

**CHRIST COLLEGE (AUTONOMOUS),
IRINJALAKUDA**

IRINJALAKUDA, THRISSUR - PIN 680 125



**DEGREE OF
MASTER OF SCIENCE
(CHOICE BASED CREDIT AND SEMESTER SYSTEM)**

UNDER THE

FACULTY OF SCIENCE

SYLLABUS

(FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2014 – 15 ONWARDS)

BOARD OF STUDIES IN ZOOLOGY(PG)

IRINJALAKUDA, THRISSUR - PIN

680 125 KERALA, 673 635, INDIA

JULY, 2014

CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA
CURRICULUM AND SYLLABI FOR M. Sc. ZOOLOGY
(CREDIT SEMESTER SYSTEM)
THIRD SEMESTER – THEORY COURSES

Code number & Title of the course	Credits	External Weightage	Internal Weightage
ZO 3 CT 07 - Cell & Molecular Biology	4	36	5
ZO 3 ET 08 - Entomology I: Morphology & Taxonomy	4	36	5
ZO 3 ET 08 - Environmental Biology I: Man, Environment & Natural Resources	4	36	5
ZO 3 ET 08 - Human Genetics I: Clinical Genetics	4	36	5
ZO 3 ET 08 - Fishery Biology I: Taxonomy, Biology, Physiology & Ecology	4	36	5
ZO 3 ET 08 - Wildlife Biology I: Biodiversity & Biota	4	36	5
ZO 3 ET 09 - Entomology II: Anatomy & Physiology	4	36	5
ZO 3 ET 09 - Environmental Biology II: Environmental Pollution	4	36	5
ZO 3 ET 09 - Human Genetics II: Diagnostic Genetics	4	36	5
ZO 3 ET 09 - Fishery Biology II: Capture & Culture Fisheries	4	36	5
ZO 3 ET 09 - Wildlife Biology II: Wildlife Conservation	4	36	5

ZO- Zoology

CT- Core Theory

ET- Elective Theory

Practical courses of the concerned theory courses shall be conducted during the same semester. However, external examination shall be conducted at the end of fourth semester only.

FOURTH SEMESTER – THEORY COURSES

ZO- Zoology

CT- Core Theory

ET- Elective The

Code number & Title of the course	Credits	External Weightage	Internal Weightage
ZO 4 CT 10 – Immunology	4	36	5
ZO 4 CT 11 - Microbiology and Biotechnology	4	36	5
ZO 4 ET 12 - Entomology III: Agricultural & Medical Entomology, Principles of Insect Pest Management and Toxicology	4	36	5
ZO 4 ET 12 - Environmental Biology III: Environmental Conservation	4	36	5
ZO 4 ET 12 - Fishery Biology III: Harvesting, Post-harvesting Technology & Marketing	4	36	5
ZO 4 ET 12 - Human Genetics III: Cancer Genetics & Genetic Services	4	36	5
ZO 4 ET 12 - Wild Life Biology III: Wildlife Management	4	36	5

THIRD AND FOURTH SEMESTER – CORE & ELECTIVE PRACTICAL COURSES

ZO- Zoology

CP- Core Practical

EP- Elective Practical

1. TOTAL CREDITS - 80

Code number & Title of the course	Credits	External Weightage	Internal Weightage
ZO 4 CP 04 – Cell & Molecular Biology, Immunology, Microbiology, Biotechnology & Microtechniques II	4	24	5
ZO 4 EP 05 - Entomology I & II	4	24	5
ZO 4 EP 05 - Environmental Biology I & II	4	24	5
ZO 4 EP 05 - Fishery Biology I & II	4	24	5

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ZO 4 EP 05 - Human Genetics I & II	4	24	5
ZO 4 EP 05 - Wild Life Biology I & II	4	24	5
ZO 4 EP 06 - Entomology III	4	24	5
ZO 4 EP 06 - Environmental Biology III	4	24	5
ZO 4 EP 06 - Fishery Biology III	4	24	5
ZO 4 EP 06 - Human Genetics III	4	24	5
ZO 4 EP 06 - Wild Life Biology III	4	24	5
PROJECT WORK	4	24	5
VIVA-VOCE	4	24	5

Total number of theory courses - **12**

Total number of practical courses - **6**

Credit for each theory course - **4**

Credit for each practical course - **4**

Total credits for theory course - **48**

Total credits for practical courses - **24**

Project work: Credits - **8** (4 credits for dissertation and 4 credits for viva-voce)

(Project report / dissertation shall be presented by Power point software)

- Practical Examination shall be conducted at end of second and fourth semester.
- Two hours per week under practical work may be allotted during the third and fourth semesters for the project work.
- The teacher who gives guidance to project work can select any topic from the syllabi including the elective course and the topic shall be assigned to each student. The research work on this topic shall be carried out by each student under the supervision of the teacher. The report of the research work shall be submitted by each student in the form of a Dissertation which shall be submitted for the evaluation a day prior to the date of viva-voce pertaining to the dissertation. A declaration by the student to the effect that the dissertation submitted by him/ her has not previously been formed the basis for the award of any degree or diploma and a certificate by the supervising teacher to the effect that the dissertation is an authentic record of work carried out by the student under his/ her supervision are to be furnished in the dissertation.
- Weightage for each core and elective theory course shall be 36 for the external examination and 5 for the internal theory examination.
- Weightage for each external core and elective practical course shall be 24 for the external examination and 5 for the internal core and elective practical examination.
- Theory examination question paper shall contain 14 short answer questions with weightage 1 each , 7 short essay questions with weightage 2 each and 2 essay questions with weightage 4 each.
- Weightage for the external practical examination can be distributed as follows-

With submission

Without submission

Major question (one number)-Weightage 8 Major (one number) - Weightage 8 Minor

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question (two numbers) ,, 2x5= 10	Minor(two numbers) ,, 2x5 = 10	Spotters (two numbers) ,, 2x1= 2	Spotters (four numbers) ,, 4x1 = 4
Submission ,, 2	Record ,, 2		
Record ,, 2			
Total	24	Total	24

9. No submission is required for the practical in elective course.

10. A candidate has to submit the following at the time of practical examination related to ZO 4 CP 04

Whole mount : 4

numbers Slides: Histology : 4

numbers

Slides: Histochemistry : 2 numbers (To test the presence of carbohydrate and protein

Control not required)

11. If a candidate fails to submit the field study / tour report, no weightage for the record be awarded.

12. Project report should be presented using power point option. Credit given for project is limited to maximum 4 and project and general viva -voce is limited to 4.

13. A minimum of two test papers for each course have to be conducted of which the best performance shall be counted for internal evaluation in each semester.

14. One seminar for each course is compulsory.

15. Criteria for the evaluation of dissertations	Weightage
1. Introduction, review of literature etc.	2
2. Objectives and relevance of the study	3
3. Methodology	4
4. Results	3
5. Discussion and interpretation	4
6. Conclusions	3
7. Involvement of the students	1
8. Style and neatness of the dissertation	1
9. References	3
Total	24

Criteria for the Viva-voce	Weightage
A. Presentation of project work- (POWER POINT Presentation)	
1. Quality and correctness of slides	2
2. Time management	2
3. Way of presentation	2
4. Clarity of presentation	3
5. Communication skill	3
6. Answers to questions	4
Subtotal	16
B. General Viva-voce:	
7. Knowledge of the student	3
8. Communications	2
9. Answers to questions	3
Subtotal	8
Grand Total	24

THIRD SEMESTER
ZO 3 CT 07 - CELL AND MOLECULAR BIOLOGY (90 Hours)

- 1. DNA replication: (11 hrs)**
 - 1.1. Semidiscontinuous synthesis-Okazaki fragments
 - 1.2. Replication origin and replication fork
 - 1.3. Unit of replication, extra chromosomal replicons
 - 1.4. Enzymes/proteins of replication- Primase, Replisomes, Helicase, DNA polymerases, Single strand binding proteins, Topoisomerases and Ligase; Fidelity of replication
 - 1.5. Replication of the ends of eukaryotic chromosome – role of telomerase
 - 1.6. Models of DNA replication –Rolling circle model and looped rolling circle model, D-loop model, θ -model
 - 1.7. Inhibitors of DNA replication – Methotrexate and Fluorodeoxyuridylate
- 2. Safeguard systems of DNA (5 hrs)**
 - 2.1. Restriction: significance, role and features of Type I, II & III restriction enzymes
 - 2.2. Modification: enzymes and significance
 - 2.3. Repair:
 - 2.3.1. Major kinds of damage to DNA and causes
 - 2.3.2. Repair mechanisms: Direct reversal, Mismatch repair, Excision repair, Recombination repair, SOS response

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- 3. Transcription of mRNA in prokaryotes and eukaryotes (9 hrs)**
 - 3.1. Structural organisation and life span of mRNA; monocistronic and polycistronic mRNA
 - 3.2. Initiation, elongation and termination of transcription
 - 3.3. Promoter (mention Pribnow, TATA, CAAT and GC box), enhancer and silencer sites
 - 3.4. Transcription factors; Transcription activators and repressors
 - 3.5. Characteristic features of RNA polymerases of phages, prokaryotes and eukaryotes and their functions
 - 3.6. Post transcriptional modification of RNA
 - 3.6.1. Capping
 - 3.6.2. Polyadenylation
 - 3.6.3. Splicing
 - 3.7. RNA editing: site specific deamination and role of gRNAs
 - 3.8. mRNA transport
- 4. Genetic code (5 hrs)**
 - 4.1. Characteristics of genetic code
 - 4.2. Start codons and stop codons
 - 4.3. Degeneracy of the code: Wobble hypothesis and isoacceptor tRNAs
 - 4.4. Special features of the genetic code in mitochondria, mitochondrial tRNA
 - 4.5. Variations in the genetic code in *Mycoplasma* and *Tetrahymena*
 - 4.6. Point mutations that alter genetic code (missense, nonsense & frameshift)
 - 4.7. Suppressor mutation, suppressor genes & suppressor tRNA
- 5. Ribosome: The site of protein synthesis: (5 hrs)**
 - 5.1. Composition, topography, active centres and biogenesis of ribosome
 - 5.2. Experiments to understand Composition, topography, active centres and biogenesis of ribosome
 - 5.2.1. Composition; Reconstitution experiments, r-protein mutants
 - 5.2.2. Topography; Methods to study ribosome structure- Immune electron microscopy, cross linking
 - 5.2.3. Active centres; affinity labelling
 - 5.2.4. Biogenesis; anucleolate mutants in *Xenopus laevis*
- 6. Translation in prokaryotes and eukaryotes: (8 hrs)**
 - 6.1. Aminoacylation of tRNA & initiation, elongation and termination of protein synthesis
 - 6.2. Aminoacyl tRNA synthetases & initiation, elongation and termination factors
 - 6.3. Translational proof-reading
 - 6.4. Differences in protein synthesis between prokaryotes and eukaryotes
 - 6.5. Translational inhibitors in prokaryotes and eukaryote – role of tetracycline, streptomycin, neomycin, chloramphenicol, erythromycin, puromycin and diphtheria toxin
 - 6.6. Post- translational modification of proteins: protein folding (role of chaperones) and biochemical modifications
- 7. Control of gene expression at transcription and translation level: (8 hrs)**
 - 7.1. Regulation of gene expression in Phages – alternate patterns of gene expression for control of lytic and lysogenic cycle in λ phage
 - 7.2. Regulation of gene expression in bacteria – basic features of tryptophan, arabinose and galactose operons
 - 7.3. Regulation of gene expression in eukaryotes –
 - 7.3.1. Role of chromatin in regulating gene expression

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- 7.3.2. Activation and repression of transcription
- 7.3.3. Regulation of translation by gene arrangement
- 7.3.4. Regulation of translation by alternate pathways of transcript splicing
- 7.3.5. Antisense RNA strategies for regulating gene expression
- 7.3.6. si RNA and mi RNA in regulation

8. Eukaryotic genome: (5 hrs)

- 8.1. Special features of eukaryotic genome
- 8.2. Features, components and reassociation kinetics of Unique, Moderately repetitive and Highly repetitive DNA
- 8.3. Junk DNA, Satellite DNA and Selfish DNA
- 8.4. Cot value and complexity of genome
- 8.5. Organisation of human genome (brief account)

9. Interrupted genes (4 hrs)

- 9.1. Definition and explanation
- 9.2. Organisation and special features of interrupted genes
- 9.3. Evolution of interrupted genes

10. Gene families: (6 hrs)

- 10.1. Definition and concept
- 10.2. Classification with example
 - 10.2.1. Simple multigene family - organisation of rRNA gene in *Xenopus*
 - 10.2.2. Complex multigene family - organisation of histone genes in sea urchin and tRNA genes in *Drosophila*
 - 10.2.3. Developmentally controlled complex multigene family e.g., globin gene
 - 10.2.3.1. Globin genes and its products
 - 10.2.3.2. Organisation of globin genes and its expression in Man
 - 10.2.3.3. Evolution of globin genes
 - 10.2.3.4. Concept of an evolutionary clock
 - 10.2.3.5. Pseudogenes

11. Transposable genetic elements - Transposons : (6 hrs)

- 11.1. Definition, features and types
- 11.2. Transposition and mechanism
- 11.3. Transposons in bacteria
 - 11.3.1. IS elements
 - 11.3.2. Tn family
 - 11.3.3. Mu phage as a transposable element
- 11.4. Transposons in eukaryotes
 - 11.4.1. SINE, Alu family; LINE, L1
 - 11.4.2. P elements in *Drosophila*
 - 11.4.3. Transposons in Maize
- 11.5. Retroviruses and transposition

12. Molecular mechanisms involved in recombination of DNA : (4 hrs)

- 12.1. Genetic recombination – types with example
 - 12.1.1. Site specific recombination
 - 12.1.2. Non-homologous recombination
 - 12.1.3. Homologous recombination
- 12.2. Molecular mechanism involved in homologous recombination of DNA in eukaryotes- Holliday model: Holliday intermediate, heteroduplex DNA, gene conversion

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12.3. Role of Rec A protein in genetic recombination

13. Microbial genetics: (5 hrs)

13.1. Prokaryotic genome- Structural organisation of *Escherichia coli*

13.2. Methods of genetic transfers in bacteria– transformation (in *Streptococcus pneumoniae*), conjugation and sexduction, transduction

13.3. Brief note on mapping genes by interrupted mating (in bacteria)

14. Organelle genome: (4 hrs)

14.1. Extranuclear genes and maternal inheritance

14.2. Chloroplast genome: special features

14.3. Mitochondrial genome

14.3.1. Special features of yeast mitochondrial genome, petite mutants

14.3.2. Special features of human mitochondrial genome

15. Cancer: (5 hrs)

15.1. Genetic rearrangements in progenitor cells, oncogenes, protooncogenes and tumour suppressor genes

15.2. Virus-induced cancer

15.3. Cancer and the cell cycle

15.4. Cancer and apoptosis

15.5. Interaction of cancer cells with normal cells

15.6. New therapeutic interventions of uncontrolled cell growth (immunotherapy and gene therapy)


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2. Benjamin Lewin (2004): Genes, Vol. VIII, Pearson Prentice Hall, Singapore
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13. Veer Bal Rastogi (2008): Fundamentals of Molecular Biology, Ane Books India
14. Watson, J. D. (1998): Molecular Biology of the gene, Benjamin Publishing house
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THIRD SEMESTER ELECTIVE COURSE- ENTOMOLOGY-I

ZO 3 ET 08 - MORPHOLOGY AND TAXONOMY

(90 Hours)

- 1. Introduction (5 hrs)**
 - 1.1. Origin and evolution of insects (including the theories)
 - 1.2. Fossil insects
- 2. Insect classification (31 hrs)**
 - 2.1. Biology and habits of the following Orders of insects – classification up to families giving salient features (for detailed study)
 - 2.2. 1. Ephemeroptera 2. Odonata 3. Orthoptera
4. Thysanoptera 5. Homoptera 6. Heteroptera. 7. Blattaria 8. Mantodea 9. Isoptera
10. Coleoptera 11. Lepidoptera 12. Hymenoptera 13. Diptera 14. Collembola 15.
Thysanura 16. Diplura 17. Protura
 - 2.3. Biology, habits & important diagnostic features of the following Orders (Brief account) 1. Plecoptera 2. Embioptera 3. Phasmida 4. Dermaptera 5. Zoraptera 6. Psocoptera 7. Siphonoptera 8. Strepsiptera 9. Neuroptera 10. Mecoptera 11. Trichoptera
- 3. External morphology (36 hrs)**
 - 3.1. Segmentation and division of the body
 - 3.2. General morphology of the head – 
 - 3.2.1. Opisthognathous, hypognathous and prognathous –
 - 3.2.2. Head segmentation- theories about the segmentation of the head
 - 3.2.3. Head skeleton- different sutures and sclerites –
 - 3.2.4. Tentorium –
 - 3.2.5. Modification in head capsules –
 - 3.2.6. Cephalic appendages –
 - 3.2.6.1. Antenna: structure, function & types
 - 3.2.6.2. Gnathal appendages: types, structure & function
 - 3.2.6.3. Mouth parts of insects
 - 3.2.7. Cervix
 - 3.3. Thorax:
 - 3.3.1. Thoracic segmentation
 - 3.3.2. Thoracic skeleton
 - 3.3.3. Endothorax
 - 3.3.4. Thoracic appendages
 - 3.3.4.1. Modifications of thoracic legs
 - 3.3.4.2. Wings: origin and evolution of wings, structure, venation, wing coupling apparatus, morphological variations
 - 3.4. Abdomen:
 - 3.4.1. Segmentation
 - 3.4.2. Skeletal composition

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343. Pregenital and post genital segments

344. Abdominal appendages

3.5. External genitalia: male and female

4. Ethology and Behaviour

(18 hrs)

4.1. Aquatic insects

4.1.1. Factors influencing the aquatic life

4.1.2. Food capture; modifications

4.1.3. Respiration in semi-aquatic and in truly aquatic insects

4.1.4. Oviposition methods

4.1.5. Anchorage, locomotion

4.1.6. Adaptations of swimming forms

4.2. Gall forming insects:

4.2.1. Definition and features

4.2.2. Formation, economic importance

4.2.3. Common gall pests

4.2.4. Extent of gall making habits

4.2.5. Gall as dwelling place, the position of gall

4.2.6. Classification of galls by Orders

4.2.7. Adaptation for the gall making habits

4.2.8. Origin and types of galls (open & closed)

4.2.9. Physiology of gall formation

4.3. Leaf mining insects

4.3.1. Definition and identification

4.3.2. Forms of leaf mines, economic importance

4.3.3. Extent of the leaf mining habits

4.3.4. Feeding habits and frass disposal

4.3.5. Ecological aspects of leaf mining

4.4. Insect-plant interdependence (co-evolution)

4.5. Social insects – social organisation

4.6. Caste differentiation

4.7. Aspects of social behaviour with reference to honey bee, termite and ant

4.8. Communication – acoustic, visual, tactile and chemical method (pheromones)

4.9. Adaptations of parasitic and predatory insects

References:

1. Ananthkrishnan, T.N. (1992): Dimensions of Insect-Plant Interactions, Oxford & IBH Publishing Co. Pvt. LTD.
2. Aswathy, V.B. (1998) Introduction to General and Applied Entomology. ISBN.
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6. Imms, A.D., Richard & Davies: A general text book of entomology, 10th edition,

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9. Nayar, K.K., Ananthkrishnan, T.N., & David, B.V. (1976). General and Applied Entomology, Tata Mac Grew Hill. New Delhi.
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11. Snodgrass, R, E. (1935): Principles of Insect Morphology. Mac Graw Hill Book.
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THIRD SEMESTER ELECTIVE COURSE - ENVIRONMENTAL BIOLOGY-I

ZO 3 ET 08 - MAN, ENVIRONMENT & NATURAL RESOURCES (90 Hours)

1. Weather and climate

(15 hrs)

- 1.1. Atmosphere- structure and composition;
Local winds: Sea and land breezes; Polar easterlies, Westerlies; Trade winds;
- 1.2. Indian and African Monsoon;
- 1.3. Inversions: temperature or thermal inversions- causes –consequences –
[subsidence inversion](#);
- 1.4. Clouds and their formation
Cloud categories: low, middle, and high clouds: Cirrus (Ci),
Cirrocumulus (Cc), and Cirrostratus (Cs), Altocumulus (Ac),
Altostratus (As), and Nimbostratus (Ns), Cumulus (Cu),
Stratocumulus (Sc), Stratus (St), and Cumulonimbus (Cb).

2. Element and factors of climate;

(15 hrs)

- 2.1. External factors: solar radiation- [Plate tectonics](#)-Milankovitch Theory –
[Orbital eccentricity - obliquity- axial precession](#).
- 2.2. Internal factors: earth's orography- oceanic and continental influence-
Deforestation- surface albedo- snow and ice- Volcanic activity-
Dust particles- Greenhouse gas concentrations-
Atmosphere- ocean heat exchange- Atmospheric Carbon Dioxide Variations-
human influences
- 2.3. Global climate changes – causes and consequences.
- 2.4. [Physical evidence for climatic change](#) – Historical
and archaeological evidence- Glaciers – Vegetation
-Ice cores – Dendroclimatology- Pollen analysis-
Sea level change

3. Human population

(10 hrs)

- 3.1. Exponential growth – geometric growth or geometric decay-
Malthusian growth model – population momentum age structure – population
pyramid, age structure diagram
Types of population pyramid - [Young and aging populations](#) – youth bulge -
- 3.3. Current trends in global population with reference to developed and developing
countries

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34. Population explosion –Baby boom – [History of population growth Projections of population growth Demographic transition Carrying capacity](#) – Human population in India

4. Ecosystem (25 hrs)

- 4.1. Ecosystems-a) types, natural & artificial, agroecosystems, City ecosystems and Spacecraft ecosystems
- 4.2. Functions of Ecosystems-
- 4.3. Ecological energetics - Fixation and utilization of energy-
- 4.4. Primary production, factors affecting & measurements of primary production,
- 4.5. Ecological efficiencies- ratios within and between trophic levels,
- 4.6. Lindmann's work, Single channel, Y shaped and universal energy flow models,
- 4.7. Place of man in the food chain,
Human expropriation of primary production,
Nutrient cycling, selection, diversity, decomposition and stability.
- 4.8. Development of ecosystems, Types and factors controlling, changes in the trends of ecological attributes,
- 4.9. Relevance of ecosystem development concept to human ecology and evolution of ecosystems
- 4.10. Human impact on ecosystems, Human settlements, Human cultural evolution, Environmental crisis,
- 4.11. Environmental protection and sustainable development, Creating sustainable cities suburbs and towns,
- 4.12. Meeting human needs while protecting the environment.

5. Resources of the Earth – Renewable & Non renewable (25 hrs)

- 5.1. Natural resources-Renewable and nonrenewable natural resources.
- 5.2. Depletion of natural resources and its effects.
- 5.3. Culture fisheries, briefly mention the common species and culture methods
- 5.4. Aquaculture. economically important crustaceans, mussels, oysters, clams and sea weeds.(Brief)
- 5.5. Fishery resources of Kerala with special reference to fresh water ornamental species.
- 5.6. Marine products - Food value of fish, Fish meal, fish body oil, Fish liver oil, Fish maw and other products.
- 5.7. Forest products -major and minor products of both plant and animal origin,
- 5.8. Economically important insects and their products-Honey, Lac and Silk.
- 5.9. Plantation, crops, and their products and uses (Tea, coffee, Rubber, Coconut, Cashew nut, Cardamom)
- 5.10. Mineral resources with special reference to India. Their over exploitation and environmental problems citing case studies from India.
- 5.11. Water as a resource –Characteristics of water. Major water compartments. Hydrological cycle.
Water management and conservation – Rain water harvesting techniques. Surface and ground water resources of Kerala
- 5.12. Energy resources
- 5.13. Conventional energy sources (coal, Oil and natural gas and oil shale)
- 5.14. Non conventional energy sources -solar energy, wind energy, geothermal energy, hydropower, biomass, biogas
Tidal energy, Energy from waste, Hydrogen, and Nuclear energy.
- 5.15. Energy crisis

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12. Emlen, J.M Population biology. The co- evolution of population dynamics and behaviour- M c Millan publishing company New York, London.
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14. Franco K.G-- Man and the changing environment
15. Irewarth Horn, An introduction to climate- Mac Graw-Hill
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24. Puri et al.- Forest Ecology- Oxford university press
25. Ramakrishnan, P. S.-Ecology and sustainable development-National book trust India
26. Raymond Dasman- Environmental Conservation- John Wiley
27. Sagrayia, K. P. – Forest and Forestry- National Book Trust, New Delhi
28. Smith R.I. - Elements of ecology- Harper and Row publishers, New york.
29. Turk and Turk-Envoronmental Science- Saunders.

THIRD SEMESTER
ELECTIVE COURSE - FISHERY BIOLOGY-I

ZO 3 ET 08 –TAXONOMY, BIOLOGY, PHYSIOLOGY & ECOLOGY (90 Hours)

- | | |
|--|-----------------|
| 1. Fish Taxonomy | (5 hrs) |
| 1.1. Classification and distribution of economically important fin fishes | |
| 2. Integument | (10 hrs) |
| 2.1. Exoskeleton | |
| 2.2. Skin and scales | |
| 2.3. Colouration | |
| 2.4. Chromatophores and pigments | |
| 2.5. Structure, function and modification of fins | |
| 3. Locomotion | (5 hrs) |
| 3.1. Body shape and musculature | |
| 3.2. Mechanism of propulsion | |
| 4. Life history of fishes | (5 hrs) |
| 4.1. Reproduction, reproductive hormones, reproductive behaviour, oviparity, ovoviviparity | |
| 4.2. Age and growth | |
| 4.3. Migration | |
| 5. Digestive physiology | (10 hrs) |
| 5.1. Food and feeding | |
| 5.2. Feeding behaviour | |
| 5.3. Feeding mechanism | |
| 5.4. Digestive enzymes | |
| 5.5. Absorption | |
| 6. Circulatory physiology | (6 hrs) |
| 6.1. Heart | |
| 6.2. Blood, blood cells, blood pigments and functions of blood | |
| 6.3. Circulation | |
| 7. Respiratory physiology | (6 hrs) |
| 7.1. Gills and Accessory respiratory organs | |
| 7.2. Gas transport | |
| 8. Excretory and Osmoregulatory physiology | (6 hrs) |
| 8.1. Excretory organs | |
| 8.2. Osmoregulation in marine, brackish water and fresh water fishes | |
| 9. Endocrine physiology | (6 hrs) |
| 9.1. Endocrine glands – structure and function | |



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9.2. Regulation of endocrine secretion

9.3. Crustacean neurosecretory system and their role in reproduction

10. Adaptive physiology

(6 hrs)

10.1. Deep sea fishes

10.2. Cave dwelling fishes

10.3. Hill stream fishes

11. Oceanography

(15 hrs)

11.1. Ecological subdivisions of the sea

11.2. Major topographic features of continental shelf, continental slope and ocean floor

11.3. Physico-chemical properties of sea water

11.4. Ocean currents

11.5. Ocean productivity

11.6. Coral reefs

12. Brackish water ecology

(5 hrs)

12.1. Characteristics of brackish and estuarine waters

12.2. Estuarine productivity

13. Limnology

(5 hrs)

13.1. Classification of inland waters – ponds, lakes, rivers and reservoirs

13.2. Physico-chemical properties of inland waters

References:



THIRD SEMESTER ELECTIVE COURSE-HUMAN GENETICS-I ZO

3 ET 08 - CLINICAL GENETICS (90 Hours)

1. Cytogenetics

(35 hrs)

1.1 Cell cycle. Chromosomal basis of inheritance. Mendelian and Non -Mendelian inheritance in humans. Dominant, Recessive, lethal, sex linked, sex influenced, mitochondrial and multifactorial.

1.2 Cytogenetic techniques: Routine cytogenetic techniques of PBLC and preparation of stained slides and nomenclature ISCN.

Banding techniques- C, G, Q, R, Acridine orange, NOR and DAPI.

1.3 Specialized techniques: HRB, fragile sites, PCC, Karyotyping, interpretation.

1.4 Chromosome abnormalities and clinical phenotypes:

Abnormalities of Chromosome Number- Polyploidy, aneuploidy, Autosomal aneuploid syndromes-trisomy 21, trisomy 18, trisomy 13. Factors causing aneuploidy, non-disjunction.

Sex chromosome aneuploid syndromes - Turner, Klinefelter, Triple X, XYY. X-inactivation.

Abnormalities of Chromosome Structure- Duplication, deletion, translocation,

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reciprocal translocation, Robertsonian translocation, ring chromosome, inversion, isochromosome, Microdeletion syndromes. Uniparental disomy, Imprinting. Chromosome instability syndromes. spontaneous abortions

2. Medical Genetics (20 hrs)

- 2.1 Hematological disorders- Hemoglobinopathies, disorders of stasis and coagulation disorders
- 2.2 Skeletal disorders: Achondroplasia, Osteogenesis imperfecta
- 2.3 Neuromuscular disorders-Muscular dystrophies, spinal muscular dystrophy, myotonic dystrophy, neurofibromatosis, tuberous sclerosis, Parkinson's disorders, Huntington chorea
- 2.4 Renal disorders- Renal cystic disorders, disorders of urinary tract,, nephritic diseases
- 2.5 Respiratory disorders-cystic fibrosis, asthma,
- 2.6 Endocrine disorders- thyroid, pancreas, pituitary, gonads

3. Human Biotechnology (25 hrs)

- 3.1 Introduction to Biotechnology
- 3.2 Recombinant DNA Technology, construction of chimeric DNA
Recombinant DNA technique for Human diseases
Isolation of cloned genes-copying mRNA to cDNA
- 3.3. Applications of r-DNA technology
Nucleic acid sequence as diagnostic tool, metabolic engineering, genetic changes for overproduction of biomolecules such as insulin, interferon and growth hormones
- 3.4. PCR, types of PCR- RT-PCR, Fluorescent PCR
- 4.5. Primer designing and purification
- 3.6. Somatic cell hybridization and monoclonal antibodies
- 3.7. Gene therapy in human-history, different types germ line, zygote and somatic cell gene therapy, SCID
- 3.8 Signal transduction pathway

4. Bioinformatics (10 hrs)

- 4.1 Overview, databanks, techniques of alignment, role of bioinformatics in the analysis of genomic information, genomics, proteomics
- 4.2 Biological databases - Nucleic acid – GenBank, EMBL, DDBJ. Protein – Swissprot, TrEMBL. Structural – PDB. Submitting sequences to databases – BankIt, SequIn, WebIn, and Sakura. Sequence retrieval by Entrez.

References:

1. Dhatolkar, A.B. - Elements of Biomedical Genetics.
2. Emery, A.E.H. and Rimoin, D.L. Principles and Practices of Medical Genetics Vol. I, II & III. Churchill Livingstone.
3. Gardner Mc Kinley *et al*: Chromosome abnormalities and genetic counselling
4. Jack Pastor Nack: Human Molecular Genetics
5. John Swansbury (Ed) (2003): Cancer cytogenetics - Methods and protocols, Humana press New Jersey
6. Jorde, L.B., Carey, J.C. and White, R.L. (2002): Medical Genetics. Mosby Press.
7. Lewin Benjamin : Gene IX
8. Lynn B. Jorde & John C. Carvy: Medical Genetics
9. Mahesh, S. & Vedamurthy: Biotechnology

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10. Mitelman Karger, F. (1995): ISCN, An International System for Human Cytogenetic Nomenclature –
11. Muller, Robert F & Young Ian D: Elements of Medical Genetics
12. Phadke Subha, R : Genetics for clinicians
13. Read Andrew et al: New clinical Genetics
14. Verma, R.S. and Babu A. (1989): Human Chromosomes - Manual of basic Techniques. Pergamon Press.
15. William B. Coleman and Gregory J, Tsongalis (Eds) (2002): The Molecular Basis of Human Cancer, Humana Press New Jersey

THIRD SEMESTER **ELECTIVE COURSE: WILDLIFE BIOLOGY-I**

ZO 3 ET 08- BIODIVERSITY AND BIOTA (90 Hours)

1. Introduction

(6 hrs)

- 1.1. Biodiversity : Definition
- 1.2. Kinds of biodiversity
- 1.3. Biodiversity hot spots
- 1.4. Endemism
- 1.5. Western Ghats Biodiversity

2. Biology and Taxonomy of Mammals & Birds

(60 hrs)

Biology and Taxonomy of the following animals with special emphasis on Western Ghats (Biology should include population status, distribution, feeding and breeding habits, major threats to their survival and conservational significance)

2.1. MAMMALS

Order Primates

- Apes: Gibbon
Monkeys: Macaques (Bonnet, Rhesus, Assamese and Lion tailed)
Langurs (Common, Capped, Golden, Nilgiri)
Lemurs: Slender Loris and Slow Loris

Order Carnivora

- Cats: Tiger, Lion, Leopard, Fishing cat, Leopard cat, Jungle cat, Indian Wild Dog, Wolf, Jackal, Indian Fox
Otters: Common Otter, Smooth Indian Otter
Bears: Sloth bear, Brown bear, Himalayan black bear, Sun bear
Panda: Giant panda, Red panda
Hyena: Striped hyaena
Civets: Malabar civet, Small Indian civet, Common palm civet
Mongoose: Common mongoose, Small Indian mongoose, striped necked mongoose

Order Artiodactyla

- Cervids: Chital, Sambar, Barking deer, Mouse deer.
Bovids: Indian Antelope, Four horned Antelope, Nilgiri tahr, Indian bison.
Suids: Indian Wild boar.

- Order Proboscidae Indian Elephant
Order Perisodactyla One horned Rhinoceros.
Order Pholidota Indian Pangolin

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Order Lagomorpha	Hispid hare
Order Insectivora	Tree shrew, Hedgehog
Order Rodentia	Indian Giant squirrel, Grizzled giant squirrel, Porcupine, Flying squirrel, striped palm squirrel
Order Chiroptera	Indian flying fox, Short nosed fruit bat, Indian pipistrella
Order Cetacea	Gangetic dolphin, Common dolphin, Sperm Whale.
Order Sirenia	Sea cow

2.2. BIRDS

- 2.2.1. Habitat preference
- 2.2.2. Flocking and aggregation.
- 2.2.3. Foraging behaviour,
- 2.2.4. Food competition and selection
- 2.2.5. Courtship and pair selection,
- 2.2.6. Brood parasitism and cooperative breeding.
- 2.2.7. Vocalisation and its Role in birds
- 2.2.8. Flyways and peculiarities of bird migration in the Indian Subcontinent
- 2.2.9. Avian classification and distribution with special reference to Indian species.

Order Columbiformes	Blue Rock pigeon, Spotted Dove.
Order Podicipediformes	Little Grebe
Order Pelecaniformes	Little and Large Cormorant, Darter
Order Ciconiformes	Pond heron, Large egret, Little egret, Median egret, Grey heron, Purple heron
Order Ansariformes	Bar headed goose, Lesser whistling teal
Order Gruiformes	Indian Moorhen, Purple moorhen, White breasted waterhen
Order Charadriiformes	River tern, Red wattled Lapwing, Yellow wattled Lapwing, Black headed gull, Bronze winged jacana, Pheasant tailed jacana.
Order Falconiformes	Hawks, Vultures.
Order Gruiformes	Indian cuckoo, Koel, Crow pheasant
Order Coraciformes	White breasted kingfisher, Small blue kingfisher, Pied kingfisher, Brown headed kingfisher, Chestnut headed Beak eater, Small green Beak eater, Hornbills
Order Pisciformes	Lesser Golden backed woodpecker, Indian golden backed woodpecker, Small green barbet
Order Psittaciformes	Rose ringed parakeet, Blossom headed parakeet, Lorikeet
Order Strigiformes	Indian horned owl, Mottled wood owl, Barn owl
Order Apodiformes	Palm swift
Order Passeriformes	Black headed Oriole, Golden Oriole, Tree Pie, Drongo, Racket tailed Drongo, Red whiskered Bulbul, Red vented Bulbul, Black headed Babbler, White headed Babbler, Munia, Magpie Robin, Jungle Babbler, Purple sunbird, Purple rumped sunbird, Indian Roller, Indian Robin, White cheeked Bulbul, Tickell's flower pecker, Thick billed flower pecker, Paradise flycatcher.

3. Fishes, Amphibians & Reptiles

(10 hrs)

3.1 FISHES Endangered and Endemic fishes of Western Ghats (Brief account

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with threat to their survival).

3.2. AMPHIBIA Amphibians endemic to Western Ghats (Brief account with threat to their survival)

3.3 REPTILES

Order Crocodylia Gharial, Estuarine crocodile, Marsh crocodile.

Order Testudines Logger headed sea turtle, Green Sea Turtle, Hawk's Bill Turtle, Olive Ridley Turtle, Leatherback Sea Turtle. (Brief account with threat to their survival)

Order Squamata Indian Monitor Lizards (Brief account only)

Endangered and endemic snakes of Western Ghats (Brief account only)

4. Sociobiology & Territoriality (10 hrs)

4.1 Sociobiology of Lion, Elephant and Deer

4.3 Territoriality and functions of territory.

5. Principles & Hypothesis (4 hrs)

5.1 Gondwana principle

5.2 Satpura Hypothesis

References:

1. Aaron, N.M. (1973): Wildlife ecology. W.H. Freeman Co. San Francisco, USA.
2. Alfred, J.R.S., Das, A.K. and Sanyal, A. K. (1998): Faunal diversity in India, ZSI Calcutta
3. Bird life International Red Data Book for Asia (1995), SACON, Coimbatore.
4. Daneil, J.C. The book of Indian Reptiles and Amphibians, Oxford publ.
5. Grzimek's Animal life Encyclopedia (1972): Vol. 1-13, Van Nostrand Reinhold Company
6. Induchoodan (2004): Keralathile Pakshikal (Malayalam) - IVth Edn. Kerala Sahitya, Academy, Thrissur.
7. IUCN, WRI and UNEP (1992): Global biodiversity Strategy.
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10. Negi, S.S. (1993) Biodiversity and its conservation in India. Indus Publishing Co., New Delhi.
11. Prater, S.H. The Book of Indian Animals. BNHS/Oxford
12. Salim Ali (2002). The book of Indian Birds, revised edn. BNHS & Oxford university press, New Delhi.
13. Salim Ali and Ripley (1983): Handbook of birds of India and Pakistan (2nd Ed.). Oxford University Press.
14. Sharma, B.D. 1999. Indian wildlife resources: Ecology and development. Daya publishing House, Delhi.
15. Singh, Samar (1987): Conserving India's Natural Heritage. Nataraj Publication.
16. Sukumar, R. (1989): Asian Elephant. Cambridge Univ. Press

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17. Trothy, J.B. Boyle and Boontawee – Measuring and monitoring Biodiversity in Tropical and Temperate Forest. Centre for International forestry Research, Bogor, Indonesia

THIRD SEMESTER ELECTIVE COURSE- ENTOMOLOGY – II

ZO 3 ET 09- ANATOMY AND PHYSIOLOGY (90 Hours)

- 1. The Integument (6 hrs)**
 - 1.1. Histology-basic components
 - 1.2. Chemical and physical properties
 - 1.3. Moulting and sclerotisation
 - 1.4. Hormonal control and function

- 2. Nutrition (5 hrs)**
 - 2.1. Nutrition requirement, water, minerals, vitamins, carbohydrates, proteins, fatty acids, sterols, nucleic acids, inorganic salts and micro-organisms.
 - 2.2. Nutrition and growth, development, reproduction

- 3. Digestion and Assimilation (8 hrs)**
 - 3.1. Anatomy and histology of gut
 - 3.2. Digestive enzymes – carbohydrases, proteases, lipases
 - 3.3. Physiology of digestion
 - 3.4. Digestion of wood, keratin, wax and silk
 - 3.5. Extra intestinal digestion
 - 3.6. Role of microbiota in digestion

- 4. Circulatory system (8 hrs)**
 - 4.1. Cellular elements in haemolymph
 - 4.2. Composition of haemolymph
 - 4.3. Dorsal vessels, accessory pumping sinuses and diaphragm
 - 4.4. Heart beat rate and control of heart beat
 - 4.5. Course of circulation of haemolymph

- 5. Excretory system (6 hrs)**
 - 5.1. Malpighian tubules-anatomy and histology - Hemipteran, Coleopteran and Lepidopteran types
 - 5.2. Physiology of excretion
 - 5.3. Dietary problems - salt and water balance- control
 - 5.4. Nitrogenous excretion-synthesis of uric acid, formation of excreta

- 6. Ventilatory system (6 hrs)**
 - 6.1. Structure of trachea, trachiole, air-sacs, spiracles
 - 6.2. Types of ventilatory process - passive, active and bulk flow
 - 6.3. Respiratory pigments
 - 6.4. Cyclic release of carbondioxide and nervous control of ventilation
 - 6.5. Ventilation in aquatic insects, endoparasitic insects and during moulting

- 7. Nervous system (14 hrs)**
 - 7.1. Anatomy and histology of brain, ganglia and nerves

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- 7.2. Reception and transmission of stimuli, production and control of nerve impulses and transmission.
- 7.3. Sense organs - anatomy, histology and physiology of mechanoreceptors - tactile senses, proprioceptors, sound perception, chemoreceptors, photoreceptors, thermoreceptors and hygroreceptors
- 7.4. Sound production and light production

8. Muscular system (8 hrs)

- 8.1. Histomorphology of muscles, skeletal muscles, visceral muscles
- 8.2. Neuromuscular junctions
- 8.3. Excitation of muscle fibres, activation of muscle fibres, role of fast and slow axons
- 8.4. Muscle development and maintenance

9. Endocrine and exocrine glands (8 hrs)

- 9.1. Histomorphology of neurosecretory cells and endocrine glands (corpora cardiaca, corpora allata and Prothoracic glands)
- 9.2. Hormones and their functions
- 9.3. Mechanism of hormone action
- 9.4. Pheromones and their function

10. Reproductive system and morphogenesis (9 hrs)

- 10.1. Development of primordial germ cells
- 10.2. Reproductive system- structure-male and female
- 10.3. Fertilization and oviposition
- 10.4. Formation of blastoderm and extraembryonic membranes
- 10.5. Sex determination and parthenogenesis

11. Embryogenesis (6 hrs)

- 11.1. Differentiation of germ layers
- 11.2. Segmentation, appendage, formation, organogenesis
- 11.3. Polyembryony, pedogenesis, viviparity, oviparity, eclosion,
- 11.4. Postembryonic development-hatching, larval development and control, polyphenism, diapauses

12. Locomotion (6 hrs)

- 12.1. Terrestrial and aquatic, basic structure of a leg
- 12.2. Maintenance of stance and patterns of movements
- 12.3. Patterns of aquatic movements
- 12.4. Structure of wings, modifications, mechanism of wing movement
- 12.5. Aerodynamics and control of wing beat

References:

1. Beament, J.W.L., Treherne, J. E. & Wigglesworth - Advances in Insect Physiology, Academic press, London
2. Bursell, E (1970): An Introduction to Insect physiology, Academic Press
3. Chapman. R.F. (1998): The Insects: Structure and Function
4. Gilbert, L.I. & Kerkut. G.A. (1985): Comprehensive Insect Physiology, Biochemistry and Physiology, Vol. 1-12
5. Pathak, S.C. (Ed) (1986): Recent advances in Insect Physiology, Morphology and Ecology. Today and Tomorrow Publishers, New Delhi.

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6. Patton, R. (1963): Introductory Insect Physiology, Saunders, USA.
7. Richards, O.W. and Davis, R.G. (1977): Imms General Text Book of Entomology. Vol.I. Chapman & Hall, London
8. Rockestein, M. (Ed) (1974): Physiology of Insecta Vol 1.VI. Academic press, New York
9. Roeder, K. D. (1953): Insect Physiology, Wiley, New York.
10. Simpson Stephen (2005): Advances in Insect Physiology. Elsevier
11. Wigglesworth, V.B. (1972): Principles of Insect Physiology, Methuen, London

THIRD SEMESTER **ELECTIVE COURSE - ENVIRONMENTAL BIOLOGY-II**

ZO 3 ET 09 -ENVIRONMENTAL POLLUTION (90 Hours)

1: AIR POLLUTION

(35 hrs)

- 1.1 Primary air pollutants: occurrence, sources and sinks of the following pollutants:
(a) compounds of carbon, (b) compounds of sulphur, (c) compounds of nitrogen, (d) gaseous halogens, (e) ozone, (f) mercury, (g) particulate matter
- 1.2 Sampling of air using sampling train and orifice flow meter
- 1.3 Method of sampling and monitoring of the following gaseous air pollutants (Two methods for each pollutant)
(a) Oxides of Carbon, Hydrocarbons
(b)) SO₂, H₂S, Mercaptans
(c) Oxides of Nitrogen, Ammonia
(d) Ozone
- 1.4 Sampling sizing of Particulate matter.
Sample collection – settlement, filtration, particle count, evaluation by optical microscopy, particle size analysis – projected diameter and statistical diameter (Feret's diameter and Martin's diameter).
- 1.5 Interaction of air pollutants in the atmosphere
Secondary pollutants: photochemical-smog, Acid rain, and green house effect,
- 1.6 Effect of air pollution:
(a) On materials, buildings, metals etc.
(b) On vegetation
(c) On weather and atmospheric conditions
(d) On human health- a brief survey of major air pollution episodes.
- 1.7 Air pollution- abatement technology, basic principles of design and working of
(a) Bag filters (b) Inertial collection- cyclones
(c) Electrostatic precipitators (d) Scrubbers
(e) Adsorption (f) Device for controlling automobile emissions
- 1.8 Noise pollution-sources, effects and abatement.

2: WATER POLLUTION

(40 hrs)

- 2.1. Organic pollution: (a) Origin and sources of Organic pollutants, Biodegradable and non-biodegradable- Domestic, Agricultural and Industrial sources.
(b) Biochemical oxygen demand (BOD) - Kinetics of BOD tests- rate constant and its importance- Method of estimation

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- (c) Chemical Oxygen Demand (COD) - Importance and method of estimation
- (d) Effects of organic pollution on aquatic systems, saprobicity system and indicator species Importance in pollution assessment
- 2.2. Eutrophication- natural and cultural sources and effects.
- 2.3. Biocides: Classification and types of Biocides- Fungicides, Pyrethroids and pesticides.
Effects of Biocides, Biological magnification Toxic effects on non target organisms- hazards to man.
- 2.4. Heavy metals sources and effects of the following in the ecosystem and human population
 - (a)Mercury - Inorganic and Organic mercury compounds - Bioconversion of inorganic and organic mercury
 - (b) Cadmium - itai - itai disease
 - (c) Lead - Plumbism
 - (d) Lesser metals - copper, zinc, selenium, chromium, molybdenum, beryllium and thallium.
- 2.5. Thermal pollution-sources, effects- cooling towers as control measures.
- 2.6. Oil spills-sources effects and control.
- 2.7. Hazards of Radioactive materials in the environment Biological effects of ionising radiations, Nuclear waste disposal.
- 2.8. Carcinogens in the environment
 - (a) Polycyclic aromatic hydrocarbons (b) Nitrosamines (c) Inorganic carcinogens Asbestos, Metal dust (d) Carcinogens in food: Artificial sweeteners, disodium benzoate and other additives.
- 2.9. Water pollution abatement technology:
 - (a) Primary, secondary and tertiary treatment systems (b) Principles of design and operation of (1) screens (2) Grit chambers (3) Sedimentation tanks (4) Oxidation ponds and (5) algal pond.
- 2.10. Design and operation of biological treatment systems: (1) Aerated lagoons (2) Activated sludge process (3) Trickling filters (4) sludge digest.
- 1.11. Sewage and sewage treatment: composition, bacteriology of sewage treatment, stabilisation-properties of sewage, categories of sewage, use of effluents in irrigation

3. TERRESTRIAL POLLUTION (15 hrs)

- 3.1 Solid waste- garbage, rubbish, ashes, debris, street litter, agricultural waste, mining waste, industrial waste, e-waste etc.
- 3.2 Problems of solid waste disposal, consequences of solid pollution- Love canal episode as an example.
- 3.3 Solid waste disposal methods: Sanitary land fill, plasma gasification, deep well injection, incineration, recycling biogas

References:

- 1. Ahluwalia & Sunita Malhotra (2009): Environmental Science-Ane books Pvt.Ltd
- 2. Ananthkrishnan T.N.- Bioresource Ecology- Oxford and IBH.
- 3. Chiras, D. (2001) : Environmental science, Jones and Bartlet publishers
- 4. Ciaccio - Water and Water Pollution.Hand book- Vol. I- V- Marcel- Dekker
- 5. Cunningham & Cunningham (2003): Principles of Environmental Science:, Tata McGraw Hill
- 6. Dehre, F. W. - Toxicity of heavy metals in the environmental Volume I & II MarcelDekker

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7. Eddy and Metcalf- Waste water engineering- Tata Mc Graw Hill
8. Ehrlich and Ehrlich- Ecoscience- W.H.Freeman and Co.
9. Hodges- Environmental Pollution- Holt, Rinehart and Winstone
10. Hussain, S.K. Text Book of water supply and Sanitary Engineering- Oxford IBH
11. Irewarth Horn, An introduction to climate- Mac Graw-Hill
12. Irving Sax- Industrial Pollution- Holt, Rinehart and Rinhold Co.
13. Jain, R.A.- Environmental Impact Analysis- Academic Press
14. Leeper- Managing heavy metals on land Marcel- Dekker
15. Mellanby – Pesticides and Pollution- Collins
16. Namerow, N.I. – Scientific stream analysis - Mc Graw Hill
17. Namerow, N.L.- Scientific stream analysis - Mc Graw Hill
18. Nemerow, N.I.-Industrial Water Pollution-Addison, Wesly.
19. Premins- Air Pollution -Mac Graw-Hill.
20. Ravera – Biological Aspects of fresh water pollution- Pergamon
21. Schroeder – Water and Waste water treatment- Mc Graw Hill
22. Smith & Smith- Minamata-Holt, Rinchart & Winston.
23. Stem *et al.* - Fundemantals of Air Pollution- Academic Press.
24. Turk and Turk-Envoronmental Science- Saunders
25. Wilson – Hand book of Solid waste mangement – Van Nostrand publishers

THIRD SEMESTER **ELECTIVE COURSE- FISHERY BIOLOGY - II**

ZO 3 ET 09 - CAPTURE AND CULTURE FISHERIES (90 Hours)

- 1. Introduction to Capture and Culture fisheries (10 hrs)**
 - 1.1. Marine fisheries - Crustaceans, Molluscans and fin fishes
Shrimps, Crabs and Lobsters
Mussels, Oysters and Cephalopods
Sardine, Mackerel, Bombay duck, Pomfretes, Ribbon fishes and Tuna
- 2. Freshwater fisheries (5 hrs)**
 - 2.1. Major river systems and fisheries
 - 2.2. Lakes and reservoir fishery
- 3. Estuarine fisheries (5 hrs)**
 - 3.1. Major estuaries and fisheries
- 4. Aquaculture (5 hrs)**
 - 4.1. History of aquaculture, scope and definition, importance of aquaculture, present state of aquaculture, future prospectus
 - 4.2. Classification of aquaculture practises
- 5. Design and construction of aqua farms and hatcheries (5 hrs)**
 - 5.1. Pond design and construction
 - 5.2. Farm design and layout

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- 5.3. Pond preparation
- 5.4. Cage farms
- 5.5. Pens and enclosures
- 5.6. Design and construction of hatcheries

- 6. Transportation and acclimatization (3 hrs)**
- 7. Nutrition and feeds (3 hrs)**
 - 7.1. Feeding habits and food utilization
 - 7.2. Live feeds
 - 7.3. Artificial feeds

- 8. Water quality management (3 hrs)**
 - 8.1. Water quality parameters
 - 8.2. Techniques for monitoring
 - 8.3. Strategies for monitoring

- 9. Fertilizers and chemicals in aquaculture (2 hrs)**

- 10. Reproduction and genetic selection (10 hrs)**
 - 10.1. Reproductive cycles
 - 10.2. Control of reproduction
 - 10.3. Induced breeding
 - 10.4. Use of hormone analogues
 - 10.5. Cryo-preservation of gametes
 - 10.6. Sex reversal
 - 10.7. Genetic selection and hybridization

- 11. Control of weeds, pests and predators in aquaculture (2 hrs)**

- 12. Aquaculture practises (20 hrs)**
 - 12.1. Integrated fish farming - paddy cum fish culture, duck cum fish culture, pig cum fish culture
 - 12.2. Polyculture
 - 12.3. Culture of shrimps
 - 12.4. Culture of prawns
 - 12.5. Culture of crabs
 - 12.6. Culture of edible oysters, pearl oysters and mussels
 - 12.7. Culture of sea weeds
 - 12.8. Culture of fresh water fishes – Indian major carps and exotic carps
 - 12.9. Culture of cold water fishes – trout and mahaseer
 - 12.10. Culture of brackish water fishes – mullets, milk fish and etroplus

- 13. Preparation and maintenance of aquarium (5 hrs)**
 - 13.1. Types of aquaria
 - 13.2. Preparation and maintenance
 - 13.3. Equipments
 - 13.4. Water chemistry
 - 13.5. Aquarium fishes and plants

- 14. Pathology (7 hrs)**

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- 14.1. Major fish diseases - viral, bacterial, fungal
- 14.2. Protozoan infections
- 14.3. Control and treatment

References:

THIRD SEMESTER ELECTIVE COURSE-HUMAN GENETICS -II

ZO 3 ET 09- DIAGNOSTIC GENETICS (90 Hours)

- 1. Biochemical Genetics (25 hrs)**
 - 1.1. Inborn errors of metabolism -Definition and mode of inheritance
 - 1.2. Disorders of carbohydrate metabolism- Galactosemia, essential fructosuria, fructose intolerance, glycogen storage disorders
Mucopolysaccharides
 - 1.3. Diseases of amino acid metabolism- Phenylketonuria, tyrosinosis, alkaptonuria, albinism, maple syrup urine disease, homocystinuria and histidinuria
 - 1.4. Disorders of lipid metabolism- Tay Sach's disease, Goucher's disease
 - 1.5. Disorders of nucleic acid metabolism- Primary gout, Leish nyhan syndrome
 - 1.6. Mineral metabolism disorders- Wilson disease, Menkes disease
 - 1.7. Disorders of porphyrins – inherited porphyrias
 - 1.8. Peroxisomal disorders - Zellweger syndrome, X linked adrenoleucodystrophy
- 2. Developmental Genetics (25 hrs)**
 - 2.1. Human embryo development- Cleavage, 2 cells, 4 cells, 8 cells, 16 cells, 32 cells, Morula, Blastula, Gastrula, Organogenesis
 - 2.2. Gonadal differentiation
 - 2.3. Placental types, implantation
Developmental features of human fetus- first lunar month to tenth lunar month
First, second and third trimester
 - 2.4. Formation of extra embryonic tissue
 - 2.5. Study of human birth defects-Syndromology, Dymorphology, Neural tube defect, Anencephaly, Meningocele, Spina bifida, Herlequin ichthyosis
- 3. Reproductive Genetics (5 hrs)**
 - 3.1. Spermatogenesis, oogenesis
 - 3.2. Computer assisted Semen Analysis (CASA)
 - 3.3. Assisted Reproductive Techniques (ART) IUI, IVF, ICSI, ZIFT, GIFT
 - 3.4. Pre-implantation Genetic Diagnosis (PGD)
- 4. Molecular Diagnosis (15 hrs)**
 - 4.1. DNA fingerprinting,
 - 4.2. Linkage analysis - RFLP, blotting techniques (southern, northern and western)
 - 4.3. Gene sequencing
 - 4.4. Probes- Preparation and classification, in-situ hybridization, FISH, mFISH, fiber FISH, application of FISH
 - 4.5. CGH, SKY, Micro array, Microchips, Comet assay

5. Prenatal Diagnosis

(20 hrs)

- 5.1. Historical perspective
- 5.2. Non-invasive techniques- Ultrasonography, foetal MRI
- 5.3. Invasive techniques- Amniocentesis, chorionic villus sampling, fetal blood sampling, fetal skin sampling,
- 5.4. Chromosome analysis, metabolic disorders, DNA Analysis
- 5.5. Current knowledge of prenatally diagnosed genetic disorders, haemoglobinopathies, coagulation disorders.
- 5.6. Treatment of genetic disorders

References:

1. Devlin, T.M. (1994): Text book of Biochemistry with clinical correlations (3rd edn.)
2. Discovery School: Test Tube Babies -CD
3. Emery, A.E.H. and Rimoin D.L. (1983): Principles and Practice of Medical Genetics, Vol. II, Churchill Livingstone, Chap.99
4. Gardner: Principles of Genetics
5. Griffith, T., Miller, Suzuki. (2002): An introduction to genetic analysis. 7th edition, W.H. Freeman and Co. NY.
6. Griffiths, A.J.F., Gelbart, W.M., Lewontin, R.C. and Miller, J.H. (2002): Modern Genetics analysis, 2nd edition. W.H. Freeman and Co. New York.
7. Hawley, R Scott & Walker MY: Advanced Genetic Analysis
8. Mange, Elaine, Johnson: Basic Human Genetics
9. P.F. Benson, Sna A.H. (1985): Fensom Genetic Biochemical Disorders, Oxford Monograph in Medical Genetics.
10. Pierce Benjamin: Genetics- A Conceptual Approach
11. Purohit, S. S: Biotechnology
12. Scriver *et al.* (2002): The metabolic and molecular basis of inherited diseases. 8th edition, McGraw–Hill.
13. Scriver *et al.*, (2002): The metabolic and molecular basis of inherited disease (8th edn) Ed.McGraw – Hill.
14. Strachan, T. and Read, A.P. (2001): Human molecular Genetics. John Wiley, New York
15. Strickberge: Genetics
16. Sushama Bai, S: Clinical evaluation of Newborn Infants and Children
17. Tomarin Robert, H: Principles of Genetics
18. Turnpenny Peter D et al: elements of Medical Genetics
19. Vides Julio Collado: Gene Regulation and Metabolism
20. Weatherall, D.J. and Clegg. (1981): The Thalassaemia Syndromes (Ed.3).

THIRD SEMESTER
ELECTIVE COURSE: WILDLIFE BIOLOGY- II ZO

3 ET 09 - WILDLIFE CONSERVATION (90 Hours)

- 1. Conservation - Scope and History (8 hrs)**
 - 1.1 History of conservation in India- Status of wildlife in India (Past and Present)
 - 1.2 Values of Wildlife - conservation values & ethics
 - 1.3 Causes of depletion of Wildlife resources - habitat loss, construction of dams, collection for trophies, hunting, poisoning, poaching and other developmental activities.
 - 1.4 Why conserve? The ecological, genetic, economic and Philosophic reasoning.
 - 1.5 Man and Wildlife conflict - crop depredation, cattle lifting, human encounters- case studies in Kerala (Brief account only), control and management.

- 2. Wildlife Habitat (14 hrs)**
 - 2.1 Forest types - classification by Champion & Seth, mention major plant species of Indian forests.
 - 2.2 (a).Deforestation - reasons for deforestation- shifting cultivation, illicit felling and encroachment, grazing and lopping, forest fire, industrial development, mining, plant diseases, insect pest, human settlements.
(b). Afforestation & Reforestation.
 - 2.3 Grasslands, Mangroves and Sacred groves (Mention conservation and management)
 - 2.4 Forestry (Social, Production, Plantation and Protection)
 - 2.5 Hydel projects and their impacts (mention habitat fragmentation, loss of forest corridors & isolation of Wildlife population), case studies in Kerala.
 - 2.6 In Situ and Ex situ conservation (Gene banking, conservation and exchange)
 - 2.7 National River Conservation Programme (NRCP)

- 3. Tribals and Wildlife (4 hrs)**
 - 3.1 Tribal groups in Kerala
 - 3.2 Role of tribals in Wildlife conservation - Joint Forest Management
 - 3.3 Ecodevelopment Projects

- 4. Exotic and pet animals (4 hrs)**
 - 4.1 Introduction of Exotic animals (Flora and Fauna) in India: Principles and problems
 - 4.2 Illegal Wildlife Trade and Pet Trade in India- Major trade centres, routes and related issues.

- 5. Protected Areas (18 hrs)**
 - 5.1 National parks and Sanctuaries: Important National Parks and Sanctuaries in India with special importance to Kerala - characteristics features, importance, declaration, formation, management, protection and administration.
 - 5.2 Marine Sanctuaries and National Parks of India: Gulf of Mannar, Gulf of Kutch & Andaman
 - 5.3 Important Bird Sanctuaries of India: Bharatpur, Ranganathitoo, Thatekkad & Vedan Thangal
 - 5.4. Man and Biosphere reserves (MAB) in India - concept, importance, ecological features and management (Brief Account). Nilgiri biosphere reserve (NBR) and Agastyavanam Biosphere reserve. Mention other biosphere reserves in India

- 6. Wildlife - Laws and Regulation (5 hrs)**
 - 6.1 Wildlife administration and legislation: administrative set up (central and state level),

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statutory bodies,

6.2. Wildlife Protection Act -1972 with its latest amendments.

6.3. Indian Forest act (Brief Account only).

7. Red Data Book

(3 hrs)

7.1 Red data book on animals

7.2 IUCN criteria and definition regarding extinct (EX), extinct in the wild (EW), critically endangered (CD), low risk (LR), data deficient (DD) & not evaluated animals (NE). The problems in the application of criteria in the wild.

8. Government and Voluntary Organizations

(10 hrs)

8.1 Role of Government and voluntary organization in wildlife conservation (IBWL, IUCN, ICF, WWF, BNHS, WPS, MNHS, TRAFFIC, CITES, NBA etc.)

8.2 Environmental Education and UN conferences on Environmental Issues

8.3 Resource depletion and Sustainable development

8.4 Earth Summit and World summit

9. Conservation Schemes

(15 hrs)

9.1 Project Tiger

9.2 Project Hangul

9.3 Crocodile breeding project

9.4 Gir Lion Project

9.5 Project Sangai

9.6 Project Elephant

9.7 Sea turtle project

9.8 Snow Leopard Project.

10. Ecological Principles of Conservation



(5 hrs)

10.1 Concept of minimum viable area

10.2 Minimum viable population

10.3 Compression hypothesis

10.4 Stable limit cycle

10.5 Fragmentation and isolation of habitats - role of corridors

10.6 Environmental and demographic stochasticity

10.7 Effective population size.

10.8 Genetic isolation (Island Biogeography theory) and genetic viability

11. Ecotourism

(4 hrs)

11.1 Tourism and Wildlife - Importance of Tourism in Wildlife conservation - tourism requirements, visitor impact, visitor management - control and safety rules.

11.2 Ecotourism, role of ecotourism in sustainable development

References:

1. Abbassi and Ramaswammi (1989): Biotechnological methods of pollution control. University Press.
2. Abdul Jamil Urfi (2004): Birds beyond Watching, University Press (India) Pvt. Ltd.
3. Dasmann, R.F. (1964) Wildlife biology, John Wiley and Sons, New York.
4. Gary, K., Meffe, Carroll, C.R. and Contributors (1997): Principles of Conservation Biology - 2nd Edition, Sinauer Associates, Inc Sunderland Massachusetts.
5. Giles, R.H. Jr. (Ed 1984): Wildlife management techniques - 3rd edition, The wildlife society, Washington D.C.

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6. Grimmet, R., Inskipp, C. & Inskipp, T. (1999): Pocket Guide to the birds of Indian Subcontinent, Oxford University Press, New Delhi.
7. Hosetti, B.B. (2003): Wetlands Conservation and management, Pointer Publishers, Jaipur, India.
8. Induchoodan (2004): Keralathile Pakshikal (malayalam) - IVth Edn. Kerala Sahitya, Academy, Thrissur.
9. Kazmerezak Krys and Van Perlo Ber (2000): A field Guide to the birds of India, OM Book Series, New Delhi.
10. Olvin Sewall Pettingil (1970): Ornithology in Laboratory & Field, Burgess Publishing Company, USA.
11. Robinson W.L. and Eric G. Bolen (1984): Wildlife Ecology and Management, Millen Publishing Co. New York.
12. Salim Ali (2002): The book of Indian Birds, revised edn. BNHS & Oxford University press, New Delhi.
13. Sharma B.K and Kaur, H. (1986): Environmental Chemistry. Goel Publishing House, Meerut.
14. Teague R.D. (Ed.). 1980. A Manual of wildlife conservation, The Wildlife society Washington D.C.
15. WII, A guide to chemical restraint of animals.

FOURTH SEMESTER

ZO 4 CT 10 – IMMUNOLOGY (90 Hours)

- 1. Introduction (6 hrs)**
 - 1.1. Innate and adaptive immunity
 - 1.2. Cells and organs of the immune system
 - 1.3. Antigens, Antigenicity, immunogenicity and Haptens
 - 1.4. Factors influencing immunogenicity
- 2. Antibodies (14 hrs)**
 - 2.1. Structure and functions of Antibody Molecules
 - 2.2. Generation of Antibody diversity
 - 2.3. Monoclonal antibodies-Hybridoma Technology and Applications
 - 2.4. Antibody Engineering
- 3. Antigen-Antibody Interactions (16 hrs)**
 - 3.1. Strength of Antigen Antibody Interactions
 - 3.2. Cross reactivity, precipitation reactions ,agglutination reactions
 - 3.3. Immunotechniques -Detection of molecules using ELISA, RIA, Western Blot, Immunoprecipitation, Immunofluorescence microscopy, Flowcytometry.
- 4. Generation of B Cell & T cell response (12 hrs)**
 - 4.1. Humoral & Cell mediated response

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- 4.2. B & T cell receptors and CD3 Complex
- 4.3. Properties of B cell & T cell Epitopes
- 4.4. Activation and differentiation of B and T cells

5. Immune effector Mechanisms (12 hrs)

- 5.1. Cytokines & Antagonists
- 5.2. Compliment System-components & functions
- 5.3. Compliment activation and regulations(classical ,alternate and lectin pathways)
- 5.4. Toll –like receptors
- 5.5. Cell mediated effector functions
- 5.6. Inflammation & hypersensitivity

6. Major Histocompatibility Complex (MHC) (10 hrs)

- 6.1. General organisation and inheritance of MHC
- 6.2. MHC genes & molecules
- 6.3. Cellular distribution of MHC molecules
- 6.4. Antigen processing and presentation –Endogenous and Exogenous pathways.
Presentation of non peptide bacterial antigens.

7. Immune system in Health and Diseases (20 hrs)

- 7.1. Immune responses during bacterial (Tuberculosis) parasitic (malaria) and viral (HIV) infections.
- 7.2. Autoimmune diseases (organ specific and systemic)
- 7.3. Primary Immunodeficiency diseases(Bruton’s disease, Di-george Syndrome & Severe combined immunodeficiency (SCID)
- 7.4. Secondary immunodeficiency Diseases (AIDS). Orgin,means of infection, course of infection, structure and types of HIV, viral multiplication, mutation, diagnosis, antiretroviral therapy and AIDS vaccine.
- 7.5. Vaccines –Recombinant Vector, DNA vaccines, synthetic peptide vaccines and multivalent vaccines

References:

1. Adul K Abbas and Andrew H Lichtman (2003).Cellular and Molecular Immunity (fifth edition).Elsevier Science,USA.
2. Carpenter. Immunology and Serology
3. Das Gupta, Modern Immunology
4. Godkar, P.B. (1998): A Text Book of Medical Laboratory Technology, Bhalani Bhalani Publishing House Mumbai
5. Hay & Hudson -Practical Immunology.
6. Janis Kuby (1997): Immunology. WH Freeman,New York
7. Joshi. K. R and Osamo N.O (1994). Immunology.Agro Bios Publishers,Jodhpurr
8. Peter Parham (2004).The immune System (2nd Edition), Garlands, New York

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9. Roit, Essentials of Immunology.
10. Shetty. N (1993) Immunology Wiley Eastern Ltd, New Delhi
11. Weir-Hand book of Experimental Immunology(Volume 1,2&3).

ZO 4 CT 11- MICROBIOLOGY & BIOTECHNOLOGY (90 hours)

Part-A-MICROBIOLOGY (45 Hours)

- 1. Introduction- (3 Hrs)**
 - 1.1 History and scope of microbiology
 - 1.2 Spontaneous generation concept
 - 1.3 Recognition of the role of microbes in diseases
 - 1.4 Composition of the microbial world
 - 1.5 Turning points in microbial research
 - 1.6 Microorganisms and the evolution of the earth
 - 1.7 Modern age of micro biology

- 2. Microbial Taxonomy and Phylogeny (4 Hrs)**
 - 2.1. Major characteristics (classic and molecular)
 - 2.2. Numerical taxonomy
 - 2.3. Taxonomic ranks
 - 2.4. Phylogenetic studies
 - 2.5. Phenetic classification
 - 2.6. Bergey's Manuel (mention major groups)

- 3. Bacterial cell structure and function (6 hrs)**
 - 3.2. Plasma membrane and internal system - Cytometrix, inclusions, ribosomes, nucleoid
 - 3.3. Bacterial cell wall Peptidoglycan - structure-
 - 3.4. Gram positive and gram negative cell wall- Mechanism of gram staining
 - 3.5. Components external to cell wall; pili and fimbriae, capsule and slime layers, Flagella and motility

- 4. Microbial nutrition (3 hrs)**
 - 4.1. Nutritional requirements,
 - 4.2. Nutritional types (Auto, Hetero, Chemo, Phototrophs & obligate parasites)
 - 4.3. Culture media and types of media-Mixed microbial population and pure cultures

- 5. Microbial growth (5 hrs)**
 - 5.1. Growth curve -synchronous growth
 - 5.2. Continuous culture
 - 5.3. Influence of environmental factors on growth
 - 5.4. Measurement of growth
 - 5.5. Measurement of cell numbers- Petroff, Hassuer counting Chamber, Spread plate and pour plate techniques
 - 5.6. Measurement of cell mass-Turbidity and microbial mass measurements

- 6. Utilization of energy (4 hrs)**
 - 6.1. Biosynthetic process-peptidoglycan synthesis, amino acid synthesis, Non synthetic processes -Bacterial motility and transport of nutrients

- 7. Viruses (4 hrs)**
7.1. General structural properties
7.2. Types: DNA viruses, RNA viruses, and enveloped viruses
- 8. Microbial diseases (4 hrs)**
8.1. Human diseases caused by bacteria- Streptococcal diseases, Typhoid, Cholera, tetanus, Leprosy, tuberculosis and Pneumonia.
8.2. Human diseases caused by viruses- AIDS, Small pox, Rabies, Measles, Swine Flu, Bird flu, SARS
8.3. Fungal diseases- Candidiasis
- 9. Control of microorganisms (5 hrs)**
9.1. Disinfectants; A - physical- Heat, filtration and radiation
B-Chemical agents - Phenol and Phenolic compounds, alcohols, halogens and aldehydes.
9.2. Antibiotics- Penicillin's, Cephalosporins, Chloramphenicol, Tetracyclines
9.3. Microbial drug resistance
- 10. Microbial fermentation (4 hrs)**
10.1. Lactic fermentation Homolactic and heterolactic fermenters, Mention dairy products ,cheese, Yogurt, kefir etc
10.2. Alcoholic fermentation-Alcoholic beverages
- 11. Environmental microbiology (3 hrs)**
11.1. Aquatic microbes
11.2. Microbiological analysis of drinking water
11.3. Waste water- microbial characteristics and treatment
11.4. Microbial Bioremediation
11.5. Biogas plants.

Part-B-BIOTECHNOLOGY (45 Hrs)

- 1. Introduction (1 hr)**
Definition, branches, scope and importance
- 2. Genetic engineering (4 hrs)**
2.1. Cloning vectors –
2.1.1. Properties of a good cloning vector
2.1.2. Types - plasmids (pBR322, pBR 327, pUC); phages (lambda phage, M13);
cosmids, Phagemids, viruses, BAC, YAC and MAC.
2.2. Shuttle vectors and expression vectors
2.3. Enzymes for r DNA technology- Restriction enzymes and ligases
- 3. Different steps involved in *in vivo* cloning (3hrs)**
3.1. Construction of chimeric DNA (Blunt end ligation, cohesive end ligation,
homopolymer tailing, use of linkers)
3.2. Selection of transformed cells –blue white selection method, colony hybridization,

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Plaque hybridization

- 3.3. Amplification – Multiplication, Expression and integration of the DNA insert in host genome

4. Molecular probes (2 hrs)

- 4.1. Production
4.2. Labelling
4.3. Applications

5. Genomic and cDNA library (4 hrs)

- 5.1. Construction
5.2. Screening –By DNA hybridization, Screening by immunological assay, and screening by protein activity.(Refer unit 4-Molecular Biotechnology by Glick and Pasternak-ASM press)
5.3. Blotting techniques- Southern blot, Northern blot, Western blot, Dot blot and Slot blot, FISH and GISH, Chromosome walking

6. Polymerase Chain Reaction (2 hrs)

- 6.1. Basic PCR – raw materials and steps involved
6.2. Inverse PCR, Anchored PCR, Asymmetric PCR, PCR for mutagenesis and Real Time PCR
6.3. Applications of PCR in Biotechnology and genetic engineering

7. Molecular markers (brief notes) (3 hrs)

- 7.1. RFLP
7.2. AFLP
7.3. RAPD
7.4. Minisatellites (VNTR)
7.5. Microsatellites (SSR)
7.6. SNPs



8. Isolation, sequencing and synthesis of genes (3 hrs)

- 8.1. Isolation (for specific proteins and tissue specific proteins)
8.2. DNA sequencing –
Maxam and Gilbert's chemical degradation method,
Sanger's dideoxynucleotide synthetic method
8.3. Synthesis of gene-Chemical synthesis of tRNA gene,
Synthesis of gene from mRNA, Gene synthesis machines

9. Transfection methods and transgenic animals (3 hrs)

- 9.1. Definition, Methods - Electroporation, DNA micro injection, Calcium phosphate precipitation, Dextran mediated transfer, shot gun method, virus mediated, lipofection method, engineered embryonic stem cell method
9.2. Transgenic animals for human welfare

10. Biotechnology - Animal and human health care (3 hrs)

- 10.1. Vaccines
10.2. Disease diagnosis
10.3. Gene therapy
10.4. Transplantation of bone marrow, artificial skin,
10.5. Antenatal diagnosis

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10.6. DNA finger printing

10.7. Forensic medicine

11. *In vitro* fertilization (2 hrs)

11.1. *In vitro* fertilization and embryo transfer in human

11.2. *In vitro* fertilization and embryo transfer in live stock

12. Animal cell and tissue culture (3 hrs)

12.1. Culture media – natural and artificial

12.2. Culture methods – primary explantation techniques, various methods of cell and tissue culture

12.3. Tissue and organ culture

13. Gene Silencing techniques (2 hrs)

13.1. Antisense RNA

13.2. RNAi

13.3. Gene knockouts

14. Cloning- (2 hrs)

14.1. Cloning procedures (adult DNA cloning, Therapeutic cloning, Embryo cloning) –

14.2. Advantages and disadvantages of cloning

15. Environmental biotechnology (3 hrs)

15.1. Pollution control – cleaner technologies, toxic site reclamation, removal of oil spill, reducing of pesticides and fertilizers, biosensors, biomonitoring.

15.2. Restoration of degraded lands - reforestation using micro propagation, development of stress tolerant plants

16. Intellectual property rights (2 hr)

16.1. Intellectual property protection,

16.2. Patents, copy right, trade secrets, trademarks

16.3. GATT and TRIPS, patenting of biological materials,

16.4. International co-operation, obligation with patent applications, implications of patenting-current issues

17. The ethical and social implications - (2 hrs)

17.1. Ethics of Genetic engineering - Social impacts - Human safety-Virus resistant plants- Animals and ethics-

17.2. Release of GEOs-Use of herbicide resistant plants-Human genome alterations by biotechnology

17.3. Social acceptance of biotechnology-Transgenic crops - Social acceptance of medical biotechnology- Acceptance of GM crops for food and pharmaceutical production, Social acceptance of Industrial biotechnology

References:

1. Alphey - DNA sequencing-Bios Scientific publishers-
2. Bernard R. Glick & Jack J. Pasternak-Molecular Biotechnology-Principles and applications of recombinant DNA- ASM press Washington D.C.
3. Charles Hardin (2008): Cloning, Gene expression, and Protein purification- Experimental procedures and process rationale - Oxford University Press.

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4. Chatterji, A.K. -Introduction to environmental biotechnology-Prentice Hall of India
5. Colin Ratledge and Bjorn Kristiasen-Basic Biotechnology - Cambridge University press.
6. Dominic, W.C. Wong-The ABCs of gene cloning-Springer international edition
7. Dubey, R.C. -A text book of biotechnology-S. Chand & Co.
8. Gupta. P.K. -Elements of biotechnology-Rastogi publications.
9. Singh, B.D.-Biotechnology-Kalyani publishers.
10. Sobti, R.C. & Suparna, S .Pachauri-Essentials of Biotechnology-Ane Books Pvt.Ltd.
11. Wilson & Walker (2008): Principles and techniques of Biochemistry and Molecular biology- Cambridge low price editions.

Part- Microbiology

12. Gandhi-Microbiology and Immunology notes and cases-Blackwell publishing
13. Hans G. Schlegel (2008): General Microbiology-Cambridge low price editions
14. Kanika Sharma-Manual of microbiology tools and techniques-Ane's student edition-Ane books Pvt. Ltd
15. Monica Cheesbrough - District laboratory practice in tropical countries, Part I and II - Cambridge low price editions
16. Mansi- Fermentation, Microbiology and Biotechnology-Taylor and Francis
17. Pelczar, M.J, Reid, R.D. & Chan, E.C.S-Microbiology-TMH edition
18. Prescott, Harley and Klein- Microbiology, IVth ed. McGraw-Hill
19. Rao, A.S.-Introduction to microbiology-Prentice Hall of India.
20. Tortora, Funke and Case - Microbiology : An Introduction Eight edition- pearson education, Veerbala Rastogi-Fundamentals of Molecular biology-Ane books
21. Wise-Bioinstrumentation and Biosensors-Taylor and Francis.

ELECTIVE COURSE-ENTOMOLOGY-III

ZO 4 ET 12- AGRICULTURAL & MEDICAL ENTOMOLOGY, PRINCIPLES OF INSECT PEST MANAGEMENT AND TOXICOLOGY (90 Hours)

1. Insect pests

(10 hrs)

- 1.1. Types of damage to plants by insects
(Injury by chewing insects, piercing and sucking insects, internal feeders, subterranean insects, to stored products and indirect effect of feeding)
- 1.2. Classification of insect pests
(Regular pests, Occasional pests, Seasonal pests, persistent pests, sporadic pests, major pests, minor pests, potential pests, key pests)
- 1.3. Causes for insect assuming pest status
- 1.4. Concepts of Economic levels, Economic injury levels, Economic threshold level
- 1.5. Pest surveillance and forecasting pest outbreak
- 1.6. Estimation of damage caused by insects to crops

2. Insect pests of crops

(20 hrs)

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2.1. Identification, Life history, damage and control of major pests of

2.1.1. Paddy (17 major pests including stem borers, army worm, rice thrips, gall midge, mealy bug, BPH, green & white leaf hoppers, rice caseworm, rice leaf roller, rice hispa, rice earhead bug, root weevil, rice grass hoppers)

2.1.2. Sugarcane (Major pests including shoot, internode & top borers, white grub, leaf hopper, sugarcane scale, mealy bug, whiteflies, Termites, Black winged bug)

2.1.3. Cotton (Major pests - Aphid, leaf hopper, thrips, whitefly, Pink, spotted and American boll worms, stem weevil, Red and Dusky cotton bugs, leaf roller)

2.1.4. Coconut (7 pests - Rhinoceros beetle, red palm weevil, black-headed caterpillar, white grub, Scale insect, Lace wing bug, coconut skipper)

2.1.5. Pulses (8 pests - Gram pod borer, plume moth, red gram pod fly, pod borer, spotted pod borer, Blue butterflies, bean aphid, white fly)

2.1.6. Common vegetables

2.1.6.1. Brinjal (shoot & fruit borer, stem borer, spotted leaf beetle, grey weevil, Pumbkin beetle)

2.1.6.2. Tomato (serpentine leaf miner, fruit borer)

2.1.6.3. Gourds (fruiflies, snake gourd semilooper, spotted beetle, Pumbkin beetle)

2.1.6.4. Bhendi(Earias, leaf hopper, Red cotton bug, Grampod borer)

2.1.6.5. Cruciferous vegetables (diamond black moth, cabbage borer, leaf webber, Cabbage green semilooper, Cabbage aphid)

2.1.7. Fruit trees

2.1.7.1. Mango (hopper, flower webber, Leaf webber, gall midges, Nut weevil, stem borer, red tree ant)

2.1.7.2. Cashew (tree borers, Hairy caterpillar, Tea mosquito bug, Apoderus, leaf miner)

2.1.7.3. Banana (rhizome weevil, banana aphid, spittle bug)

2.1.7.4. Citrus(Fruit sucking moth, citrus butterfly)

2.1.1. Spices

2.1.1.1. Pepper (pollu beetle, shoot borer, Marginal gall thrips)

2.1.7.5. Cardamom (cardamom thrips, rhizome borer, cardamom whitefly, hairy caterpillars, *Eupteroteand pericallia*)

2.1.7.6. Turmeric and Ginger (Leaf roller, shoot borer)

2.2. Identification, nature of damage & control of insect pests of stored products: rice weevil, sweet potato weevil, lesser grain borer, tobacco beetle, drug store beetle, pulse beetle, Angoumois grain moth, potato tuber moth, Red flour beetle, rice moth)

3. Medical entomology

(10 hrs)

- 3.1. Identification, nature of attack & control of Insect pests of domestic animals
 - 3.1.1. Cattle (any five pests)
 - 3.1.2. Fowl (any three pests)
 - 3.1.3. Sheep & Goat (any two pests)
- 3.2. Systematics and biology of major arthropod vectors of human diseases belonging to Diptera, Anoplura, Siphonaptera - Control of vectors

4. Principles of Insect pest management

(15 hrs)

Ecology based pest management

- 4.1. Prophylactic methods
- 4.2. Curative or direct methods
 - 4.2.1. Cultural methods
 - 4.2.2. Mechanical methods
 - 4.2.3. Physical methods
 - 4.2.4. Legal methods
 - 4.2.5. Biological control-
 - 4.2.5.1. History of biological control, ecological basis of biological control
 - 4.2.5.2. Natural enemies (Parasites, Parasitoids, Predators), Feasibility of biocontrol,
 - 4.2.5.3. Applied biological control (Conservation and enhancement, Importation and colonization, Mass culture and release)
 - 4.2.5.4. Importance of systematics, Advantages and disadvantages
 - 4.2.5.5. Important biocontrol projects undertaken in India by employing Parasites and predators
- 4.2. Autocidal control - Sterile male technique and other methods, Chemosterilants, Methods of sterilization, Application, Dynamics, Advantages and disadvantages Examples of autocidal control)
- 4.3. Insect growth regulators (IGRs) – Brief note on Insect growth hormones and mimics (JH mimic & ecdysone agonists) and chitin synthesis inhibitors as insect control agents
- 4.4. Behavioural (pheromonal) control (Brief note on Trail, Alarm, Aggregation and sex pheromones and the behaviour produced, Mode of application, Pest management with pheromones, Advantages and disadvantages, Examples
- 4.5. Insect attractants: definition, types of attractants, applications in insect pest management, examples, advantages and disadvantages
- 4.6. Insect repellents: definition, desirable features of good repellent, types of repellents, applications in insect pest management, examples, advantages and disadvantages
- 4.7. Insect antifeedants: definition, examples, applications in insect pest management,

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advantages and disadvantages

48. Microbial control of crop pests by employing Bacteria, Virus and Fungi - Classification of entomophagous Bacteria, Virus, Fungi, Mode of action, formulation, Application, Examples
49. Integrated Pest Management- Definition, IPM in Agroecosystem, Kinds of pest, (Key pests, Occasional pests, Potential pests, Migrant pests) Establishing the need to take action, Guidelines for developing IPM, Tactics in IPM, IPM of Rice

5: Chemical Control

(20 hrs)

- 5.1. Insecticide formulation (Brief note on Emulsifiable concentrates, Water-miscible liquids, Wettable powders, Water soluble powders, Oil solutions, Flowable powders, Aerosoles, Granulars, Fumigants, Ultra-low volume concentrates, Fogging concentrates, Dusts, Poison baits and Slow release insecticides)
- 5.2. Classification of insecticides
 - 5.2.1. Based on mode of entry
 - 5.2.2. Based on mode of action
 - 5.2.3. Based on chemical nature
- 5.3. Chemistry, toxicology & mode of action of following class of insecticides; mention examples for each class
 - 5.3.1. Synthetic Organic compounds
 - 5.3.1.1. Organochlorine insecticides
 - 5.3.1.1.1. DDT
 - 5.3.1.1.2. BHC
 - 5.3.1.1.3. Cyclodiene group (special reference to endosulfan; examples: heptachlor, aldrin)
 - 5.3.1.2. Organophosphorous insecticides (examples: TEPP, Dichloros, monocrotophos, parathion)
 - 5.3.1.3. Carbamates (special mention of carbofuran; examples: Carbaryl, arprocarb)
 - 5.4. Inorganic compounds as insecticides - arsenic compounds, fluorides, sulphur compounds
 - 5.5. Fumigants – definition, examples, methods of fumigation, hazards of fumigation, advantages and precautions
 - 5.6. Botanical insecticides- chemical properties, mode of action and toxicity of the following : Nicotine, Rotenone, Pyrethrum and Neem
 - 5.7. Synthetic pyrethroids – definition, uses as insecticides, mode of action (examples: Pyrethrin, allethrin)
 - 5.8. Insecticide synergists – definition, types of synergism, mode of action & examples

6. Insecticide Application Technology

(5 hrs)

- 6.1. Dusting and dusters -

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6.2. Spraying and sprayers – syringes, knapsack sprayers, foot pump-sprayers, rocker sprayer, pneumatic hand sprayers, pneumatic knapsack sprayers, hand atomizer, hydraulic sprayers

6.3. Aerosols

6.4. Other equipments (mist blower, fog generators, smoke generators, aerosol bombs)

7. Insecticides and Environment


(10 hrs)

7.1. Insecticide resistance -Genetic, Physiological and biochemical mechanism

7.2. Pesticides and the environment- its impact on wildlife and human health

7.3. Microbial and environmental degradation of pesticides

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19. Pradhan, S. (1969), Insect pests of Crops, National Book Trust, New Delhi.
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21. Srivastava, K.P. (1996): A Text Book of applied Entomology Vol.1, Kalyani publishers.
22. Vasantharaj David and Kumaraswami, Hand Book of Economoc Zoology.
23. Wilkinson, C.F. (1976): Insecticide Biochemistry and Physiology – Plenum Press N.Y.

ELECTIVE COURSE: ENVIRONMENTAL BIOLOGY-III

ZO 4 ET 12 - ENVIRONMENTAL CONSERVATION (90 Hours)

1. Habitat Conservation (25 hrs)

- 1.1. Forest Ecology
 - 1.1.1. Major vegetation types - dry and moist deciduous, semi evergreen, evergreen, and montane evergreen forests
 - 1.1.2. Tropical rain forests; geography, climate; precipitation; features of plants-leaves, root, bark.
 - 1.1.3. Shola forests (Cloud forests) ; global distribution; fog precipitation; cloud stripping; water shed function; fauna; vegetation.
 - 1.1.4. Montane shola grass land matrix
 - 1.1.5. Mangroves
- 1.2. Deforestation and its consequences
 - 1.2.1. Need for scientific management and conservation of forests
 - 1.2.2- Social forestry and agro forestry
- 1.3. Habitat destruction, Fragmentation and Degradation causes and consequences
- 1.4. Wetlands and waterfowl conservation
 - 1.4.1. Ramsar convention aims and objectives, Ramsar sites in Kerala
 - 1.4.2. Coastal zone management
 - 1.4.2.1. Special features of CRZ
 - 1.4.2.2. Coastal Zone Management plan and its objectives
 - 1.4.2.3. Categorization of the Coastal Zone; ‘Setback line’: Coastal Zone Management
 - 1.4.3. Indicative list of ecologically sensitive areas (ESA)
 - 1.4.3. Coral reefs: list of major coral reefs; conservation problems
 - 1.4.4. Ocean acidification; Ocean Warming and Coral Bleaching;
 - 1.4.5. Coral tourism; water pollution; sedimentation; coral mining;

2. Biodiversity conservation (40 hrs)

- 2.1. The richness of biodiversity
- 2.2. The importance of biodiversity (Direct and indirect values)
- 2.3. Reasons for high species diversity in the tropics.

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- 2.4. Biodiversity of India
- 2.5. The threatened biodiversity with special reference to critically endangered vertebrates from India.
- 2.6. Loss of biological diversity and Causes of extinction.
- 2.7. Endemism
- 2.8. Keystone species and Keystone resources–
- 2.10. Exotic species introductions, invasive species, disease and over exploitations
- 2.11. Global hotspots - hotspots in India,- Western ghats and Sreelanka, Indo Burma, and Eastern Himalayas.
- 2.12. Biological control and Integrated Pest Management.
- 2.13. Organic farming and its importance

3. Strategies of conservation

- 3.1. Concept of minimum viable area and minimum viable population
- 3.2. National Parks, aims and objectives -Briefly mention the important national parks in India with special reference to Kerala (Eravikulam, Silent valley, Mathikettan chola, Anamudi chola and Pambadum chola National parks from Kerala)
- 3.3. Sanctuaries-Major sanctuaries in India and mention the sanctuaries in Kerala.
- 3.4. Biosphere Reserves –Their aims and objectives, briefly mention them-with special reference to Kerala
- 3.5. Conservation strategies at the global level-Role of World conservation union, CITES, WWF and other international conventions and protocols
- 3.6. IUCN categories of threatened animals and red data book.
- 3.7. Wildlife management in India; Role of Government and non governmental agencies. Briefly mention wildlife protection act 1972 and its amendments and schedules
- 3.8. Endangered species -strategies of conservation with special reference to India - Project Tiger, Project Elephant, Project hangul, Operation Rhino. Crocodile breeding project, Project Sangai, Gir lion project, Himalayan Musk deer project.
- 3.9. Ex situ conservation -Zoo, Aquarium, Seed bank, Gene bank, Pollen bank, etc-
- 3.10. In situ conservation.- National parks, sanctuaries, Biosphere reserves, Community reserves and other protected areas.
- 3.11. Traditional Ecological Knowledge (TEK)-
 - 3.11.1. Introduction and need for its conservation
 - 3.11.2. Economic benefits
 - 3.11.3. Social implications-sacred groves, sacred landscape, sacred species
 - 3.11.4. TEK and sustainable development.

4. Environmental Impact

(25 Hrs)

- 4.1. Aims and uses of preparing Environmental Impact Statement (EIS)
- 4.2. Aims and objectives of Environmental Impact Assessment (EIA),
- 4.3. Environmental management systems-ISO-14000 standards
- 4.4. Cost benefit analysis of environmental protection incorporating, environmental costs and benefits of designing projects.
- 4.5. Development and displacement of rural communities, ethical and socio - economic problems, Disappearing culture and traditions, Impact on environment. Urban environment and new problems.
- 4.6. Ecotourism - Importance of Ecotourism, visitor impact, visitor management, control and safety rules – threats to local culture, ecolodges. Economic & Ecological effects of ecotourism

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- 4.7. Restoration of ecology and degraded rural landscape- Illustrate with case studies from India.
- 4.8. Environmental protection movements – Global, national, and local, historical, present social pressure group agencies like green, and Chipco movement, Narmada Bachao

References:

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2. Alan Beebi & Ann Maria-First Ecology-2006-Oxford university press
3. Ananthkrishnan, T.N. - Bioresource Ecology- Oxford and IBH.
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5. Bandopatyaya Jaya J. et al- Indian environment Crises and response- Natraj publishers Dehradun
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12. Emlen, J.M. Population biology. The co- evolution of population dynamics and behaviour-Mac Millan publishing company New York
13. Irewarth Horn, An introduction to climate- Mc Graw-Hill
14. Jain R.A.- Environmental Impact Analysis- Academic Press
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17. Odum H. T. System ecology, an Introduction- John Wilsy & Sons, New York.
18. Owen O. S. Natural resources conservation, An Ecological Approach- Mac Millan.
19. Ramakrishnan, P.S.-Ecology and sustainable development-National book trust India
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21. Puri *et al.*- Forest Ecology- Oxford university press
22. Raymond Dasman- Environmental Conservation- John Wiley
23. Sagrayia, K.P. – Forest and Forestry- National Book Trust, New Delhi
24. Smith R.I. Elements of ecology- Harper and Row publishers, New York.
25. Turk and Turk-Environmental Science- Saunders College Publishing

ELECTIVE COURSE - FISHERY BIOLOGY – III

ZO 4 ET 12 – HARVESTING, POST HARVESTING TECHNOLOGY AND

PART-I. HARVESTING

1. Commercial fishing method (1 hr)

- 1.2. Brief history of commercial fishing
- 1.3. Introduction to materials for construction of nets and ropes

2. Crafts and gears for harvesting (21 hrs)

- 2.1. Towed or dragged gear
 - 21.1. Bottom trawling
 - 21.2. Beam trawl
 - 21.3. Otter trawl
 - 21.4. Side trawling
 - 21.5. Stern trawling
 - 21.6. Bottom pair trawling
 - 21.7. Mid water (pelagic) trawling
 - 21.8. Targeted and selective trawling
 - 21.9. Turtle excluder device (TED)
 - 21.10. Dredging
- 2.2. Encircling gear
 - 22.1. Beach seining
 - 22.2. Purse seining
 - 22.3. Seine nesting
- 2.3. Static gear
 - 23.1. Gill nets
 - 23.2. Trap nets
 - 23.3. Long lines
 - 23.4. Pots and traps
- 2.4. Other gears
 - 24.1. Squid jigging
 - 24.2. Net fishing
 - 24.3. Harpooning
- 2.5. Fish aggregating devices (FAD)
- 2.6. Echo-sounder and sonar
- 2.7. Catch per unit effort and economic consideration of vessel operations
- 2.8. Onboard handling and processing



Part-II- POST HARVEST TECHNOLOGY

3. Chemical composition of fish (2 hrs)

- 3.1. Chemical composition of fish muscle
- 3.2. Significance of proteins and lipids
- 3.3. Nutritive value of fish muscle over red meat

4. Post-mortem changes in fish muscle (4 hrs)

- 4.1. Pre-rigor mortis and post mortem changes
- 4.2. Physical and biochemical changes associated with the post mortem changes
- 4.3. Importance of post mortem changes in fish processing

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4.4. Problems associated with post mortem changes and solutions

5. Fish spoilage mechanisms (4 hrs)

- 5.1. Microbial spoilage
- 5.2. Enzymatic spoilage
- 5.3. Biochemical spoilage

6. Handling of fresh fish (3 hrs)

- 6.1. Icing and icing methods
- 6.2. Different types of ice - block ice, flake ice and dry ice
- 6.3. Handling - on board chilling and use of refrigerated sea water (RSW)
- 6.4. Fish landing platforms
- 6.5. Hygienic handling of fish on board and on shore

7. Methods (Techniques) of processing/preservation and their products (10 hrs)

- 7.1. Drying
- 7.2. Salting
- 7.3. Smoking
- 7.4. Freezing - plate freezers, blast freezers and individual quick freezing (IQF)
- 7.5. Battered and breaded products
- 7.6. Accelerated freeze drying (AFD)
- 7.7. Immersion freezing and cryogenic freezing
- 7.8. Canning
- 7.9. Irradiation
- 7.10. Assessment of capacity of plate, blast and IQF freezers

8. Processing of shrimps (3 hrs)

- 8.1. Commercially important prawns and shrimps of India
- 8.2. Pre-processing of prawns and shrimps into different varieties - peeled and devined (PD), peeled and undevined (PUD), head-less shrimps (HI), head on shrimps (HON)
- 8.3. Grades of shrimps
- 8.4. Cooked shrimps
- 8.5. IQF shrimp

8.6. Processing of lobsters (3 hrs) **Commercially important lobsters of India**

- 8.7. Pre and processing lobsters into different varieties of products
- 8.8. Grades of packing

9. Processing of cephalopods (3 hrs)

- 9.1. Commercially important cephalopods (squids and cuttlefish) of India
- 9.2. Pre-processing of cephalopods into different varieties
- 9.3. Grades of packing

10. Processing of fish (4 hrs)

- 10.1. Commercially important fishes of India
- 10.2. Fish filleting
- 10.3. Surimi
- 10.4. IWP products, grades for fish products

11. Fishery by-products (9 hrs)

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- 11.1. Body oil, liver oil and sauces
- 11.2. Shark fins, fin rays, fish maws/isinglass
- 11.3. Fish silage, chitin and chitosan
- 11.4. Fermented fishery products

12. Fish processing plant and cold storage (2 hr)

- 12.1. The pre-processing and processing plant, cold storage - general conditions relating to premises building, equipment, general conditions of hygienic of plant and workers, conditions of storage of frozen products
- 12.2. Requirements for registration with MPEDA, approval of processing plant by FIA allotment code

13. Quality control (7 hrs)

- 13.1. Fundamental aspects of quality
- 13.2. Major quality problems in sea foods
- 13.3. Quality of water and ice-chlorination and use of UV rays
- 13.4. Microbiology
- 13.5. Microbial hazards of sea foods - *E. coli*, *Salmonella*, *V. cholerae*, *Staphylococcus*
- 13.6. Inspection systems
- 13.7. Brief introduction to the quality control concepts of HACCP, ISO and IQM (total quality management)

14. Packing and export of seafood (4 hrs)

- 14.1. Methods of packing of various sea food products for export
- 14.2. Identification marks
- 14.3. In house stuffing and transport in refrigerated containers

15. Fishery education, research, development and export promotion agencies (3 hrs)

- 15.1. Objectives and activities of the following institutions (very brief) – CIFT, CMFRI, CIRNET, NIO, FSI, CIBA, FIA, MPEDA
- 15.2. Objectives of fishery extension
- 15.3. Qualities for fishery extension workers
- 15.4. Organizations of extension programs

Part- III- FISHERY MANAGEMENT AND INTERNATIONAL MARKETING

16. Fishery management (2 hrs)

- 16.1. Marketing of fish in India
- 16.2. Fisherman and fisherman co-operatives

17. International marketing (4 hrs)

- 17.1. Scope and importance
- 17.2. Major sea food products and markets of India
- 17.3. Documents required for export - letter of credit, invoice, bill of landing etc
- 17.4. Buyers and buyers agents
 - 17.4.1. Trade promotion
 - 17.4.2. Role of trade promotion offices and embassies
 - 17.4.3. Seafood trade fairs
 - 17.4.4. Trade promotion visits
 - 17.4.5. Value added products and its marketing

ELECTIVE COURSE - HUMAN GENETICS-III

ZO 4 ET 12- CANCER GENETICS AND GENETIC SERVICES (90 Hours)

1. Cancer Genetics

(30 hrs)

- 1.1. Genetic basis of cancer: Neoplasms, Tumorigenesis, Apoptosis
Classification, diagnosis, prognosis, treatment
- 1.2. Oncogene families: Cancer causing genes, Tumor suppresser genes, Proto-oncogene
DNA repair gene. Mechanism of Oncogene expression, over expression of Oncogene,
cellular Oncogene producers.
- 1.3. Leukemia- ALL, CLL, AML, CML, Philadelphia chromosome, bcr-abl gene fusion,
PML- RARA gene fusion
- 1.4. Solid tumours: Breast cancer, prostate cancer, retinoblastoma, osteosarcoma,
Two hit hypothesis
- 1.5. Reticulo-endothelial system: lymphomas- Burkitt, Non-
Hodgkin lymphoma, Multiple myeloma. Telomeres and Telomerases-
Introduction and function of telomeres
and telomerases, involved in DNA repair and damage.
variation of telomere length, genetic disorders and telomeres (Progeria, Ataxia telangiectasia)
- 1.6. Genomic instability and cancer
variation rates in normal and neoplastic cells, mutation and genomic instability, common DNA damaging agents
(environmental, chemical, physical, biological).
therapy and mechanism of anticancer drugs.

2. Genetic Counseling

(15 hrs)

- 2.1 Definition
- 2.2 Indication for genetic counseling
- 2.3 Steps in genetic counseling
- 2.4 Premarital genetic counseling
- 2.5 Psychological aspects of genetic counseling
- 2.6 Special considerations in genetic counseling
- 2.7 Pre-natal counseling
- 2.8 Population screening

3. Genetic engineering

(10 hrs)

- 3.1. Introduction
- 3.2. Molecular tools of genetic engineering
- 3.3. Vectors- methods of gene transfer
- 3.4. Gene cloning strategies- DNA amplification, Gene libraries, site directed
mutagenesis and protein engineering- manipulation of gene expression in host cells
- 3.5. Basic techniques in genetic engineering
- 3.6. Agarose gel electrophoresis, Counter clamped homogenous electric field,
electrophoresis (CHEF), PAGE, SDS – PAGE

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4. Gene Mapping and cloning 5 Hrs

- 4.1. Physical mapping, gene mapping, linkage analysis, recombination frequencies, LOD score, linkage equilibrium, linkage disequilibrium
- 4.2. Human Genome Project: Objectives, achievements and applications
Positional cloning, Sequence tagged sites, Genomic library.
- 4.3. Chromosome walking, chromosome jumping

5. Ethics hrs)

(10

- 5.1. Medical ethics in India and Abroad
- 5.2. Organ banks, human cloning, genetic registries,
- 5.3. IVF ethics
- 5.4. PND act, MTP act
- 5.5. ELSI of genetics

6 Immunogenetics

(5 hrs)

- 6.1. Major Histocompatibility Complexes
General organization of MHC and disease association
- 6.2. Blood group system- Genetics of ABO and Rh factor, Rh incompatibility
- 6.3. Immune system in health and diseases-Immune response to infectious disease, Primary and secondary deficiencies, autoimmunity, SCID, Wiskott Aldrich syndrome, Agamaglobulinemia.

7. Radiation Genetics hrs)

(5

- 7.1. Biological effect of radiation, dosimetry
- 7.2. Radiation sensitizers, radio protectors and other factors. Radiation protection – radiation safety, maximum permissible doses. Clinical applications of radiation biology – in therapeutic radiology, diagnostic radiology and nuclear medicine.

8. Population Genetics hrs)

(10

- 8.1. Twin studies
- 8.2. Dermatoglyphics- qualitative and quantitative parameters
Dermatoglyphics in medical disorders
- 8.3. Epidemiology- descriptive and analytical methods
- 8.4. Hardy Weinberg equilibrium- Properties of equilibrium populations
Selection favoring and against heterozygotes
- 8.5. Non random mating in human populations- consequences of inbreeding, genetic load

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14. Sambrook, J. *et al* (2000): Molecular Cloning – A Laboratory Manual Cold-Spring Harbor Lab Press
15. Stefan Suzycki (2003): Human Molecular Biology-A Laboratory Manual Black Well Publishing Company.
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18. Venitt, S and Parry, J.M. (1984): Mutagenicity testing- A practical approach, IRL Press
19. Xion Jin: Essential Bioinformatics

ELECTIVE COURSE: WILDLIFE BIOLOGY - II

ZO 4 ET 12- WILDLIFE MANAGEMENT (90 Hours)

1. **Wildlife Management** (5 hrs)
 - 1 **Concepts and Principles**
 - 2 **Policies and laws in wildlife management**

2. **Habitat and management** (18 hrs)
 - 2.1. Components of habitat (Physical and Biological), Mention different types of habitats.
 - 2.2. Habitat Evaluation Procedures (HEP).
 - 2.3. Habitat Suitability Index (HSI)
 - 2.4. Environmental Impact Assessment (EIA).
 - 2.5. Concept of herbivory, frugivory and carnivory (predation).
 - 2.6. Food selection and patterns of habitat utilization.
 - 2.7. Forest and fire: Impacts of fire on vegetation succession, effects of fire on soil, forest development and wildlife, Fire prevention, fire detected system, fire control and suppression procedures in India and developed nations.
 - 2.8. Impacts of pollution on forest and wildlife, Environmental sanitation.

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2.9 Vegetation profile: Techniques for estimation of plant abundance, frequency, dominance and importance value index, Preparation of vegetation profile, various techniques for assessment of vegetation cover

3. Wildlife population estimation (12 hrs)

- 3.1. Direct Count: - Total count, Drive count, Time area counts and transect count
Indirect Count: - Call count, Track count and Pellet count/dung count
- 3.2. Abundance estimation techniques for mammals, birds, reptiles and amphibians.
- 3.3. Capturing and Marking Techniques: - Live trapping of birds and Mammals, Chemical immobilization, methods of marking captured birds and mammals, Peterson or Lincoln Index method.
- 3.4. Determination of Age and sex in animals and birds

4. Modern Methods of Wildlife study (15 hrs)

- 4.1 Wildlife photography: Still and Videography, recording of calls, study of animal evidences.
- 4.2 Remote sensing, GIS, Radar in wildlife research.
- 4.3 Radio telemetry: Importance, scope and methodology
- 4.4 Genetics in wildlife management- Pedigree analysis and karyotyping techniques

5. Food habit analysis (8 hrs)

- 5.1 Sampling method: Direct and indirect methods, qualitative and quantitative methods
- 5.2. Kinds of study materials, preservation and analytical procedures.

6. Prey predators management (5 hrs)

- 6.1. Foraging behaviour, optimal foraging theory, group foraging, depredation, forage poisoning

7. Wetland Management (10 hrs)

- 7.1. Study of Waterfowl, waterfowl management, Habitat manipulation, food production, water development and cover improvement.
- 7.2. Management of Indian Cranes. Endangered and Non-endangered crane, crane conservation, migration, impact of pollution on wetland birds. Conventions related to Wetland management.
- 7.3. Ramsar sites in India, Conventions on wetlands
- 7.4. Pheasants and Pheasant management- Pheasants of Himachal Pradesh, Pheasantry.

8. Zoo management (10 hrs)

- 8.1. Basic consideration for designing a modern zoo,
- 8.2. Functions of a modern zoo,
- 8.3. Zoo layout and exhibition of animals,
- 8.4. Zoo services
- 8.5. Zoo sanitation
- 8.6. Captive breeding,
- 8.7. Safari parks
- 8.8. Moonlit zoo

9. Healthcare and disease management (7 hrs)

- 9.1 Disease monitoring and control, surveillance of disease.
- 9.2 Viral, bacterial, rickettsial, mycoplasmal, and protozoan disease.
- 9.3 Nutritional deficiency disease, worm infestation and related disease, Zoonosis.

References:

M.Sc ZOOLOGY (ACADEMIC YEAR 2014 Onwards)

1. Aaron, N.M. (1973): Wildlife ecology. W.H. Freeman Co. San Francisco, USA.
2. Abbassi and Ramaswami (1999): Biotechnological methods of pollution.
3. Barret, E.C and Anton Micallef (1991): Remote Sensing for Hazard Monitoring and Disaster Assessment, Taylor and Francis, London.
4. Canter, L.W. and Graw, MC, Environmental Impact Assessment, Hill publication, New York.
5. Chang – Kang, Tsung (2002): Introduction to Geographic information system. Tata McGraw-Hill Publishing Company Limited. New Delhi
6. Choudary, Suahant and Malik, Pradeep. A guide to chemical Restraint of Wild Animals. Nataraj Publishers, Dehradun
7. Dasman R.F. (1964): Wildlife biology, John Wiley and Sons, New York.
8. Giles R.H. Jr. (Ed) (1984): Wildlife management techniques-3rd Edition, the wildlife society, Washington D.C.
9. Gopal, Rajesh (1992): Fundamentals of Wildlife Management, Justice Home, Allahabad, India.
10. Hosetti, B.B. (1997): Concepts in Wildlife Management, Daya Publishing House, Delhi.
11. Lilleand, T.M, and Kieffer, R.W., John Wiley and Sons. Remote Sensing and image Interpretation.
12. Negi, S.S. (1993): Biodiversity and its conservation in India. Indus Publishing Co., New Delhi.
13. Negi, S.S. Manual for Wildlife Management in India.
14. Robert, G.H. (1978): Wildlife management. W.H. Freeman and Co., San Francisco, USA.
15. Robinson W.L and Eric G. Bolen (1984): Wildlife ecology and management. MC Millen Publishing Co. New York.
16. Rodgers W.A (1991): Techniques for wildlife census in India.
17. Sabbins, F.E., Freeman, Remote sensing: Principles and Applications.
18. Saharia V.B. (1982): Wildlife of India
19. Samar Singh – Natural heritage
20. Sanayal, Ram Bramha (1995): A Handbook of the Management of Animals in Captivity.
21. Schaller (1978): The deer and Tiger.
22. Sharma B.K. and Kaur, H. (1996): Environmental chemistry. Goel publishing House, Meerut.
23. Sharma, B.D. (1999): Indian wildlife resources: Ecology and development. Daya publishing House, Delhi.
24. Singh, S.K (2005): Textbook of Wildlife Management. IBDC.Lucknow
25. Singh, Samar (1987): Conserving India's Natural Heritage. Nataraj Publication.
26. Teague R.D. (Ed), (1980): A manual of wildlife ecology Conservation, The wildlife society Washington D.C.
27. Tikkader (1994): Threatened animals of India.
28. WII, A Guide to chemical restraints of animals.

FOURTH SEMESTER PRACTICALS

**ZO 4 CP 04 – CELL & MOLECULAR BIOLOGY, IMMUNOLOGY,
MICROBIOLOGY, BIOTECHNOLOGY AND MICROTECHNIQUES**

ZO 4 CP 04 - CELL & MOLECULAR BIOLOGY

(Practical classes to be conducted during third semester)

1. Estimation of DNA by Diphenyl Amine method
2. Estimation of RNA by Orcinol method
3. Estimation of Protein by Lowry' method.
4. Cell fractionation and Differential Centrifugation to isolate mitochondria, nuclei and nucleolus.
5. Isolation of RNA from Yeast.
5. Isolation of plasmid DNA.
6. Isolation of genomic DNA.
7. Isolation of DNA from Liver/Spleen/Thymus.
8. Maintenance of E.coli culture (shake and surface cultures) and quantitative evaluation (number of cells/ml) of a given sample of culture by dilution and plating.
9. Preparation of salivary gland polytene chromosome from drosophila larva.
10. Drosophila banding technique and Karyotyping.
11. Grass hopper – (testes –squash preparation) to study various meiotic stages

References:

1. Brown, T.A. (1998): Molecular biology Lab Fax. Vol. 1 and 2, Academic press
2. Brown, T.A. (2007): Essential Molecular Biology – A practical approach Vol. 2, Oxford University Press
3. Wilson & Walker (2006): Principles and techniques of Biochemistry and Molecular biology, Cambridge University Press

ZO 4 CP 04 - IMMUNOLOGY

(Practical classes to be conducted during fourth semester)

1. Study of cells of immune system.
2. Histology of organs of immune system.
3. Bleeding of animals and preparation of serum.
4. Separation of lymphocytes.
5. Demonstration of agglutination reaction.
6. Immuno Electrophoresis.
7. Demonstration of ELISA technique.
8. Production of antibodies.
9. Preparation of antiserum.

ZO 4 CP 04 – MICROBIOLOGY

(Practical classes to be conducted during fourth semester)

1. Selective isolation and enumeration of bacteria.
2. Bacterial staining technique
 - a. Simple staining of bacteria.
 - b. Negative staining
 - c. Hanging drop technique.
 - d. Gram staining.
 - e. Endospore staining.
3. Turbidity test for contamination of milk.
4. Phosphate activity of milk.
5. Microbial filters and their application.
6. Preparation of media and sterilization.eg: Nutrient agar, mac conkey agar, sterilization by wet and dry heat, disinfection.
7. Cultivation of yeast and molds
8. Isolation of pure colonies of bacteria.
9. Growth curve of yeast - monitoring progress of microbial culture.
10. Bacteriological analysis of water e.g., fecal pollutants.
11. Anaerobic culturing.
12. Antibiotic sensitivity test.



ZO 4 CP 04 – BIOTECHNOLOGY

(Practical classes to be conducted during fourth semester)

1. Isolation of plasmid DNA.
2. Isolation of total RNA from tissues
3. Separation of DNA by electrophoresis.
4. Bacterial transformation.
5. PCR
6. Cell immobilization.

ZO 4 CP 04 - MICROTÉCHNIQUE AND HISTOCHEMISTRY

(Practical classes to be conducted during fourth semester)

1. Preparation of stained and unstained whole –mounts.
2. Identification of the various tissues of animals in serial sections prepared using Nuclear

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and cytoplasmic stains

3. Processing a few types of tissues for the histochemical staining-Staining of serial Sections to show the presence of

- a) Carbohydrates by PAS method
- b) Proteins by Mercuric bromophenol blue method
- c) Fats by Sudan Black B method
- d) DNA by Feulgen Technique.

Submission:

Stained/unstained Whole mounts -	4 numbers
Double stained serial histology slides	- 4 numbers
Histochemical slides	- 2 numbers

References:

1. Ausubel, F.M., Brebt R, Kingston, R.E., Moore, D. D., Seidman, J. G., Smith, J.A. and Struht, K. (2002): Short protocols in Molecular Biology. John Wiley & Sons, Inc.
2. Sambrook, J. and Russel, D.W. (2001): Molecular cloning: A laboratory Manual. CSHL Press, New York.



PRACTICALS ELECTIVE COURSE- ENTOMOLOGY –I ZO 4 EP 05- MORPHOLOGY & TAXONOMY

(Practical classes to be conducted during third semester)

1. Study of the sclerites of head and thorax of different Orders of insects: Grasshopper, Cockroach, Housefly, Honeybee
2. Study of the different types of antennae
3. Adaptive radiation of pterygote mouth parts (Adult & Larval)
4. Adaptive radiation of pterygote legs
5. Locomotory structure in ectognaths.
6. Wings: their shape variation in the venation of pterygote wings.
7. Study of different types of genitalis.
8. Stinging apparatus – Honeybee
9. Morphological studies of different castes of social insects.
Detailed study:
 - (a) Honey bee and hives
 - (b) Termitarium and termites.
10. Dissection of alimentary canal and associated glands of different groups of insects.
11. Dissection of reproductive system in insects.
12. Dissection of nervous system in different groups of insects and showing various degrees

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- of concentration.
13. Dissection of stomatogastric nervous system (oesophageal, sympathetic, single recurrent nerve and paired recurrent nerves).
 14. Dissection of the tracheal system and air sacs in insects - Cockroach, Grasshopper, Honeybee.
 15. Training for students in the various methods of collection and preservation of insects for scientific studies.

ELECTIVE COURSE- ENTOMOLOGY -II ZO 4 EP 05 - ANATOMY AND PHYSIOLOGY

(Practical classes to be conducted during third semester)

1. Haemocytes: Staining and Identification of haemolymph in various insects using Giemsa /Wrights/BPB Stain
2. Estimation of total haemolymph proteins
3. Dye Transport: Estimation of dyes such as Indigo, carmine or neutral red transported by Malpighian Tubules.
4. Identification of at least 3 amino acids in haemolymph by paper chromatography
5. Estimation of digestive carbohydrases in the alimentary canal of insect.
6. Survey of digestive enzymes - Amylase, invertases, proteases and lipases in Cockroach/ Dragon flies.
7. Estimation of glucose content in the insect haemolymph from different orders.
8. Preparation of key for the identification insects.

11. FIELD WORK REPORT-

Field study shall be conducted to observe the insects in their natural environment. A detailed field report shall be submitted by each student which includes the observation of insects in their natural habitat like forest, scrub jungle, grass lands, water bodies, sandy areas, litter, and so on with the procedure adopted.(Students are expected to be familiar with the procedures of insect collection, preservation, spreading and curation using freely available insects).The field report with the dated signature of the teacher concerned and duly certified shall be submitted at the time of practical examination along with the practical record. No marks shall be awarded for the record without field report.

(Students need not submit collections)

References:

1. Deb, A.C. (1997): Copehensive practical Biochemistry,New central Book Agency,Culcutta.
2. Jayaraman, J. (1992): Laboratory Manual in Biochemistry.Wiley Eastern Ltd.
3. Osser, B.L. (1965): Hawks Physiological Chemistry, 14th edition. McGraw Hill Book Company, New York
4. Plummer, D.T (1997): An introduction to Practical Biochemistry, Tata Mac Graw Hill, Mumbai
5. Sadasivan. S. and Manikan. A. (1992): Biochemical Methods for Agricultural Sciences. Wiley Eastern Ltd.

PRACTICALS

**ELECTIVE COURSE: ENVIRONMENTAL BIOLOGY –I
ZO 4 EP 05: AIR POLLUTION, RADIATION BIOLOGY AND HEAVY
METALS**

(Practical classes to be conducted during third semester)

A. AIR POLLUTION

I. Air samplers – Simple, Handy and High volume air samplers.

II. Monitoring of the following pollutants in ambient and polluted air:

1. Dust fall
2. Suspended particulate matter
3. Sulphation rate using lead peroxide candle.
4. Sulphur dioxide
5. Nitrogen dioxide
6. Ammonia

III. Study on the effect of SO₂ on vegetation

B. RADIATION BIOLOGY

1. Demonstration of UV induced lipid peroxidation in tissue homogenates
2. Effect of Vitamin E on UV induced lipid peroxidation

C. HEAVY METALS

I. Estimation of the following metals in effluent and sediment samples

1. Copper-Biquinoline method
2. Zinc- Zincon method
3. Chromium (Hexavalent) - Diphenylcarbazide method

References:

1. Aery, N.C.-Manual of Environmental Analysis- Ane Books Pvt.Ltd
2. Greenberg *et al*-Methods for the examination of water and waste water-APHA publishers Washington D.C.
3. Indian standard methods for measurement of air pollution-ISI - New Delhi
4. Indian standard method of sampling and test for industrial effluents Part III-ISI New Delhi
5. Michael –Ecological methods for field and Lab investigations-Tata Mc Graw-Hill
6. Sawyer & Mc Carty-Chemistry for environmental engineering –Mc Graw Hill Publisher

PRACTICALS

**ELECTIVE COURSE: ENVIRONMENTAL BIOLOGY –II ZO 4
EP 05 - WATER POLLUTION**

(Practical classes to be conducted during third semester)

Waste water characterization – determination of the following parameters in waste water samples

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1. Turbidity – Nephlo meter or Secchi disc method
2. Odour
3. Dissolved solids – gravimetric method
4. Suspended methods - gravimetric method
5. Dissolved oxygen (modified Winkler method)
6. Biochemical oxygen demand – Dilution method
7. Chemical oxygen demand – Dichromate digestion
8. Ammonia nitrogen – Indophenol blue method
9. Nitrite nitrogen – Azo dye method
10. Nitrate nitrogen –Phenol disulphonic acid method
11. Sulphate
12. Inorganic phosphates – APHA method
13. Hardness EDTA titration Method
14. Residual chlorine
15. Species diversity indices and indicator species
16. Primary production
 - a) Light and dark bottle method
 - b) Chlorophyll method.

References:

1. Greenberg et.al-Methods for the examination of water and waste water-APHA publishers Washington D.C.
2. Indian standard methods for measurement of air pollution-ISI - New Delhi
3. Indian standard method of sampling and test for industrial effluents Part III-ISI New Delhi
4. Michael –Ecological methods for field and Lab investigations-Tata Mc Graw-Hill
5. NC Aery-Manual of Environmental Analysis- Ane Books Pvt.Ltd
6. Sawyer & Mc Carty-Chemistry for environmental engineering –Mc Graw Hill Publishers
7. Trivedi & Goel-Practical methods in Ecology and Environmental Sciences- Environmental publications Karad

PRACTICALS

ELECTIVE COURSE - FISHERY BIOLOGY - I

ZO 4 EP 05 – TAXONOMY, BIOLOGY, PHYSIOLOGY & ECOLOGY

(Practical classes to be conducted during third semester)

1. Identification of common and local fishes
2. Dissection of accessory respiratory organs
3. Dissection of urinogenital system
4. Dissection of arterial system
5. Mounting of internal ear
6. Study of different types of scales
7. Determination of haemoglobin content in fish blood

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8. Determination of amylase, protease and lipase activities in different parts of alimentary canal of fish
9. Determination of rate of ammonia and urea excretion in fishes
10. Age determination of fishes using scales and otolith

PRACTICALS

ELECTIVE COURSE- FISHERY BIOLOGY - II ZO EP 05 - CAPTURE AND CULTURE FISHERIES

(Practical classes to be conducted during third semester)

1. Demonstration of induced breeding in fishes
2. Estimation of fecundity
3. Identification and study of ecto and endoparasites in fishes
4. Study of gut content analysis in fishes
5. Study and maintenance of fresh water aquarium
6. Determination of water and soil p^H
7. Studies on texture of soil
8. Test for H_2S
9. Test for Alkalinity
10. Test for salinity
11. Determination of water transparency
12. Determination of Ammonia, Nitrogen, Phosphorus and Free calcium carbonate
13. Identification of culturable species of shrimps, prawns and fishes
14. Identification of larval stages of shrimps, prawns and fishes



PRACTICALS

ELECTIVE COURSE - HUMAN GENETICS-I ZO 4 EP 05 - CLINICAL GENETICS

(Practical classes to be conducted during third semester)

- 1 Sterilization, medium preparation
- 2 Peripheral blood lymphocyte culture
- 3 Banding - G banding, C banding, NOR banding
- 4 Karyotyping and reporting- Normal, Down's, Edward's, Klinefelter's, Patau's, Turner's.
- 5 Experiments with Spectrophotometer- blood urea, serum creatinine, BUN.
6. Study of hematological disorders- Bleeding time, Clotting time, Prothrombin time
7. Detections of HbF, HbA
8. Study of organ system diseases by charts, photographs etc.-
Thalassemia, Hemophilia, DMD, Neurofibromatosis, Huntington's chorea, Pituitary dwarfism, Congenital adrenal hyperplasia.

M.Sc ZOOLOGY (ACADEMIC YEAR 2014 Onwards)

References:

1. Emery, A.E.H. and Rimoin, D.L. Principles and Practices of Medical Genetics Vol. I, II & III. Churchill Livingstone
2. ISCN (1995) - An International System for Human Cytogenetic Nomenclature – F. Mitelman Karger.
3. Jorde, L.B., Carey, J.C. and White, R.L. (2002): Medical Genetics. Mosby Press.

ELECTIVE COURSE-HUMAN GENETICS -II ZO 4 EP 05 - DIAGNOSTIC GENETICS (Practical classes to be conducted during third semester)

1. Clinical tests for inborn errors of metabolism
2. Urine spot test for Mucopolysaccharides
Urine spot test for Cystinuria and Homocystinuria
3. Lysosomal Enzyme assays (Arylsulfatase A and B)
4. Estimation of serum cholesterol, proteins, triglycerides, lipids
5. Stages of human development-
(Demonstration with video of with slides, models or charts, visits to labs
Cleavage, 2 cells, 4 cells, 8 cells, 16 cells, 32 cells,
Morula, Blastula, Gastrula, Organogenesis
6. Developmental features of human fetus- first lunar month to tenth lunar month
7. Human birth defects-Spina bifida, Meningocele, neural tube defect
8. ART- IVF, ICSI, GIFT, ZIFT, Semen analysis
9. PGD- FISH, PCR based analysis
10. Amniocentesis, CVS - demo by video

References:

1. Devlin, T.M. (1994): Text book of Biochemistry with clinical correlations (3rd edn.).
2. Emery, A.E.H. and Rimoin, D.L. (1983): Principles and Practice of Medical Genetics, Vol. II, Churchill Livingstone, Chap.99.
3. Weatherall, D.J. and Clegg. (1981): The Thalassemia Syndromes (Ed.3).

PRACTICALS ELECTIVE COURSE: WILDLIFE BIOLOGY-I ZO 4 EP 05 - PRACTICAL PAPER – I (Practical classes to be conducted during third semester)

1. Dissections.
 - A) Arterial system of bird (Pigeon/quail/chicken)
 - B) Flight muscles.
 - C) Perching mechanism - pigeon
2. Examination and identification of poisonous and non poisonous snakes
3. Examination and identification of different types of feathers.
4. Examination and identification of horns and antlers.

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5. Examination and identification of scales of reptiles, birds, and modified hairs of pangolin and porcupine.
6. Scats / pellet analysis – significance (Population estimation).
7. Study of the dental formula of various mammals.
8. Study of mammal necropsy procedures
9. Spotters: Pug marks, teeth like lophodont, carnassial dentition, nest of birds, Hair of mammals, feathers, spines, nails, claws, horns, antlers, and other item related to wildlife biology.

PRACTICALS **ELECTIVE COURSE: WILDLIFE BIOLOGY-II ZO 4 EP** **05 -PRACTICAL PAPER II** **(Practical classes to be conducted during third semester)**

1. Taxidermic procedures – Skinning, curing of a common bird (Pigeon / Quail).
2. Pterylography and comparison (Pigeon/ Quail)
3. Study of ecto and endo parasites of locally available bird and mammal
4. Hair sample analysis.
5. Identification of Fresh water fishes, Reptiles, Endangered amphibians, birds and mammals.
Good quality photographs may be used for the purpose
6. Identification and interpretation of calls of local birds (from recorded cassettes).
7. Recording of zoo diseases and control measures, management of zoo animals.
8. Remote sensing (Photographic interpretation)
9. Typical vertebra of a bird, reptile and mammal
10. Spotters: Ecto and Endo parasites, bones of characteristic importance in the skull of crocodile, snake, dog, monkey and other items relevant to wildlife biology.

PRACTICALS **(Practical classes to be conducted during fourth semester)** **ELECTIVE COURSE- ENTOMOLOGY –III** **ZO 4 CEP 06 - AGRICULTURAL, MEDICAL ENTOMOLOGY AND PRINCIPLES OF** **INSECT PEST MANAGEMENT AND TOXICOLOGY**

1. Field observation, identification and collection of insect pest of paddy, coconut, sugarcane, cotton, pulses, vegetables, fruit trees spices and forest trees.
2. Field observation, identification and collection of insect pest of Man and domestic animals
3. Field observation, identification and collection of insect damages to crops
4. Study of life histories of insect pests
5. Laboratory rearing of insect pests (any two)

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6. Observation of laboratory rearing of Parasitoids and Predators
7. Identification of insecticide appliances
8. Field study of insecticide application
9. Field study to observe and collect insect pollinators, parasitoids and predators, scavengers and weed killers
10. Estimation of LD 50 values for some insect pests

Field report- Each student shall submit a field report consisting of the areas visited like paddy fields, coconut groves, sugarcane fields, cotton fields, fields of pulses and vegetables, fruits, parasitoids and predator breeding stations, beekeeping stations, sericulture institutes, Toxicology laboratories etc.

(The field report with the dated signature of the teacher concerned and duly certified shall be submitted at the time of practical examination along with practical record. No marks shall be awarded for the record without field report)

PRACTICALS

ELECTIVE COURSE: ENVIRONMENTAL BIOLOGY-III ZO 4 CEP 06 – SOIL AND SEDIMENT ANALYSIS

A. Soil and Sediment Analysis

1. Collection and Preservation
2. Redox potential.
3. Alkalinity.
4. p^H
5. Exchangeable calcium and magnesium
6. Sodium and potassium.
7. Available phosphorous.
8. Ammonia Nitrogen
9. Chlorides
10. Organic Matter –Walkley Black Method
11. Sulphates



B. Environmental Microbiology

12. Standard plate count of soil and water samples
13. MPN of total coliforms
14. MPN of faecal coliforms

C. Bioassay Studies and Insecticides

15. Fish/Daphnia bioassay test to find out the toxicity of heavy metals/pesticides
16. Calculation of LC50 or TLm

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17. Determination of the concentration of the following insecticides in water:
 - a) DDT
 - b) Methyl parathion
18. Inhibition of acetylcholine esterase by organophosphates/ carbamate insecticides (demonstration only)

References:

1. Aery, A.C.-Manual of Environmental Analysis- Ane Books Pvt. Ltd
2. Greenberg et.al-Methods for the examination of water and waste water-APHA publishers Washington D.C.
3. Indian standard methods for measurement of air pollution-ISI - New Delhi
4. Indian standard method of sampling and test for industrial effluents Part III-ISI New Delhi
5. Michael –Ecological methods for field and Lab investigations-Tata Mc Graw- Hill
6. Sawyer & Mc Carty-Chemistry for environmental engineering –Mc Graw Hill Publishers
7. Trivedi & Goel-Practical methods in Ecology and Environmental Sciences- Environmental publications Karad..

PRACTICALS

ELECTIVE COURSE – FISHERY BIOLOGY - III

ZO 4 EP 06 – HARVESTING POST HARVESTING TECHNOLOGY AND MARKETING

1. Identification of fishing craft, gears and gear material from models, drawings and photographs
2. Study of processing of commercially important fin fishes and shell fishes
3. Identification of different fishery byproducts
4. Identification of different mechanisms used in fish processing
5. Staining of bacteria
6. Preparation of culture media
7. Study of bacterial culture
8. Laboratory technique to detect pathogenic bacteria of public health, significance of *E. coli*, *Salmonella*, and *Staphylococcus*
9. Preparation of scoring key to identify different stages of fish spoilage
10. Estimation of ash and water content of fish muscle
11. Estimation of total amino acid in fish muscle
12. Estimation of trimethyl amine
13. Extraction of liver and body oil
14. Study of canning and refrigeration

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STUDY TOUR

A study tour not less than ten days duration (Need not be at a stretch) to fishery research institutes such as CIFT, CMFRI, CIFNET, IFP, etc, fish hatcheries, fish landing centers, boat building yards, aqua-farms etc. The field reports with dated signature of the teacher concerned and duly certified should be submitted at the time of examination.

PRACTICALS

ELECTIVE COURSE - HUMAN GENETICS - III

ZO 4 EP 06 - CANCER GENETICS AND GENETIC SERVICES

1. Problems in genetic counseling
2. Agarose gel electrophoresis
3. Preparation of human genomic DNA
4. Blood grouping and cross matching
5. Experiments with PCR
- 6 Estimation of CA/MN on cells
- 7 SCE, Micro Nucleus Assay
8. Study of Ph¹ chromosome, FISH in genetics, bcr-abl gene fusion, PML- RARA fusion
- 9 Qualitative and quantitative analysis of Ig., ELISA, Western blotting
10. Experiments with ELISA Reader- FSH, LH, T3,T4,TSH, Testosterone
11. Study of radiation induced chromosomal aberrations
12. Study of dermatoglyphic features
13. Calculation of gene frequencies of dominant and recessive autosomal alleles

PRACTICAL

ELECTIVE COURSE: WILDLIFE BIOLOGY-III ZO 4 EP 06 -WILD LIFE MANAGEMENT

10. Qualitative analysis of digestive enzymes of the gut. (Herbivores/ Carnivores/ Omnivores).
11. Measurements (Morphometry) for systematic study. Total length, body length, tail length, various dimensions of the skull etc. of mammals, birds, reptiles, amphibians and fishes.
12. Quantitative estimation of uric acid in birds and reptiles.
13. Identifying features of the beaks and feet of common birds. Students are expected to identify from photographs / Xerox.
14. Assessment of the age of mammals using their teeth.
15. Measurement of temperature, light, rainfall, humidity, transpiration and wind speed.
16. Collection and quantitative and qualitative analysis of soil fauna.
17. Territory mapping. Quadrature sampling, Line transect, Line intersect, Point prime methods of population study. Pellet counting for deer population of elephant dung in a sanctuary.

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18. Spotters: Various item related to wildlife biology.

Study Tour

A study tour of not less than 10 days duration (need not to be at a stretch) to sanctuaries, National Parks, Zoos, Research Institutes and other places of ecological importance. The field report with the dated signature of the teacher concerned and duly certified should submit at the time of examination.

Slides should be submitted at the time of examination during IV semesters.

MODEL QUESTION PAPERS

THIRD SEMESTER M. Sc. DEGREE EXAMINATION (CSS) Zoology ZO 3 CT 07 – CELL AND MOLECULAR BIOLOGY

Time: Three hours

Maximum weightage: 36

I. Answer **all fourteen** questions

(Weightage – 1)

1. Distinguish between monocistronic and polycistronic mRNA.
2. Name two non-sense codons and their common names.
3. Enlist the rRNAs of eukaryotic ribosome
4. Name two antibiotics as translational inhibitors. Mention their action.
5. What are chaperones? Mention their role in post-translational modification.
6. Distinguish between minisatellite and microsatellite.
7. What is site specific recombination? Cite example.
8. Distinguish between transduction and transformation.
9. What is a promoter site? Mention 3 consensus sequences of eukaryotic promoter site.
10. Comment on start codons
11. What is gRNA? What is its function?
12. Give short note on supressor tRNA
13. What is affinity labeling? What is its application in ribosome studies?
14. What are petite mutants? Name the petite mutants of Yeast.

(14 x 1 = 14)

II. Answer any **seven** questions

(Weightage – 2)

15. Explain psuedogenes.
16. Describe the rolling circle model of DNA replication.
17. Write short note on posttranscriptional modification of RNA.
18. Explain wobble hypothesis.
19. Compare translation in eukaryotes and prokaryotes.
20. Describe the basic features of tryptophan operon.
21. What is siRNA and miRNA? What are their roles in regulating gene expression?
22. What is cot ½? How it is related to complexity of the genome?
23. What is a complex multigene family? Explain the organization of histone gene in sea urchin.
24. Human mitochondrial genome.

III. Answer any **two** questions

(Weightage – 4)

25. Give an account of semiconservative method of replication. Add a brief note on the enzymes and protein involved in DNA replication.
26. Write an essay on the organization of interrupted genes and their evolution.
27. Describe the various methods of DNA repair.
28. (a) What are transposons? Give an account of the mechanism of transposition, and transposons in eukaryotes and prokaryotes.

(2 x 4 = 8)

**THIRD SEMESTER M. Sc. DEGREE EXAMINATION (CSS)
Zoology**

**ELECTIVE COURSE-ENTOMOLOGY-I ZO 3
ET 08 - MORPHOLOGY & TAXONOMY**

Time: Three hours

Maximum Weightage: 36

I. Answer **all fourteen** questions

(Weightage – 1)

1. What are opisthognathose insects? Give examples.
2. Give a short note on fronz.
3. Describe the structure of clavate antenna with examples.
4. What is anamorphosis? Give an example.
5. What is pterostigma? Give an example.
6. What are Scorpion flies? To which order does it belong?
7. What are blood worms? To which family does it belong?
8. What is a colophore? What is its function?
9. What are gall insects? Give three examples.
10. Mention the ovipository mechanisms in aquatic insects.
11. Distinguish between allomones and kairomones. Give one example for each.
12. What are pheromones? Mention their role in communication.
13. What are Cuckoo wasps? To which family does it belong?
14. Comment on the significance of visual communication.

(14 x 1 = 14)

I. Answer any **seven** questions

(Weightage – 2)

15. Give the structure and function of Tentorium.
16. Describe the function of antenna.
17. Ecological behaviour of locusts.
18. Describe the segmentation of insect head.
19. Give a brief note on the leaf mining insects.
20. What are web spinners? Explain with an example.
21. Write a short note on acoustic communication.
22. Give an account of fossil insects.
23. Explain briefly the habit and habitat of stone flies.

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24. Describe the wing coupling apparatus.

(1 x 2 = 14)

II. Answer any **two** questions

(Weightage – 4)

25. Describe the leg modifications in insects.

26. Classify Odonata up to families giving examples.

27. Explain insect-plant interdependence with special reference to co-evolution.

28. Give an account of origin and evolution of insects. Add a note on the theories explaining it.

(2 X 4 =8)

THIRD SEMESTER M. Sc. DEGREE EXAMINATION (CSS)

Zoology

ELECTIVE COURSE - ENVIRONMENTAL BIOLOGY- I ZO

3 ET 08: MAN, ENVIRONMENT & NATURAL RESOURCES

Time: Three Hours

Maximum Weightage: 36

I. Answer the following: -

(Weightage :1)

1. What are trade winds?

2. Distinguish between polar easterlies and westerlies.

3. What is subsidence inversion.

4. Write notes on cloud categories.

5. Explain Dendroclimatology?

6. Describe population pyramid.

7. What are agro ecosystems? Mention their features.

8. What is environmental crisis?

9. What is fish maw, write notes on its uses.

10. What is the scientific name of Rubber tree, and mention the important uses of latex.

11. What is hydrological cycle.

12. Which are the conventional energy sources?

13. Write notes on fish liver oil.

14. Name the **monor** forest products

(14 x 1 = 14)

II. Answer any seven of the following:-

(Weightage – 2)

15. Describe the major products obtained from coconut trees and their uses.

16. Write notes on the surface water resources of Kerala.

17. Which are the important marine products add a note on their uses?

18. Explain demographic transition.

19. Write notes on space craft ecosystems.

20. Describe Malthusian growth model.

21. Explain Milankovitch theory.

22. Write notes on green house gases.

23. Explain clouds and their formation.

24. Describe Lindmans work.

(7 x 2 = 14)

III. Answer any two of the following:-

(Weightage – 4)

25. Write an essay on mineral resources of India.

M.Sc ZOOLOGY (ACADEMIC YEAR 2014 Onwards)

26. Write an essay on Non conventional energy sources.
27. Describe global climate change, its causes and consequences.
28. Explain primary production and the methods of estimating primary production.
(2 x 4 = 8 weightage)

THIRD SEMESTER M. Sc. DEGREE EXAMINATION (CSS)

Zoology

ELECTIVE COURSE - ENVIRONMENTAL BIOLOGY-II ZO 3

ET 09 - ENVIRONMENTAL POLLUTION

Time: Three Hours

Maximum Weightage: 36

I. Answer the following:- (Weightage – 1)

- a. Ozone layer.
- b. Wet and dry aggregate filters.
- c. Ferets & Martins diameter.
- d. Effect of particulate matter on respiratory system.
- e. Deepwell injection.
- f. Hazardous solid wastes.
- g. Effect of air pollution on metals.
- h. Primary gaseous air pollutants.
- i. PAN & Ozone.
- j. Stabilization.
- k. Algal ponds.
- l. Broad irrigation method.
- m. Torrycanyon accident.
- n. Activated sludge process.



(14 x 1 = 14)

II. Answer any seven of the following:- (Weightage – 2)

15. Biogas.
16. Electrostatic precipitation.
17. Chemical oxygen demand.
18. Photochemical smog.
19. Scrubbers.
20. Love canal episode.
21. Plumbism.
22. Biological treatment of sewage
23. Tricling filters.
24. Artificial sweetners.

(7 x 2 = 14)

III. Answer any two of the following:- (Weightage – 4)

25. What is noise pollution? What are its sources and effects on living and nonliving things? Outline the abatement technology relating to noise pollution.
26. What is Eutrophication? Discuss the causes and consequences of eutrophication. Explain its control measures.
27. Discuss the various methods of radioactive waste disposal.
28. Describe the sources and effects of heavy metal pollution in the environment.

(2 x 4 = 8)

THIRD SEMESTER M. Sc. DEGREE EXAMINATION (CSS)
Zoology
ELECTIVE COURSE - FISHERY SCIENCE-I
ZO 3 ET 08 - TAXONOMY, BIOLOGY, PHYSIOLOGY & ECOLOGY

Time: Three hours

Maximum weightage: 36

- I. Answer all *fourteen* questions (weightage-1)
1. Comment on physiological colour changes in fishes.
 2. What is ultim-branchial organ?
 3. List the different types of scales seen in fishes.
 4. What is neurohypophysis? Mention its function.
 5. Define deep sea trenches and give examples.
 6. What is EEZ?
 7. Comment on upwelling.
 8. What is coral reef?
 9. What is thermocline?
 10. Comment on diadromus migration.
 11. What is ovoviviparity? Give its evolutionary significance.
 12. What is continental slope?
 13. Give scientific names of four economically important fishes.
 14. Comment on digestive enzymes in fishes.
- (14 x 1 = 14)
- II. Answer any *seven* questions (Weightage - 2)
15. Comment on the functions of blood
 16. Give the names and functions of reproductive hormones
 17. Write in brief, crustacean neurosecretory system and their role in reproduction
 18. Write notes on excretion in lung fishes
 19. Describe briefly the accessory respiratory organs in fishes
 20. Comment on benthic divisions of sea
 21. What are the peculiarities of Piscian circulation
 22. Write briefly on mechanism of propulsion
 23. Describe in brief age and growth of fish
 24. Comment on mud banks
- (7 x 2 = 14)
- III. Answer any two questions (Weightage - 4)
25. Describe osmoregulation in marine fishes.
 26. Explain the factors affecting primary production in ocean.
 27. Explain briefly the ocean currents.
 28. Describe the adaptations of cave dwelling fishes.
- (2x4=8)

THIRD SEMESTER M. Sc. DEGREE EXAMINATION (CSS)
Zoology
ELECTIVE COURSE - FISHERY SCIENCE-II
ZO 3 ET 09 - CAPTURE AND CULTURE FISHERIES

Time: Three hours

Maximum weightage: 36

I. Answer all fourteen questions

(weightage - 1)

1. Define integrated fish culture with examples
2. List four bacterial fish diseases
3. Write short notes on sex reversal
4. Methods of fish seed transport
5. Cryopreservation of gametes
6. Cage farming
7. Comment on hormone analogues
8. Four uses of sea weeds
9. Distinguish between Penaeid and Non-Penaeid prawns
10. Feeding and breeding habits of Pomfrets
11. Viviparous ornamental fishes
12. Aquarium plants
13. Crab fattening
14. Ployculture

(14 x 1 = 14)

II. Answer any seven questions

(Weightage - 2)

15. Write notes on induced breeding in fishes.
16. What are the major symptoms of Dropsy? What are the control measures?
17. Give an account on water quality parameters.
18. How will you prepare an artificial feed?
19. Major river systems and fisheries of south India.
20. Write an account on hybridization in aquaculture.
21. Protozoan infections.
22. Preparation and maintenance of freshwater aquarium.
23. Design and construction of hatcheries.
24. Classification of aquaculture practices.

(7 x 2 = 14)

III. Answer any two questions

(Weightage – 4)

25. Write an account on present status and future prospects of aquaculture in India
26. Describe the biology of oil sardine and mackerel
27. Discuss the steps involved in the culture of fresh water prawns and write notes on their commercial significance
28. Write an account on culture of brackish water fishes

(2 x 4 = 8)

THIRD SEMESTER M. Sc. DEGREE EXAMINATION (CSS)

Zoology

**ELECTIVE COURSE – HUMAN GENETICS - I ZO-
3-CET-08 - CLINICAL GENETICS**

Time: 3 hours

Total Weightage: 36

I. Answer the Following:-

(Weightage – 1)

1. Define autosomal dominant with examples.
2. Write any four haematological disorders.
3. Differentiate proteomics and Genomics.
4. What is SCID?

M.Sc ZOOLOGY (ACADEMIC YEAR 2014 Onwards)

5. Define Gene bank.
6. What is Achandropasia?
7. What is Translocation? Write different type of translocation.
8. What is database?
9. Define Parkinsonson's disease.
10. What is Idiogram?
11. Write any four different types of banding patterns.
12. Mention Trisomy 21.
13. Write about Neurofibromatosis.
14. Discuss molecular scissors with examples.

(14 x 1 = 14)

II. Answer any seven the following: -

(Weightage – 2)

15. Write short notes on PCR.
16. Detailed account on Genomic Imprinting.
17. Distinguish between structural and Numerical chromosome aberration in man.
18. Write an essay about r DNA technology in human disease.
19. Write a note on various tools usage in Bioinformatic studies.
20. Give a brief account on Somatic cell Hybridization.
21. Discuss briefly on Cytogenetic Techniques.
22. Write short notes on Vectors.
23. Discuss briefly on prospectus of Gene therapy in Humans.
24. Write short notes on respiratory disorders.

(7 x 2 = 14)

25. Answer any two of the following:-

(Weightage – 4)Discuss

- salient features of Signal transduction pathway?
26. Discuss briefly on Karyotyping interpretations?
27. Write an account of Mendelian Laws of Inheritance
28. Explain the following In terms of Inheritance
 - (A) Muscular dystrophy
 - (B) Osteo genesis imperfecta
 - (C) Huntington chorea
 - (D)Nephritic disease

(2 x 4 = 8)

THIRD SEMESTER M. Sc. DEGREE EXAMINATION (CSS)

Zoology

ELECTIVE COURSE – HUMAN GENETICS - II ZO 3

ET 09 - DIAGNOSTIC GENETICS

Time: 3 hours

Maximum Weightage: 36

I. Answer the following:-

(Weightage -1)

1. What is CASA?
2. Mention different of types of cleavage.
3. Explain comet assay?
4. What is CGH?
5. Differentiate between ZIFT and GIFT.
6. What is RFLP?
7. Differentiate between SKYFISH and Fiber FISH.
8. Define Fructose Inheritance.
9. Discuss about ultrasonography.
10. Explain Amniocentesis.

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11. Differentiate between microarray and microchips.
12. What is Linkage?
13. Explain PGD with example.
14. Write short notes on placental types.

(14 X 1 = 14)

II. Answer any seven the following

(Weightage -2)

15. Define salient features of 1st, 2nd and 3rd trimesters of human embryo development.
16. Give an account of human assisted reproductive techniques.
17. Describe protocols and applications of FISH.
18. Briefly explain Glycogen storage disorders.
19. Describe the methods involved in Gene sequencing.
20. Discuss briefly on different chromosomal probes.
21. Discuss briefly on different blotting techniques.
22. Briefly explain lipid metabolic disorders.
23. Write briefly on Inborn errors of metabolism.
24. Discuss briefly on peroxisomal disorders.

(7 X 2 = 14)

III. Answer any two of the following

(Weightage – 4)

25. Give an account of prenatal diagnosis.
26. Write an account on DNA Fingerprinting.
27. Write an account on human birth defects.
28. Explain the following In terms of Inheritance patterns in man
(A) Syrup Urine disease (B) Zellwegar syndrome
(C) Menkes disease (D) Leish Nyhan Syndrome

(2 X 4 = 8 Weightage)

THIRD SEMESTER M. Sc. DEGREE EXAMINATION (CSS)

Zoology

ELECTIVE COURSE: WILDLIFE BIOLOGY - I ZO 3

ET 08 - BIODIVERSITY AND BIOTA

Time: Three Hours

Maximum Weightage: 36

I. Answer the following: -

(Weightage – 1)

1. Nilgiri Tahr
2. Gaur
3. Indian Pangolin
4. Barn Owl
5. Little Cormorant
6. Gangetic Dolphin
7. What are Hot spots? Mention hot spots of India?
8. Flyways of bird migration
9. Brood parasitism

M.Sc ZOOLOGY (ACADEMIC YEAR 2014 Onwards)

10. Guano and its commercial value
11. Ecological role of vultures.
12. Nesting habits of Hornbills.
13. Endemism
14. Classify any four birds of your locality.

(14 x 1 = 14)

II. Answer any seven of the following: -

(Weightage – 2)

15. Critically evaluate Satpura hypothesis.
16. Comment on territoriality in animals.
17. Briefly explain taxonomic positions of endangered birds of Western Ghats.
18. Explain birds as pollinators
19. Write notes on Endemic fresh water fishes of Western Ghats.
20. Explain Gondwana hypothesis.
21. India is a mega biodiversity country. Explain?
22. Write notes on Monitor Lizards
23. Explain major contributions of Dr. Salim Ali
24. Briefly explain the impacts of exotic species on wildlife

(7 x 2 = 14)

b. Answer any two of the following: -

(Weightage – 4)

25. Comment on different types of calls in birds? Briefly explain the role of vocalisation in recent avian research.
26. Briefly explain the population status and major threats to the survival of larger predators of Western Ghats.
27. Explain the sociobiology of elephants.
28. Briefly explain the endemic mammals of Western Ghats. Add notes on their population status, threats and conservational significance.

(2 x 4 = 8)

THIRD SEMESTER M. Sc. DEGREE EXAMINATION (CSS)

Zoology

ELECTIVE COURSE: WILDLIFE BIOLOGY - II ZO 3

ET 09 - WILDLIFE CONSERVATION

Time: Three Hours

Maximum Weightage: 36

I. Answer the following :-

(Weightage -1)

1. What is meant by sustainable Development? Explain resource exploitation.
2. What is the role of UN in environmental conservation? Briefly explain Earth summit.
3. Explain the role of governmental and non-governmental organizations in environmental education?
4. What is endemism? Give two examples from mammals?
5. Which is the flagship animal of Eravikulam National Park? Briefly explain the significance of the habitat.
6. Differentiate between vulnerable and endangered species with reference to IUCN Red Data Book. Give examples.

M.Sc ZOOLOGY (ACADEMIC YEAR 2014 Onwards)

7. Write notes on BNHS? Mention two important publications?
8. What is illegal wildlife trade? How it affects the conservation of wildlife?
9. What is a wildlife corridor? Mention its significance.
10. What is ecotourism? Mention its significance in conservation with two examples of ecotourism sites from Kerala.
11. What is the role of IBWL in promoting wildlife conservation in India?
12. Briefly explain Red Data Book on animals.
13. Write notes on exotic species and related problems with two examples.
14. Differentiate afforestation from reforestation.

(14 x 1 = 14 Weightage)

II. Answer any seven of the following: - (Weightage – 2)

15. Give an account of project Tiger with special reference to Kerala.
16. Give an account of Project Elephant?
17. Write notes on human – animal conflict and its impacts on wildlife?
18. Explain briefly on the following.
 - a) Compression hypothesis
 - b) Effective population size
 - c) Inbreeding depression
 - d) Minimum viable population
19. Give an account of habitat fragmentation and its effect on wildlife corridors giving examples.
20. Distinguish between sanctuaries, national parks and Biosphere reserves.
21. Explain the role of tribal in conservation and management of protected areas.
22. What are mangroves? Discuss its ecological role?
23. What is afforestation? Explain with reference to social Forestry?
24. What is meant by MAB Program? Briefly explain its importance and ecological features, giving two examples?

(7 x 2 = 14 Weightage)

III. Answer any two of the following: -

(Weightage – 4)

25. Give a brief account of wildlife protection Act 1972 in India and its amendments.
26. Explain causes of depletion of wildlife in Kerala.
27. Discuss the impacts of hydroelectric projects on wildlife.
28. Write an essay on the forest types of India.

(2 x 4 = 8 Weightage)

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION

(CSS)

Zoology

ZO 4 CT 11 - MICROBIOLOGY & BIOTECHNOLOGY

Time: Three Hours

Maximum Weightage : 36

I. Answer the following :-

(Weightage – 1)

(Seven questions from Microbiology & Seven from Biotechnology)

1. What are plasmids? Mention their features.
2. Distinguish between YAC and MAC
3. What are linkers?
4. Explain blue white selection method.
5. Describe FISH technique.
6. What is *in vitro* fertilization?
7. What are GATT and TRIPS?

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8. Describe gram staining.
9. Distinguish between spread plate and pour plate techniques.
10. Describe microbial drug resistance.
11. Write notes on major fungal diseases.
12. Explain the structure of bacterial cell wall.
13. Describe Bergey's scheme of classification.
14. Describe various types of media used for the culture of microbes.

(14 x 1 =14 Weightage)

II. Answer any seven of the following :-

(Five questions from Microbiology & five from Biotechnology)

15. Explain the advantages of cloning technique.
16. Describe the features of Knockout mouse.
17. Explain DNA finger printing.
18. What are molecular markers? Describe any two of them.
19. What are molecular probes? Explain its uses.
20. What are antibiotics? Mention their role in disease treatment.
21. What are disinfectants? Classify them.
22. Describe the major diseases caused by Bacteria.
23. Describe the general structure and properties of viruses.
24. Write notes on influence of environmental factors on growth of microbes.

(7 x 2 = 14 Weightage)

Answer any two of the following

(Two questions from Microbiology & two from Biotechnology)

25. What is PCR? Describe the types and its applications.
26. Describe the role of Biotechnology in pollution control.
27. Write an essay on human diseases caused by viruses.
28. Write an essay on microbial fermentation and the products.

(2 x 4 = 8 Weightage)

MODEL QUESTION PAPERS

FOURTH SEMESTER M. Sc. DEGREE EXAMINATION

(CSS)

ELECTIVE COURSE - ENTOMOLOGY

**ZO 4 ET 12 - AGRICULTURAL, MEDICAL ENTOMOLOGY AND
PRINCIPLES OF INSECT PEST MANAGEMENT AND TOXICOLOGY**

Time: Three hours

Maximum weightage: 36

I. Answer the following:-

(Weightage – 1)

1. Distinguish between major and minor pests.
2. What are pheromones? Mention two pheromones which are used in insect control.
3. Name 2 insect growth regulators and their functions.
4. Role of chemosterilants in insect pest management.

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5. Role of insect repellents in insect pest management.
6. Write short note on hopper burn in paddy.
7. Give the common and scientific names of 4 major pests of vegetables.
8. Give the common and scientific names of 4 major pests of sugarcane.
9. Write short note on insecticide synergists.
10. Enlist 4 major pests of Mango.
11. What is pest surveillance?
12. What are systemic insecticides? Give examples.
13. Cite 2 insect predators employed in insect control..
14. Distinguish between parasites and parasitoids.

(14 x 1 = 14 weightage)

II. Answer any **seven** questions

(Weightage – 2)

15. Give the nature of damages of 4 major pests of coconut.
16. What are the major causes for insect assuming pest status?
17. Write short note on cultural methods of insect pest management.
18. Enlist major Dipteran vectors of human diseases and the diseases transmitted by them.
19. Give a brief account of the life history and damage caused by 2 major insect pests of stored products.
20. Give a brief note on toxicity and mode of action of endosulfan.
21. What are the components of IPM?
22. Aerosols as insecticide formulation.
23. What are the factors responsible for the degradation of pesticides?
24. Explain the biology of fleas.

(2 x 2 = 4 weightage)

III. Answer any **two** questions

(Weightage – 4)

25. Enumerate the major pests of cotton. Describe the nature of damage and control measures.
26. Describe the chemistry and mode of action of synthetic pyrethroids.
27. Give an account of microbial control of crop pests.
28. Write short notes on all the four of the following
 - a) Dusting and dusters for insecticide application.
 - b) Fumigants in the control of insect pests.
 - c) Effect of pesticide pollution on human health
 - d) Genetic mechanism of insecticide resistance

(2 x 4 = 8 Weightage)

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION
(CSS)
Zoology
ELECTIVE COURSE-ENVIRONMENTAL BIOLOGY ZO 4
ET 12 – ENVIRONMENTAL CONSERVATION

Time: Three Hours

Maximum Weightage: 36

1. Answer the following :-

(Weightage – 1) Describe

- general features of ever green forest.
2. What are cloud forests?
3. Mention the importance of coral reefs.
4. What are wetlands?
5. Describe IPM
6. Name the Ramsar sites in Kerala.

M.Sc ZOOLOGY (ACADEMIC YEAR 2014 Onwards)

7. Explain the term Biodiversity.
8. Describe endemism with suitable examples.
9. What is meant by Key stone species
10. What are exotic species illustrate with example.
11. Explain the term biodiversity hotspot.
12. Name the National parks in Kerala.
13. Write notes on Western Ghats.
14. Mention IUCN categories of animals.

(14 x1=14 Weightage)

II. Answer any seven of the following:-

15. Explain in situ conservation strategies.
16. Describe sustainable development.
17. Mention the major features of wildlife protection act
18. What are biosphere reserves? Write their role in conservation.
19. Describe the aims and objectives of Project Tiger.
20. Explain EIS and its role in conservation.
- 21-Describe the socio economic problems associated with displacement of rural communities.
22. Explain the role of Ramsar convention.
23. Describe the economic benefits of traditional ecological knowledge.
24. How habitat degradation affect the existence of species.

(7 x 2 = 14 Weightage)

III. Answer any two of the following:-



25. Write an essay on major vegetation types
26. Describe deforestation and its consequences.
27. Explain the reasons for loss of biodiversity and causes of extinction.
28. Write an essay on world conservation strategy.

(2 x 4 = 8 Weightage)

FOURTH SEMESTER M. Sc. DEGREE EXAMINATION

(CSS)

Zoology

ELECTIVE COURSE – FISHERY SCIENCE - III

ZO 4 ET 12- HARVESTING, POST HARVESTING TECHNOLOGY AND MARKETING

Time: Three hours

Maximum Weightage: 36

I. Answer **all fourteen** questions

(Weightage – 1)

1. What is TED? Give the importance of it.
2. Different types of fishing traps.
3. Comment on FAD.
4. Targetted and selective trawling.
5. What are encircling gears? Give examples.
6. Gear materials.

M.Sc ZOOLOGY (ACADEMIC YEAR 2014 Onwards)

7. Different types of ice.
8. Battered and breaded products.
9. Irradiation.
10. Grades of shrimps.
11. Activities of CMFRI.
12. Surumi.
13. Value added products.
14. Fermented and fishery products.

(14x1 = 14)

II. Answer any seven questions

(Weightage – 2)

15. Squid jigging.
16. Ecosounder and sonar.
17. On board handling and processing.
18. Chemical composition of fish.
19. Different types of freezers.
20. Processing of Cephalopods.
21. Fundamental aspects of quality.
22. Methods of packing of various seafood products for export.
23. Fishermen cooperatives.
24. Sea food trade fairs.

(7 x 2 = 14)

III. Answer any two questions

(Weightage – 4)

25. Write an account on fishery by product.
26. Fundamental aspects of quality control problems of sea food.
27. Give an account on the various crafts and gears operated in inland waters.
28. Describe the various methods of fish preservation and processing techniques.

(2 x 4 = 8)

FOURTH SEMESTER M. Sc. DEGREE EXAMINATION

(CSS)

Zoology

ELECTIVE COURSE – HUMAN GENETICS - III

ZO 4 ET 12 - CANCER GENETICS AND GENETIC SERVICES

Time: Three hours

Maximum Weightage: 36

I. Answer the Following

(Weightage-1)

29. Write a note on Genetic registries.
30. Define Burkitt lymphoma.
31. Differentiate between Hodgkin & Non –Hodgkin lymphoma.
32. Explain retinoblastoma.
33. Describe apoptosis.
34. Differentiate between Telomeres & Telomerases.
35. Briefly explain the consequences of inbreeding.
36. What is Philadelphia chromosome?

M.Sc ZOOLOGY (ACADEMIC YEAR 2014 Onwards)

37. What is ELSI?
38. Explain Gene Libraries.
39. What is PAGE?
40. What is LOD Score?
41. Define Dosimetry.
42. Differentiate between PND act & MTP act

II. Answer any seven the following

(Weightage-2)

43. Write a detailed note on Human Genome Project?
44. Briefly explain vectors used in Gene Cloning?
45. Distinguish between chromosome walking & chromosome jumping
46. What is Cancer? Give details about its genetic basis?
47. Write about principle and procedures of different types of Electrophoresis
48. Role of Dermatoglyphics in diagnosis of human disorders
49. Discuss briefly on MHC\HLA class of antigens in humans
50. Discuss about different types of Auto immune diseases
51. Define Oncogene? Briefly explain the mechanism of Oncogene expression
52. Distinguish between incidence & prevalence among genetic disorders

(7 x 2 = 14 weightage)

III. Answer any two of the Following

(Weightage-4)

53. What is Genetic Counseling? Discuss the strategies of Genetic Counseling.
54. Discuss the cytogenetics of Leukemia.
55. Write an essay on biological effects of radiation.
56. Describe analytical methods in Epidemiology.

(2 x 4 = 8 Weightage)



FOURTH SEMESTER M.Sc. DEGREE EXAMINATION (CSS)

Zoology

ELECTIVE COURSE: WILDLIFE BIOLOGY

ZO4ET12- WILDLIFE MANAGEMENT

Time: Three Hours

Maximum Weightage: 36

I. Answer the following: -

(Weightage – 1)

1. Mention different techniques for the assessment of vegetation cover?
2. Write down any four methods to determine age of mammals.
3. Comment on functions of a modern zoo.
4. Briefly explain food selection and patterns of habitat utilization.
5. Write notes on importance of radiotelemetry in wildlife studies.
6. What are Ramsar sites? Mention Ramsar sites in India.
7. Comment on endangered Indian cranes.

M.Sc ZOOLOGY (ACADEMIC YEAR 2014 Onwards)

8. Write notes on Zoonosis.
9. Give an account on fire control and suppression procedures in India.
10. Write down the policies and laws in wildlife management.
11. What are safari parks? Mention demerits of this concept.
12. Briefly explain four capturing techniques in wildlife.
13. Discuss mycoplasmal disease.
14. Comment on convention on Wetlands.

(14 x 1 =14 weightage)

II. Answer any seven of the following:-

15. Explain wildlife photography.
16. Write notes on Habitat Suitability Index.
17. Discuss components of wildlife habitat.
18. Explain briefly on the following:-
 - a) Carnivory
 - b) Depredation
 - c) Optimal foraging theory
 - d) Pheasantry
19. Briefly explain any two viral and bacterial diseases on wildlife.
20. Explain the importance of Radar and GIS in wildlife research.
21. Give a brief account on Pheasant management?
22. Briefly explain Chemical immobilization techniques in wildlife research.
23. Give a brief account on basic consideration for designing a modern zoo.
24. Comment on captive breeding and their role in wildlife conservation.

(7 x 2 = 14 Weightage)



III. Answer any two questions.

25. Explain various methods adopted in wild life for the food habit studies.
26. What are Wetlands? Explain wetland management with special emphasis on waterfowl.
27. Comment on Impacts of pollution on forest and wildlife. Add notes on Environmental sanitation.
28. Discuss the direct and indirect methods for the wildlife population estimation.

(2 x 4 = 8 Weightage)