dissertation	6	100
Total		22	

Subject Name: INSECT PHYSIOLOGY, TOXICOLOGY AND VECTOR BIOLOGY

Structure and physiology of integumentary, digestive, excretory, circulatory, respiratory, endocrine, reproductive, and nervous system. Sensory receptors. Growth, metamorphosis and diapause in insect.

Definition of pesticides, brief history, pesticides registration, pesticide industries and markets. Dose-response relationship; mode of action of insecticide, carcinogenic, mutagenic and teratogenic effects, and evaluation of toxicity. Group characteristics of insecticide, structure and function of organochlorine, organophosphorus, carbamate, pyrethrod, other plant origin as well as bio-insecticides, neonicotinoids and nitrogenous insecticides, fumigants, IGRs. Metabolism or degradation of pesticides - phase I and phase II reactions. Insecticide resistance and health hazards.

Introduction to vector biology, economic importance and control of fleas, lice, bugs, mosquitoes, flies and parasitoids. Vector-parasite interaction; host-pathogen interaction, Insect transmitting bacteria and viruses of medical, veterinary and agricultural importance; control of insect vector.

Suggested Literature:

1. The Insects: Structure and function, Chapman, R. F., Cambridge University Press, UK
2. Physiological system in Insects, Klowden, M. J., Academic Press, USA
3. The Insects, An outline of Entomology, Gullan, P. J. , and Cranston, P. S., Wiley Blackwell, UK
4. Insect Physiology and Biochemistry, Nation, J. L., CRC Press, USA

5. Toxicology and Risk Assessment: A Comprehensive Introduction, Greim H., and Snyder, R. (ed), John Wiley and Sons, UK
6. The Complete Book of pesticide management, Whitford, F., Wiley Interscience, John Wiley and Sons, UK
7. Safer Insecticides, Hodgson, E., and Kuhr, R. J., (ed), Marcel Dekker Inc., New York, USA
8. Pesticide Application Methods, Matthews, G, A., Blackwell Science, London, UK
9. Pesticide Biochemistry and Physiology, Wilkinson, C. F., Plenum Press, New York, UK
10. Metabolic pathways of agrochemicals Part II, Roberts, T. R., and Hutson, D. H. The Royal Society of Chemistry, UK
11. Medical and Veterinary Entomology Mullen, G., Durden, L., Academic Press, USA
12. Medical and Veterinary Entomology, Kettle, D. S., Cabi Press, USA
13. Medical Entomology for students, Service, M. Cambridge University Press, UK

Subject Name: Aquatic Resources and Their Conservation

UNIT 1

Riverine fisheries- important river systems and their hydrological conditions, flora and fauna with special reference to fisheries, dams and their impact on riverine fisheries, fish ladders, interlinking of rivers and likely impact on fisheries. Cold water fisheries - ecology of hill streams, biology of important cold water fishes of India, recreational fishing. Lacustrine fisheries - origin of lakes and lake morphology, light, temperature and density relationship in the lacustrine ecosystems, heat energy and water movements, oxygen and other dissolved gases in lakes, pH and redox potential, fisheries profile and potential of major Indian lakes.

UNIT 2

Estuarine fisheries- major estuarine systems of India, hydrography, flora and fauna with special reference to fisheries. Marine fisheries – coastal and deep sea fisheries, permanent and seasonal stratification, upwelling, the photic zone, control of primary production by light and nutrients availability, chemical properties of sea water, biology of important fishes (sardine, mackerel, tuna), marine protected areas. Integrated resources- coastal wet lands, mangroves, coral reefs, sea grasses and their conservation.

UNIT 3

Fishing techniques-- technologies for localizing catches- remote sensing, sonar, radar; crafts and gears. Stock assessment and management-- Natural markers- morphological analyses, environmental signals, genetic analyses; Applied markers- marking and tagging, Stock identification data analysis - stock composition analysis, age and growth, fecundity estimation, application of statistical methods in fisheries.

UNIT 4

Fish conservation- fishing laws and regulation, permitting. Post-harvest technology—Fish spoilage, rigor mortis, rancidity, enzymatic spoilage, microbial spoilage; Fish preservation and processing- handling of fish at harvest/onboard, principles of fish preservations, methods of preservation, problems associated with fish preservations, quality control, fishery byproducts.

UNIT 5

Aquatic pollution- types and sources, impact of pollution on aquatic organisms, ecosystem analysis- bio-indicators, biomonitoring, environmental factors and fish health, xenobiotics. Waste management- national and international standards. Extension services – basic principles and emerging issues of extension, role of information and communication technology in fisheries extension.

Suggested Literature:

1. Computers in Fisheries Research, Megrey, B. A. and Moksness, E. (2009), Springer, USA
2. Biological Invasions in Marine Ecosystems Ecological, Management and Geographic Perspectives. Rilov, G. and Jeffrey, A. C. (2009), Springer-Verlag, GERMANY
3. Handbook of Fisheries and Aquaculture, Indian Council of Agricultural Research, ICAR, (2006), DIPA, New Delhi, INDIA

Subject Name: GENOMICS

UNIT 1

Organization and structure of genomes - size, complexity, gene-complexity, virus and bacterial genomes, organelle genome, architecture of mitochondrial genome, conserved chloroplast DNA; organization and nature of nuclear DNA in eukaryotes; transposable elements, retro-transposons, SINE, LINE, Alu and other repeat elements, pseudogenes, segmental duplications.

UNIT 2

Mapping genomes - physical maps, EST, SNPs as physical markers, radiation hybrids, FISH, optical mapping, gene maps, integration of physical and genetic maps; sequencing genomes: high-throughput sequencing, strategies of sequencing, recognition of coding and non-coding regions and annotation of genes, quality of genome-sequence data, base calling and sequence accuracy.

UNIT 3

Bioinformatics - datasets, sequence analysis based on alignment, de novo identification of genes, in silico methods. Comparative genomics - orthologs and paralogs, protein evolution by exon shuffling; human genome project, comparative genomics of bacteria, organelles, and eukaryotes

UNIT 4

Large scale mutagenesis and interference - genome wide gene targeting; systematic approach, random mutagenesis, insertional mutagenesis, libraries of knock-down phenocopies created by RNA interference; transcriptome analysis, DNA micro-array profiling, data processing and presentation, expression profiling, proteomics – expression analysis, protein structure analysis, protein-protein interaction.

Suggested Literature:

1. Principle of Genome Analysis and Genomics, Primrose, S. B. and Twyman R. M., (7th Ed., 2006), Blackwell Publishing Company, Malden, USA

2. Genomes 3, Brown, T. A., Garland Science Publishing, London, UK
3. Bioinformatics: Sequence and Genome Analysis, Mount, D. W., Cold Spring Harbor Laboratory Press, New York, USA

Subject Name: MOLECULAR ENDOCRINOLOGY

UNIT 1

Discovery of hormones as chemical signals for control and regulation of physiological processes. Nature of hormonal actions. Major questions in biology of hormones. Techniques for quantitation of hormones. Design and development of hormonal assays.

UNIT 2

Structure of peptide and protein hormones. Purification and characterization of hormones. Structure-Function relationships in different hormones. Phylogenic analysis of hormonal structures and functions. Biosynthesis of protein hormones. Storage and secretion of hormones: molecular mechanisms of regulation. Transcriptional and post-transcriptional mechanisms of hormone biosynthesis and secretion. Regulation of biosynthesis and secretion. Inhibitors of hormone biosynthesis and their use.

UNIT 3

Nature of hormonal effects and actions. Discovery of receptors in target tissues. Mechanisms of hormone action and signal attenuation... Signal discrimination, signal transduction and signal amplification in hormone regulated physiological processes. Structural requirements for successful hormone-receptor interactions. Receptor antagonists and their applications. Metabolism of hormones by target and non-target tissues. Pharmacokinetics of hormones. Hormones and behavior- cellular and molecular actions of semiochemicals.

UNIT 4

Hormones as therapeutic agents. Current developments in design and production of hormonal contraceptives. Recombinant protein hormones-production and application in regulation of fertility in farm animals and humans. Evolution of chemical communication in animal systems. Unsolved problems in hormonal biology.

Suggested Literature:

1. Peer reviewed journal articles, monographs and reviews as and when recommended.
2. Molecular Biology of Steroid and Nuclear Hormone receptors, ed. Freedman L. P., (1998), Birkhauser, Boston, USA
3. Biochemical actions of hormones, ed. Litwack, G. (1985), Academic press, New York, USA

Subject Name: PRACTICAL+ DISSERTATION

1. Model study of respiratory system in butterfly.
2. Estimation of LD₅₀ and LC₅₀ using insects.
3. Identification and morphological studies of major vector species of Anopheles, culex and Ades.
4. PCR amplification and analysis by agarose gel electrophoresis.

5. Transformation in E.coli.
6. Southern hybridization of genomic DNA with suitable gene as probe.
7. Study of benthic macro invertebrates in natural water bodies.
8. Study of fishing gears and nets with the help of models.
9. Determination of age and growth; gonadosomatic index.
10. Principle and function of light or electron microscope.
11. Study and function of molecular cloning.
12. Theory and function of expression vector.

Note: The Normal Rule and Regulation pertaining to the Examination and other issues will be applicable in Faculty of Science as per Arunachal University of Studies Act 2012, Subsequent Statute and Rules & Regulations.