DEPARTMENT OF ZOOLOGY

M.PHIL ZOOLOGY

M.PHIL PROGRAMME

SYLLABUS

Effective from the Academic Year 2016-2017

Loyola College (Autonomous)

Chennai- 600 034

DEPARTMENT OF ZOOLOGY

M.Phil. Restructured Syllabus

(Effective from 2007-08)

Total Credits : 36

Semester	Nature	Code	Course Title	Credits
I	MC	ZO 1116	Research Methodology	6
			(Any one)	6
	ES	ZO 1156	Arthropod Predation	
	ES	ZO 1157	Environmental Sciences	
	ES	ZO 1158	Fishery Resources	
	ES	ZO 1159	Molecular Biology & Biotechnology	
	ES	ZO 1160	General Entomology	
	ES	ZO 1161	Environmental Biotechnology	
	ES	ZO 1162	Prin. of Anim. Taxon & Elec. Res. Tools	
II			(Any one)	6
	ES	ZO 1256	Perspectives of Water Bugs	
	ES	ZO 1257	Environmental Toxicology and Biotechnology	
	ES	ZO 1258	Energy Budget in Aquatic Ecosystem	
	ES	ZO 1259	Molecular Techniques and Applications	
	ES	ZO 1260	Agricultural Entomology	
	ES	ZO 1261	Environmental Toxicology	
	ES	ZO 1262	Biodiversity and Bioethics	
II	MC	ZO 1217	Dissertation & Viva Voce	18

ZO 1116 : RESEARCH METHODOLOGY

Paper - I

Semester: I — Credit : 06

Category: Major Core (MC) — Hours/week :10

Unit 1: Molecular Biology & Microbial Technology

TEM, SEM, cytophotometry, flow cytometry, preparation of tissues for microscopy. Structural conformation of protein and nucleic acids, polypeptides, glycoproteins and peptides, hydrogen bonding and

hydrophobic interaction. Organisation of transcriptional units, mechanism of transcription in prokaryotes and Eukaryotes, RNA processing (Capping, polydenylation, splicing, intron and exons). Tissue culture in plants and animals, micropropagation somatic hybridization, transgenesis, allopheny and artificial seeds. Membrane organization, Ion transduction hormone mediated message transduction, protein kinases system, neurotransmitters, acetylcholine system and liposomes NMR and ESR spectroscopy, application of tracer technique, half-life isotopes.

Unit 2: Biological chemistry

Inter conversion of hexose and pentoses, Biosynthesis of purines and pyrimidines, fatty acids, triglycerides, phospholipids and steroids. Enzymes kinetics, co-enzymes and isoenzymes, biological oxidation energy transuctors.

Unit 3: Biotechnology

Regulation of gene expression, lytic cas cape, lysogenic repression, DNA methylation post translation modification and transport of protein signal hypothesis. Molecular biology of cancer, genetic and metabolic disorders and detoxification. Lysogeny and lytic cycle in bacteriophage, molecular recombination, DNA ligases, gene cloning for c DNA libraries, DNA transformation and hybridoma technology. Immunoglobulin, cell mediated immunity, Lymphokinesis, T-cell receptor, HLA, autoimmunity, monoclonal antibodies.

Unit 4: Separation Techniques

HPLC, chromatography, electrophoresis, ultra centrifugation, ELISA, Blotting techniques, sequencing of proteins and nucleic acids, DNA foot printing c DNA libraries.

Unit 5: Bioinformatics & Nanotechnology

Introduction to Bioinformatics and Computational biology-Genomics, Proteomics, Pharmacogenomics.

Introduction to Nanoscience and Nanotechnology- Nanomatrials, Electron Massbaur Spectroscopy for biotechnological application, Silicon nanotubes nanosciences as biological sensors-crystallography, Biophysics and system level & nanostructure of DNA; DNA nanomachine, DNA lithography; DNA computing.

Unit 6: Research approaches

Review of literature, selection of research area, biological abstracts, CD ram, internet, websites, vital statistical analysis (Test of significance, t-test, chi-square, ANOVA, Regression, Correlation Co-efficient)

References :

1. Kirby L.T DNA fingerprinting, An introduction, New York, W.H. Freeman and Co.1992.
2. De Robertis, E.D.P., and De Robertis, E.M.F. Cell and Molecular Biology (6 Ed), W. B.Saunders College, Philadelphia. 1990.
3. Kothari, C.R. Research Methodology, New Age International (P) Limited Publishers, New Delhi, 2006.
4. Zubay,G.L. Biochemistry, W.M.C..Brown Publishers, New York 1998.
5. Stewart,S, - Immunology, Immunopathology and Immunity, 6th ed. ASM Press Washington D.C., 2001
6. Rosner , B., Pundamentals of Bio - Statistics, Duxbury Press, California, 2000
7. Ignacimuthu, S SJ: Basic Bioinformatics Narsosa Publishing House.2005. www.narosa.com.
8. Introduction to Nanoscale science and technology. Ed. By Massimilano D Ventra, I edition, Kluwar Academic.2004.

ZO 1156 : ARTHROPOD PREDATION

Paper - II

Semester: I — Credit: 06

Category: Elective Subject (ES) — Hours/week: 10

Unit 1: Classification of predatory arthropods – Insects and their distribution in various habitats – predatory spiders - systematics and their phylogeny.

Unit 2: Predator's strategy. Optional foraging, prey handling device, Holling's concept-foraging strategies, density dependent/independent factors, attack rate and handling time, Roger's equation.

Unit 3: Types of Predatory Responses. Functional response trials (Types 1, 2 and 3), types of responses. Numerical and fecundity responses and statistical application.

Unit 4: Prey predator relationship Prey-predator interaction, prey-predator oscillation, models- prey switch – prey shift strategies- predator's experience in predation.

Unit 5: Arthropod predators as bio-agents, Bio-control of pests using predatory arthropods, mass rearing strategy, release and capture techniques manipulation of behavioral strategies in predators.

References :

1. Hassell, M.P. the dynamics of Arthropod predator –prey systems, Princeton University Press, New Jersey. 1998.
2. Holling, C.S.Models on arthropod predation, CRC Press, New York, 1955..
3. Arthur Woods: Biological control agents: McGraw Hill Publn., Oxford, 2003.
4. Benckiser, G. and S. Schnell. Biodiversity in agricultural production systems, CRC Press, 2006.

5. Vincent H.Resh and David M.Rosenberg. The ecology of aquatic insects Praeger, London, 1984.
6. Usher, M.B. and M.H. Williamson, Ecological Stability. Chapman and Hall, London, 1994.
7. Southwood, T.R.E. Ecological methods, Chapmann and Hall, London, 2001

ZO 1157 : ENVIRONMENTAL SCIENCES

Paper - II

Semester: I — Credit: 06

Category: Elective Subject (ES) — Hours/week: 10

Unit 1

1. Concepts of abiotic environment-environmental factors, climatic factors, edaphic factors
2. Chemistry of water and soil
3. All pollution- types, sources of pollution- gasses, smoke, particulate matter, solvents and vapours- their interaction with plants and animals and human beings, air quality monitoring
4. Water pollution- sources, biodegradation, aerobic and anaerobic decomposition, effects of pollution on water bodies. Water quality, water treatment- coagulation, flocculation, settling, filtration, disinfection, sludge treatment and disposal

Unit 2

1. Hazardous wastes- waste processing and handling, transportation, resource recovery, alternatives, Hazardous waste management
2. Radioactive wastes and management- waste measurements and health effects, sources, movement through environment

Unit 3

1. Environmental legislation- Laws concerned with environmental pollution
2. Environmental Impact Assessment, economic assessment and environmental auditing

Unit 4

1. Restoration ecology- concepts, principles and implementation, impact analysis- Case studies

Unit 5

1. Environmental ethics- causes of problems, religion, social structure and Science and Technology as the causes, environmental conflicts, future of environmental ethics

References :

1. Vesilind, P & Pierce. J. J - Environmental Engineering., 1992
2. George L. Clarke - Elements of Ecology. John Wisley & Sons Inc., New York, 1954
3. Standard methods of APHA., 2004
4. Sharma & Kaur - Environmental Chemistry, Goel Publishing House, Meerut., 1994
5. De Anil; Kumar - Environmental Chemistry, wly Eastern Ltd., 1990
6. John Cairens, Jr - Restoration Ecology., 1986

ZO 1158 : FISHERY RESOURCES

Paper - II

Semester: I — Credit: 06

Category: Elective Subject (ES) — Hours/week: 10

Unit 1 : Freshwater fishes

Catla catla, Labeo rohita, Cirrhinus mrigala, Cyprinus carpio, Hypophthalmicthys molitrix, Ctenopharynyngodn idella

Cat fishes: *Clarius batrachus, Clarius geriepinus*

Unit 2 : Cultivable species – crustaceans

Penaeus monodon, P. indicus, P.merguiensis, P. semisulcatus.

Fresh water prawn – *Macrobranichium rosenbergii*

Crab – *Scylla serata, S. tranymobarica.*

Unit 3 : Types of culture

Monoculture – mono-sex culture, composite fish culture – poly culture – cultivable species of fresh water and marine prawn culture – Traditional, extensive and intensive culture.

Unit 4 : Integrated fish farming

Fish cum duck – pig cum fish – dairy wastes in aquaculture – paddy cum fish culture – prawn culture in paddy fields – diseases and problems in integrated farming.

Unit 5 : Culture of Mollusca

Cultivable species of molluses – pearl oyster culture – Edible oyster culture – culture of mussels – rope culture – stake culture – clam culture – Feed, growth and production – disease, predator, Biofouling and control measures of molluses.

References:

1. Pandey.K and Shukla.J.P - Fish and Fisheries, Rastogi Meerut., 2005
2. Jhingran, V.G - Fish and Fisheries of India, Hidustan, New Delhi., 1982
3. Pillay, T.V.R. - Aquaculture., 1992
4. Rath. R.K. - Fresh water aquaculture., 1972

ZO 1159 : MOLECULAR BIOLOGY AND BIOTECHNOLOGY

Paper - II

Semester: I — Credit: 06

Category: Elective Subject (ES) — Hours/week: 10

Unit 1 : Chemical Nature of Genetic Materials (i.e., DNA and RNA)

Historical; deoxyribonucleic acid or DNA-molar ratics of nitrogen bases in DNA molecule, the equivalence rule, physical, molecular or geometrical organization of DNA, considerations of Watson and Crick in the construction of double helical structure of DNA molecule, Watson and Crick's model of DNA, polymorphism of DNA helix (or alternative forms of DNA double helices), Z-DNA (or left-handed DNA); ribonucleic acid (RNA)-molecular structure of RNA, replication of genetic RNA.

Unit 2 : Non-Genetic Ribonucleic Acid (RNA) and transcription

Chemical composition of non-genetic ribonucleic acid (RNA); comparison between DNA replication and transcription; mechanism of prokaryotic transcription-enzymatic synthesis of RNA, the RNA polymerase enzyme, binding of RNA polymerase to promoter, initiation, elongation and termination, classes of RNA molecules and processing; mechanisms of eukaryotic transcription –promoter, enhancer and silencers, initiation of eukaryotic transcription, chromatin structure and transcription; types of non-genetic RNA and processing – ribosomal RNA (rRNA), messenger RNA (mRNA), transfer RNA (tRNA).

Unit 3 : Regulation of Gene Action

Regulation of gene action on prokaryotes-transcriptional control mechanisms; negative control, inducible operons (inducible systems), repressible system, positive control, effects of glucose on lac operon (catabolic repression), translational control, post-translation control (feedback inhibition or end product inhibition); regulation of gene action in eukaryotes - regulation of gene action at the level of genome, regulation of

gene action at the level of transcription, post-transcriptional regulation, translational control, post-modification of proteins to make them active ones; hormonal control of gene expression.

Unit 4 : Genetic Engineering (Isolation, Sequencing, Synthesis of Gene and DNA Fingerprinting)

Tools of genetic engineering, certain general techniques of genetic engineering- isolation and use of restriction enzymes, Southern blotting technique, northern blotting technique, western blotting technique, vectors, transformation and molecular cloning, isolation of genes - isolation of ribosomal RNA genes in *Xenopus*; sequencing of gene-Maxam and Gilbert's chemical degradation method, Sanger's dideoxynucleotide synthetic method, direct DNA sequencing using PCR; synthesis of gene-organochemical synthesis of polynucleotides (or chemical synthesis of tRNA genes), synthesis of gene from mRNA (or enzymatic synthesis of tRNA genes), synthesis of gene from mRNA (or enzymatic synthesis of gene); application of genetic engineering – DNA fingerprinting; the ultimate identification test.

Unit 5 : Genetic Recombination and Gene Transfer (Bacterial conjugation, transformation, transduction, episomes and plasmids)

Conjugation: examples of conjugation, F element and F^+® F^- transfer, formation of Hfr cells and Hfr® F^- transfer, mapping the bacterial chromosomes; transformation; transduction and recombination of viruses, recombination in viruses; episomes and plasmids: episomes, plasmids-fertility (F) factor, R plasmid, col factor, replicaton and recombination in plasmids, uses of plasmids in genetic engineering and biotechnology.

Unit 6 : The Human Genome Initative - Finding all the Human Genes

Making a High-resolution genetic map of humans uses reference

markers, human chromosomes are separated from each other using cell sorting machines, DNA for cloning can be microdissected from human chromosomes, somatic cell hybrids serve as sources for purified human chromosomes DNA, X-irradiated fragments of human chromosomes are used for gene mapping.

References :

1. James D. Watson, and Michael Gilman, and Jan Witkowski, and, Mark Zoller, Recombinant DNA, II edition, Scoentic American Books, W.H. Freeman company, New York, 2001.
2. P.S. Verma and V.K. Agarwal, Concept of molecular biology, S.Chand & Company Ltd, Ram Nagar, New Delhi, 1998.
3. Watson , JD. The human genome project, Past, present, and future" *Science*, 1990
4. Wu, R., Recombinant DNA, Academic New York, 1990.

ZO 1160 : GENERAL ENTOMOLOGY

Paper - II

Semester: I — Credit: 06

Category: Elective Subject (ES) — Hours/week: 10

Unit 1: Classification of Class Insecta.

The classification of insects has passed through many changes and with the growth of detailed knowledge an increasing number of orders has come to be recognized. Subclass 1. Apterygota (Orders 1to 4) and Subclass 2. Pterygota (Orders 5 to 29).

Unit 2: Biodiversity of Insects.

Insects represent the single most diverse group of organisms on earth. Overview of the Insect; Evolution and Biodiversity of Insects; Measurement of Insect Diversity; The value of Insect Diversity's Components and Conservation of Insect Diversity.

Unit 3: Morphology, Anatomy and Physiology of Insects.

The insect morphology, anatomy and physiology collectively constitute a back-bone of entomology and it is of great importance to biologists and agriculturists. Form of organisms; Organization of the parts of the body; Structural relationship and function.

Unit 4: Insects in relation to Public Health and their control.

Insects attack man in a number of ways, some simply annoy man and some others directly injure man for his blood, while a few, in the process transmit various kinds of diseases. (Mosquito, Housefly, Sandfly, Bedbug, Flea and Head louse).

Unit 5: Productive Insects and Helpful Insects.

Productive Insects (Silkworm, Honey bees and Lac Insects) and Helpful Insects

(Insect pollinators, Predators and Parasitoids, Weed killers, Soil builders and Scavengers).

References :

1. Richard J. Elzinga. Fundamentals of Entomology - Prentice - Hall of India Pvt. Limited, New Delhi., 1978
2. Nayar K.K., T. N. Ananthakrishnan and B.V. David. General and Applied Entomology - Tata - McGraw Hill Publishing Company Ltd, New Delhi., 1976
3. D.B. Tembhare, A Text Book of Insect Morphology, Physiology and Endocrinology, S. Chand & Company Ltd, New Delhi., 1984
4. S. John William, Defeating the Public Enemy, The Mosquito A Real Challenge, Loyola College Publications, Chennai., 2007
5. R.F. Chapman, The Insects - Eng. Uni. Press, London., 1969

ZO 1161 : ENVIRONMENTAL BIOTECHNOLOGY

Paper - II

Semester: I — Credit: 06

Category: Elective Subject (ES) — Hours/week: 10

Objective : To understand the role of Bictechnology in Environment Protection.

Unit I: Introduction to Environmental Biotechnology & Microbiology and Waste Water Treatment:

Current Status of Biotechnology in Environment Protection and its Future.

Biological Treatment, Impact of Pollutants on Biotreatment.

Cell Physiology and Important Microorganisms.

Plasmid Borne Metabolic Activities

Bioaugmentation, Packaged Microorganisms.

Use of Genetically Engineered Organisms.

Unit 2: Bioreactors for Waste Water Treatment:

Biological Processes for Industrial Effluent Treatment.

Aerobic Biological Treatment and Anaerobic Biological Treatment.

Periodic Biological Reactors and Membrane Bioreactors.

Use of Immobilized Enzymes and Microbial Cells.

Unit 3: Removal of Specific Pollutants & Bioremediation:

Sources of Heavy Metal Pollution.

Microbial Systems for Heavy Metal Accumulation.

Biosorption, Bioleaching and Redox Mechanism.

Bioremediation - Case Histories, Constraints and Priorities of Bioremediation.

Bioaugmentation for Bioremediation.

Bioreactors for Remediation Processes.

Types of Bioremediation and Applications.

Biotechnology and Oil Spills .

Unit 4: Biotechnology for Hazardous Waste Management :

Xenobiotic Compounds, Recalcitrance, Hazardous Wastes.

Biodegradation of Xenobiotics.

Biological Detoxfication.

Biotechnology Applications to Hazardous Waste Management.

Examples of Biotechnological Applications to Hazardous Waste Management.

Unit 5: Biotechnology for Pesticide, Food and allied Industries & Novel Methods for Pollution Control:

Tannery Industry and Biotechnology.

Paper Industry and Biotechnology.

Biological Treatment Methods.

SCP and Biomass from Waste, Distillery Industry

Biotechniques for Air Pollution Abatement and Odor Control - Deodorization Process, Applications.

Solid Waste Management.

Vermitechnology.

Waste Water Treatment Using Aquatic Plants.

Root Zone Treatment.

Aiming for Biodegradable and Ecofriendly Products.

References :

1. "Waste water Engineering Treatment and Disposal and Reuse" by Metcalf & Eddy.
2. "Water Pollution Management Hand Book" by Lepathak.
3. "Waste Water Management" by Arceivala.
4. "Environmental Biotechnology" by C. F. Forster and D. A. J. Wase.

5. "New Processes of Waste water treatment and recovery" by G. Mattock (ED) Ellis Horwood.
6. "Biochemical engineering fundamentals" 2nd ed. by J E Bailey and D F Ollis, McGraw - Hill - Chapters 13 & 14., 1986
7. Practical Biotechnology: Methods and Protocols by S Janarthanan and S Vincent, Universities Press - Hyderabad., 2007

ZO 1162 : PRINCIPLES OF ANIMAL TAXONOMY AND ELECTRONIC RESEARCH TOOLS

Paper - II

Semester: I — Credit: 06

Category: Elective Subject (ES) — Hours/week: 10

Objectives : To throw light on the various components of animal taxonomy and applications of electronic research tools in biological research

Unit 1: Concepts and recent trends in taxonomy

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

Unit 2 : Applications of taxonomy

Theoretical biology, Applied biology – Agriculture and forestry, National Defense, Human health, Apiculture, sericulture, lac culture and aquaculture, Paleontology, forensic science.

Unit 3: Zoological Classification and species concepts

Kinds of classification, phyletic lineages, components of classification, lennaean hierarchy. Typological, nominalistic, biological, evolutionary and recognition species concepts. Kinds of species.

Unit 4: Zoological nomenclature and taxonomic tools

Origin of code, ICZN, zoological records, collection methods, preservation of data,curating, storing and cataloging, methods of identification,description of taxonomic characters, taxonomic publication.

Unit 5 : Electronic Research Tools

Basics of internet, Search Engines, E-Books, E Theses, E journals, Subject Gateways and E Databases.

References :

1. Kapoor, V.C. - Theory and practice of animal taxonomy, Oxford and IBH Publishing, New Delhi, 247pp, 1998
2. Agarwal, and U.Gupta - Animal Taxonomy, S. Chand and Company, New Delhi. 86pp, 2004
3. http://digitallibrary.upenn.edu/books
4. http://extext.library.adelaide.edu/au/dirs.html
5. http://library.curtin.edu.au/ebooks/direct_books.html
6. http://www3.interscience.wiley.com
7. www.anova.org
8. www.eb.com
9. http://bubl.ac.uk
10. http://eprints.rclis.org
11. www.academicinfo.net/infoscilibraryj.html
12. www.doaj.org
13. www/istl.org/00-fall/internet.html
14. http://zipo.vtls.com/cgi-bin/ndltd/chameleon
15. www.welch.jhu.edu

ZO1256 : PERSPECTIVES OF WATER BUGS

Paper - III

Semester: II — Credit: 06

Category: Elective Subject (ES) — Hours/week: 10

Unit 1: Distribution

Classification and distribution of various groups of insects (immature stages and / or adult) in the aquatic media – types of aquatic habitats for the occurrence of aquatic insects – stream ecology – pond as an ecosystem.

Unit 2: Systematics

Sampling and mounting techniques - Systematic position of aquatic hemipterans- key up to the family level – Structure of genitalia -Phylogenetic relationship.

Unit 3: Bioecology

Biology of belostomatid bugs – their population dynamics - abiotic factors and their effect on water bugs – sensory receptors – food pump and food preference – aquatic vegetation and their relevance in clustering of water bugs-.

Unit 4: Behavioural biology

Aggregation - Feeding behaviour, locomotory behaviour , mating behaviour and oviposition in water bugs, eclosion- predatory strategies.

Unit 5: Reproductive biology

Fecundity in water bugs, postembryonic developments - allometric growth pattern- tolerance of nymphal stages to the toxicity of polluted water bodies.

References :

1. Menke, A.S - The semi aquatic and aquatic Hemiptera Bulletin of California insect Survey p 1-165., 1979
2. Vincent H.Resh and David M.Rosenberg - The ecology of aquatic insects Praeger, London,p 1-625., 1984

3. Meritt, R.W and K.W.Cummins - An introduction to aquatic insects. Kendall and Hunt Pub.Co.N Y. p 1-441., 1979
4. Venkatesan, P. - Perspective of aquatic Entomology-a Monograph pp.1-170., 1991
5. Schuh and Slater - True bugs. Cornell press, p.1-416., 1998
6. Scahefer, C.W. and Panizzi - Heleroptera of economic importance, CRC Press, New York. P. 1-534., 2000

ZO 1257 : ENVIRONMENTAL TOXICOLOGY AND BIOTECHNOLOGY

Paper - III

Semester: II — Credit: 06

Category: Elective Subject (ES) — Hours/week: 10

Unit 1

1. Introduction: Aquatic environment, toxicants and toxicity, factors that affect the environmental concentrations of the toxicants, factors that influence toxicity
2. Toxicity tests:: acute toxicity tests, chronic toxicity tests, statistical analysis, factors that modify toxicity, mixture toxicity and microbial toxicity studies
3. Sublethal effects: Sublethal effects of toxicants on behavior, biochemistry, physiology, histology and morphology

Unit 2

1. Specific chemical effects: pesticides, heavy metals, polycyclic aromatic hydrocarbons, detergents, industrial effluents, ammonia, nitriles and nitrates
2. Chemical distribution/ fate: analytical techniques, bio-accumulation, bio-transformation and fate modeling
3. Hazard evaluation: environmental legislation, field validation, chemical safety evaluation and effects of evaluation

Unit 3

1. Environmental mutagenic agents: physical and chemical mutagenic agents, effects on genetic material, mechanisms of mutation, mutagenic screening
2. Mutations and human health: Clinical implications of genetic damage, epidemiological approach to evaluate genetic hazards, monitoring of genetic diseases in the new born
3. Environmental carcinogens and teratogens: mode of action, genetic effects, screening test for carcinogenicity and teratogenicity

Unit 4

1. Production of useful substances by microorganisms: production of primary and secondary metabolites, enzymes, capsular polysaccharides, fermentation in a solid medium, bio-conversion, production of single-celled proteins, microbial conversion of wastes and agricultural and industrial byproducts. Nature and quality of wastes and byproducts, microbial degradation and conversion, use of microbes in pollution control

Unit 5

1. Energy production: From biomass to microorganisms, biomass and energy, production of ethanol, biogas and hydrocarbons
2. Biotechnology and animal productivity: Transgenic fish, livestock and forestry, biosensors, biopesticides, biofertilizers and bioplasts
3. Human genome project: DNA sequencing
4. Cloning: Organ cloning and stem cell research
5. Animal; reproduction: Embryo transfer technology
6. Animal health care: Vaccines and diagnostics kit development
7. Bioprospecting: Genomics, drug discovery, Nanobiotechnology

References :

1. Albert Sasson - Biotechnology: Challenges and promises., 1984

2. Sutten, H. E - Teratogenic effects of environmental mutagens and carcinogens., 1995
3. Rand & Petrocelli -Fundamentals of Aquatic Ecology., 1985
4. Jitendra Prakash - Biotechnology research and industry survey., 1995

ZO 1258 : ENERGY BUDGET IN AQUATIC ECOSYSTEM

Paper - III

Semester: II — Credit: 06

Category: Elective Subject (ES) — Hours/week: 10

Unit 1: Aquatic environment

Productivity and Ecological bioenergetics- water and soil condition of ponds – management of soil and water – soil conditioning – weed eradication – watering – water quality – energy flow through and ecosystem.

Unit 2: Fish feed

Feed management – nutritional requirement of fish – physiological bioenergetics – varieties of fish feed – formulated feeds – feed processing - management of feeding – species specific artificial fish feeds – principles of nutrition in respect of whole feeds for fish – carbohydrates – fats – proteins – minerals – vitamins.

Unit 3: Fisheries and water pollution

Pollution of rivers and estuaries effect of heavy metals of fish – effect of pesticide on fish – environmental behavior and toxicity of mercury, lead, cadmium, zine, copper, manage and iron.

Unit 4: Fish Pathology

Nutritional diseases and fish health management – Fungal, Bacterial protozoan and crustacean diseases – significance, cause and control of diseases.

Unit 5: Waste production in Aquaculture

Water and waste water use – sources and utilization of water – use of animal wastes – use of sewage – use of heated effluents recycling of water – Feed derived form metabolic waste products – wastes from food and food stuffs – feed loss – methods of measuring waste production – fertilizer derived wastes – resicues of biocides.

References :

1. Jhingran, V.G - Fish and Fisheries of India, Hindustan, New Delhi., 1982
2. Pandey.K and Shukla.J.P - Fish and Fisheries, Rastogi Meerut., 2005
3. Rejendra kumar Lalh - Fresh water aquaculture. Scientific publishers., 1993
4. T.V.R. Pillai - Aquaculture and the environments, Fish News book., 1992
5. C. K. Varshney - Water pollution and Management, Wiley Eastern., 1991

ZO 1259 : MOLECULAR TECHNIQUES AND APPLICATIONS

Paper - III

Semester: II — Credit: 06

Category: Elective Subject (ES) — Hours/week: 10

Unit 1: New tools for studying Gene function

Restriction endonuclease sites provide the simplest access for mutagenesis, linker insertion is used to map a bacterial transposon, construction to nested deletions maps the boundaries of a transcriptional control region, linker - scanning mutagenesis permits systematic analysis of promoters, random nucleotide substitutions are obtained by chemical modification of DNA or by enzymatic misincorporation, synthetic

oligonucleotide facilitate mutagenesis, mutant clones can be identified by hybridization and DNA sequencing, the PCR can be used to construct genes encoding chimeric proteins - Blotting technique

Unit 2: Recombinant DNA in medicine and industry

Expression systems are developed to produce recombinant proteins, insulin is the first recombinant drug licensed for human use, recombinant human growth hormone is produced in bacteria by two methods, A Hepatitis B virus vaccine is produced in yeast by expression of a viral surface antigen, complex human proteins are produced by large-scale mammalian cell culture, monoclonal antibodies function as "magic bullets", human antibodies that recognize specific antigens can be directly cloned and selected.

Unit 3: Studying whole genomes

Very large pieces of DNA can be separated by pulsed field gel electrophoresis (PFGE), PFGE is used to make large scale physical maps, putting together the cloned genome of *E.coli* requires finding overlapping segments, yeast artificial chromosomes (YACs) are used for cloning huge DNA fragments, a multiplex method speeds up DNA sequencing, automated DNA sequencing greatly speeds up the process, understanding of DNA sequences is furthered by homology comparisons, novel methods will be required for large – scale sequencing of DNA. DNA nanotechnology.

Unit 4: Proteomic tools

Unit 5: Genomic tools

References :

1. Gait, M. *Oligonucliotide synthesis: A practical approach*. IRL, Oxford, Eng., 1984
2. Hall, S.S. *Invisible frontiers: The race to synthesize a human gene*. Atlantic monthly press, New York, 1987.

3. Hood, L. "Biotechnology and medicine of the future". *F.am.med.assoc*, 1988.
4. Smith, S.B., S.Gurrieri, and C.Bustamente. "Fluorescence microscopy and computer simulation of DNA molecules in conventional and pulsed-field gel electrophoresis". In E.Lai and B.W.Birren, eds., *Electrophoresis of large DNA molecules : theory and applications*. Cold Springs Harbor Laboratory, Cold Spring Harbor, New York., 1990.
5. Trainor, G.L. "DNA sequencing, automation, and the human genome", *Anal.Chem..*, 1990.

ZO 1260 : AGRICULTURAL ENTOMOLOGY

Paper - III

Semester: II — Credit: 06

Category: Elective Subject (ES) — Hours/week: 10

Unit 1: Receptor system and Sensory perception in Phytophagous Insects

The recognition of the co-evolution of insects and plants as a phenomenon of far reaching significance is relatively recent. Nature of Insect-Plant Interactions and Mechanisms of host plant selection in Phytophagous Insects.

Unit 2: Causes for Insects Assuming Pest Status

When the numbers of an insect increase, it reaches the pest status. Destruction of forests; Destruction of Natural Enemies; Intensive and Extensive cultivation of crops; Introduction of new crops and Improved strains; Improved agronomic practices.

Unit 3: Forecasting of Pest outbreak

The forecast of pest infestation must be related to the economic threshold of the pest. Quantitative Studies; Studies on the pest life-history and Field studies on the effects of climate on the pest and its environment.

Unit 4: Types of damage to plants by Insects

Insects inflict injury to plants either directly or indirectly in their attempts to secure food and almost all the portions of the plants. Direct effects of feeding (chewing, piercing and sucking) and injury by other methods (egg-laying and nest making).

Unit 5: Methods and Principles of Insect Pest Control

Any factor that is capable of making life hard for the insect that will kill, repel or interfere with its feeding, mating, reproduction or dispersal can be taken as a method of insect control in its broadest application. Natural Control (Climatic, Topographic Factors and Natural Enemies) and Applied or Artificial Control (Mechanical, Biological, Chemical, IPM and Eco-Friendly Agricultural methods).

References :

1. Elements of Economic Entomology - B. Vasantharaj David, Popular Book Depot, Chennai., 2000
2. Agricultural Entomology and Pest Control - S. Pradhan, ICAR, New Delhi., 1973
3. Manual on Integrated Pest Management in Rice and Cotton - Ministry of Agriculture, Govt. of India, Faridabad., 1995
4. Pest Management and Food Production - International Food Policy Research Institute, Washington, U.S.A., 1998
5. A General Textbook of Entomology - A.D. Imms, Asia Publishing House, Bombay., 1957

ZO 1261 : ENVIRONMENTAL TOXICOLOGY

Paper - III

Semester: II — Credit: 06

Category: Elective Subject (ES) — Hours/week: 10

Unit 1:

Environmental Toxicology, Economic Toxicology and Forensic toxicology-

dose response relationships, frequency response and cumulative response, statistical concepts LD50's/LC50's – potency versus toxicity, margin of safety-concepts of hypersensitivity and hyposensitivity.

Unit 2:

Biological factors that influence toxicity; chemical factors that influence toxicity, influence of route of administration, abnormal response to chemicals; basis of selective toxicity; laboratory determination of toxicity of chemicals. Bio-transformation and Bio-accumulation.

Animal management in Toxicological Evaluation: Animal extrapolation; Eco-Toxicology.

Unit 3:

Influence of ecological factors on the effects of toxicity; Pollution of the Ecosphere by industries; Global dispersion of toxic substance; Dispersion and circulating mechanisms of pollutants; degradable and non-degradable toxic substances; food chain.

Unit 4:

Eco-system influence on the fate and transport of toxicants. Photosynthetic bacteria; Bio-absorption of heavy metals. Information management system in Eco-toxicology.

Toxic effects of insecticides and other pollutants on humans and other mammals.

Unit 5:

A detailed study of the following topics will be made on heavy metals: (1) Properties and occurrence (2) Production (3) Industrial uses (4) Metabolism and Physiology including metal detoxification (metalloproteins and their role) (5) Toxicology (6) Prophylaxis (7) Therapy. Aluminium, antimony, arsenic, barium, beryllium, bismuth, cadmium, chromium, cobalt, copper, lead, magnesium, manganese, mercury, molybdenum, nickel, platinum, rubidium, silver, tin and zinc.

References:

1. Mervyn. Richardson - Environmental Toxicology Assessment, CRC Press., 1995
2. David A. Wright and Pamela Welbourn - Environmental Toxicology. Cambridge University Press., 2002
3. Wayne G. Landis, Jane Staveley Hughes - Environmental Toxicology and Risk Assessment, ASTM International Publishers,. 1993
4. Lorris G. Cockerham, Barbara S. Shane - Basic Environmental Toxicology, CRC Press., 1994
5. Ming-Ho Yu - Environmental Toxicology: Biological and Health Effects Of Pollutants, CRC Press., 2005
6. Wayne G. Landis, Ming-Ho Yu - Introduction to Environmental Toxicology: Impacts of Chemicals Upon Ecological Systems, 3rd edition, CRC Press., 2004
7. Sigmund F. Zakrezewski - Environmental Toxicology, Oxford University Press., 2002

ZO 1262 : BIODIVERSITY AND BIOETHICS

Paper - III

Semester: II — Credit: 06

Category: Elective Subject (ES) — Hours/week: 10

Objective : To throw light on the various components of biodiversity, their ecological importance, inter relationships and the inevitable role of bioethics in the sustainable utilization of biodiversity

Unit 1: Biodiversity potential of India

Concepts on Biodiversity, Ecosystem diversity, Biodiversity assessment, Species and genetic diversity, Diversification of animal and plant kingdom, wildlife resources, conservation plans and treaties, Wild Life Protection Act, 1972: Merits and demerits, Zoos, sanctuaries, National Parks, Biosphere reserves and protected areas in India, extinct, critical, endangered and vulnerable fauna and flora of India. Biotechnology and conservation of biodiversity.

Unit 2: Biodiversity of Terrestrial and Fresh water ecosystems

Wetlands, reserve forests, rain forests and desert plains in India and their biodiversity, plants animals of lotic and lentic ecosystems. Threats to wetlands and rivers. Rivers of India and their bioresources.

Unit 3: Biodiversity of Marine and mangrove ecosystems

Coastal, coral reef, mangrove, sea grass and sea weed ecosystems and their faunal and floral resources. Threats to marine biodiversity. lagoons and estuaries. Pelagic and benthic animal of the sea. Marine productivity. Coral reefs and coral associated fauna. Human impact on coral reefs.

Unit 4: Bioethics and biodiversity

Origin of Bioethics, science and society, Origin of social life, significance of hunting, Natural selection and its limitations. Priority problems of our time, biology for future, nature or nurture. Problem of sustainable utilization of natural wealth. Animal rights. Problems of urbanization.

Unit 5: Bioethics and modern science

Upsurge in molecular biology, chemical control of life processes, Dilemma of modern science. Optimum environment. Genetic modifications. Gene therapy. Science and biological man. Quest for optimum environment. Science of future. Intracellular responses to environmental change. Bioethics in Indian scenario.

References

1. Swaminathan, M.S and S. Jana. Biodiversity
2. Negi, S.S. Biosphere Reserves in India: Land use, biodiversity and conservation.
3. Hanson, E.D. Animal Diversity.
4. Potter, V.R. - Bioethics – Bridge to Future, Prentice Hall, New Jercy. 205 pp., 1971
5. Azariah, J. Bioethics in India, EUBIOS.
6. Thorpe, W.H. - Science, Man and Morals. Cornell Uni Press. 176 pp., 1965