

M. Sc. ZOOLOGY: 2018–2019

(CBC System)

Course Code-MI ZOO 01CT-01 No of Credits-4

Paper I: Biosystematics, Structure and Function of Invertebrates

UNIT – I

Biosystematics: Basic concepts of Taxonomy; Rules of nomenclature; Basis of invertebrate classification; Hierarchy of categories; Molecular Cytotaxonomy: Importance of cytology and genetics in taxonomy.

UNIT – II

Body plans; Coelom, Symmetry, Metamerism

Locomotor mechanisms: Amoeboid locomotion; Ciliary locomotion; Flagellar locomotion; Non-jointed appendages; Jointed appendages

UNIT – III

Feeding apparatus of Invertebrates

Feeding and Digestion: Microphagy, Macrophagy; Herbivores, Omnivores, Carnivores, Filter feeding; Ciliary feeding,

Digestion: intracellular and extracellular digestion.

UNIT – IV

Endocrine system: Neurosecretory cells; Endocrine structures in invertebrates; Role of hormones in moulting and metamorphosis in Insects and Crustaceans.

UNIT – V

Reproduction: Asexual reproduction; Parthenogenesis; Origin of sex; Sexual reproduction.

Regeneration in Invertebrates.

M. Sc. ZOOLOGY: 2018—2019

(CBC System)

Course Code- MI ZOO02CT-02 No of Credits-4

Paper II-Ethology and Evolution

UNIT - I

Concept of Ethology - Introduction, definition and historical outline, Fixed action pattern, sign stimulus, Orientation, kinesis and taxis. Methods of studying behavior.

UNIT - II

Social organization and its advantages. Eusociality, Insect societies, primate societies, Parental care in fishes, amphibians and mammals.

UNIT - III

Learning- types of learning, Biological rhythms, Reproductive Behaviour – display, courtship, sexual selection and mating systems. Ecological Behaviour – kin selection.

UNIT - IV

History of Evolution, General concepts of evolution, detailed account of destabilizing forces of evolution: Natural selection, Isolation, Genetic drift, Geometric migration, Meiotic drive, Hardy-Weinberg law of genetic equilibrium calculating allele & genotype frequency, mathematical calculation of frequency changes in mutation,.

UNIT - V

Concept of Speciation, Factors responsible for speciation, Modes of speciation (Sympatric, Allopatric and Parapatric), Micro and Macro-evolution: human evolution. Geological time scale and fossils.

M. Sc. ZOOLOGY: 2018–2019

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Course Code-MI ZOO03 CT03 No of Credits-4

Paper III -Instrumentation and Techniques in Biology

UNIT- I

Principles and application of Phase contrast, Fluorescence, Transmission, Scanning, Confocal and Atomic force microscopes, Micrometry.

UNIT- II

Principles and application of pH meter, colorimeter, spectrophotometer, Centrifuge and Ultracentrifuge, Electrophoresis (Paper, agarose, PAGE), Chromatography (TLC, Ion exchange, Column &HPLC).

UNIT- III

Fixation and Fixatives: Methods of fixation, chemicals used as fixatives and their preparation, chemical basis of fixation (formaldehyde, glutaraldehyde, chromium salts, mercury salts, alcohol and acetone), washing and post fixation methods, decalcification, Cryopreservation.

UNIT- IV

Stains and Staining techniques: cellular organelles stain (mitochondria, Golgi Apparatus, ER, Nuclear and Cytoplasmic Stains, Double and Triple stain)

UNIT- V

Microtomy- Dehydration, Clearing and Infiltration, Embedding methods, Trimming, Sectioning. Cryostat sectioning and Mounting, Mounting media, Freezing techniques, Freeze drying, Freeze fracture and itching.

M. Sc. ZOOLOGY: 2018–2019

(CBC System)

Course code-MI ZOO 04 CT-04 No of Credits-4

Paper IV -Cell and Molecular Biology

UNIT- I

Biomembranes: Basic structure, Transport across cell membranes, Diffusion, Osmosis (Uniports, Symports and Antiports), Ion Channels, Active Transport and Membrane Pumps, Electrical properties of biomembranes and Membrane potential.

UNIT- II

Cell adhesion and Communication: Tight junctions, Gap junctions, Connexins, Desmosomes and Spot desmosomes.

Cell–Cell signaling : Second messenger system, cAMP , Cell surface receptors and intra cellular receptors.

UNIT- III

Cell Cycle : Role of Microtubules in cell cycle. Cyclines and cycline dependent kinases, Regulation of CDK – cyclin activity; Check points of cell cycle.

Biology of Aging: Maximum life span and life expectancy, Causes of aging, genetic instability, free radicals, oxidative damage and antioxidants, Telomerase.

Cell Death: Necrosis and Apoptosis; genes involved in apoptosis.

UNIT- IV

Intracellular transport : Intracellular protein trafficking, Signal hypothesis. Golgi sorting : Post and co-translational modifications. Lysosomal polymorphism.

Regulation of intracellular transport.

UNIT- V

C-value Paradox, Euchromatin and Heterochromatin. Human karyotype, Chromosomal banding (Paris conference nomenclature).

Somatic Cell Genetics : Cell fusion and hybrid agents, mechanism of fusion Formation of Heterokaryon (Hybrid selection and chromosomal segregation).

Applications of Hybridoma technology.

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Course code-MI ZOO 05 CP 01 No of Credits-4

Practical – I

(Paper I and II)

1 STUDY OF MUSEUM SPECIMENS

(A) PROTOZOA

Amoeba proteus w.m., *Paramecium* .w.m., *Paramecium* fission
Paramecium conjugation, *Plasmodium* (signet ring), *Vorticella* w.m.,
Nyctotherus w.m., *Entamoeba histolytica* w.m., Radiolarian ooze,
Ceratium w.m., *Volvox* w.m., *Monocystis* trophozites

(B) PORIFERA

Hyalonema, *Euplectella*, *Leucosolenia*, *Cliona*, *Spongilla*, *Chalina*,
Euspongia, *Sycon*, *Hircinia*, *Grantia* *Olynthus*

(C) COELENTERATA

Physalia, *Porpita*, *Gorgonia*, *Metridium*, , *Aurelia*, *Corallium*, *Adamsia*,
Edwardsia, *Cerianthus*, *Fungia*, *Pennatula*, *Madrepora*, *Vallela*,
Sagarita, *Renilla*, *Zoanthus* *Favia*, *Virgularia*, *Millepora* *Alcyonium*.

(D) PLATYHELMINTHES AND ASCHELMINTHES

Taenia, *Fasciola*, *Echinococcus*, *Ascaris*(male and female),
Dracunculus, *Dugesia*.

(E) ANNELIDA

Polynoe, *Phoronis*, *Chaetopterus*, *Pontobdella*, *Nereis*, *Heteronereis*,
Hirudinaria, *Glycera*, *Eunice*, *Terebella*, *Arenicola*, *Bonelia*, *Aphrodite*,
Eurythoe

(F) ARTHROPODA

Squilla, *Palaemon*, *Scolopendra* *Julus*, Queen termite, *Papillio*,
Bombyx mori, *Vespa*, *Sacculina* on Crab, *Locust*, *Carcinus*, *Limulus*,

Hermit crab, Balanus, Peripatus, Pediculus, Lepisma, Phyllum, Mantis religiosa, Palamnaeus, Cimex, Lepas

(G) MOLLUSCA

Sepia, Loriculus, Teredo, Chiton, Aplysia, Doris, Dentalium, Octopus, Ligula, Mytilus, Pila, Margeritifera, Turbinella, Ostrea, Pinctada, Solen, Loligo, Limax, Pecten, Nautilus, Patella.

(H) ECHINODERMATA

Asterias, Ophioderma, Clypeaster, Echinus, Holothuria, Antedon, Ophiothrix

2 STUDY OF PREPARED SLIDES

(A) PORIFEERA

L.S. of *Grantia*, T.S. of *Sycon*, L.S. Of *Sycon*, *Leucosolenia* Spongin fibres, Gemmule, Spicules.

(B) COELENTERATA

Hydra with bud, T.S. of *Hydra*, L.S. of *Hydra*, T.S. of Testes *Hydra*, T.S. of Ovary of *Hydra*, *Obelia* colony.

(C) PLATYHELMINTHES AND ASCHELMINTHES

Schistosoma W.M., *Taenia* immature proglottid, *Taenia* mature proglottid, *Taenia* gravid proglottid, *Miracidium* larva W.M., Sporocyst larva W.M., *Cercaria* larva W.M., *Redia* larva W.M., T.S. of gonads of *Fasciola*, T.S. of *Planaria*, T.S. of *Ascaris* female, T.S. of *Ascaris* female, *Trichinella spiralis* cyst W.M., *Enterobius* W.M., *Ancylostoma* W.M.

(D) ANNELIDA

Tubifex W.M., septal nephridia of *Pheretima*, L.S. of anterior region of *Pheretima*, T.S. through Pharynx of *Pheretima*, T.S. of typhlosolar region of *Pheretima*, T.S. through gizzard of *Pheretima*, T.S. through prostate gland of *Pheretima*, T.S through stomach of *Pheretima*, W.M. of jaw of *Hirudinaria*, T.S. of *Neries*, W.M. of *Glossiphonia*.

(E) ARTHROPODA

W.M. of *Culex* male, W.M. of *Culex* female, W.M. of pupae of *Culex*, W.M. of pupae of *Anopheles*, W.M. of *Anopheles* male, W.M. of *Anopheles* female, Mouth parts of male *Culex*, Mouth parts of female *Culex*, Mouth parts of male *Anopheles*, Mouth parts of female *Anopheles*, Different types of mouth parts, Different types of legs: jumping, clinging, running, pollinating, W.M. of *Pediculus*, W.M. of *Xenopsylla*, W.M. of *Lucifer*, W.M. of Zoea larva, W.M. of Nauplius larva, W.M. of Metanauplius, W.M. of *Mysis*, W.M. of *Caprella*, W.M. of *Cypris*, W.M. of Alima larva, W.M. of trachea of *Periplaneta*, W.M. of salivary glands of *Periplaneta*, W.M. of larva of *Anopheles*.

(F) MOLLUSCA

T.S. of *Lamellidens*, T.S. of *Lamellidens* through foot, T.S. gill of *Lamellidens*, Glochidium larva, Valiger larva, W.M. of radula *Pila*, T.S. of osphradium of *Pila*.

(G) ECHINODERMATA

C.S. of arm *Asterias*, T.S. of tube feet of *Asterias*, W.M. of pedicellaria of *Asterias*, W.M., Bipinnaria larva, W.M. of Echinopluteus larva.

3 PERMANENT PREPARATIONS OF THE FOLLOWING:

- (a) Protozoa** : Preparation of culture of various protozoans, mounting of various protozoans including parasitic forms
- (b) Porifera** : Gemmules, spicules, spongin fibres
- (c) Coelenterata** : *Obelia* colony medusa, *Pennaria*, *Sertularia*, *Pluniularia*, *Companularia*, *Hydra*, *Hydra* with gonads.

- (d) **Helminthes** : Immature, mature and gravid proglottids, scolex of *Taenia* larval forms
- (e) **Annelida** : *Pheretima*: Ovary, septal nephridium, seta (*in situ*) spermatheca. *Neries* and *Heteroneries* Parapodia trochophore larva, *Hirudinaria*: Jaws and testicular nephridia.
- (f) **Athropoda** : *Apis*: Sting apparatus *Periplaneta*: Salivary glands testes, spermatheca. Mounting of various types of mouth parts. Mounting of various larval forms
- (g) **Mollusca** : *Pila*: Mounting of gill, osphradium and radula, *Lamellidens* : Gill lamella.
- (h) **Echinodermata** : Mounting of larval forms

Preparation of Taxonomic Keys.

VIRTUAL DISSECTIONS/LABELING

- 1 Annelida : General anatomy, alimentary canal and reproductive system of *Pheretima* and *Hirudinaria*.
- 2 Mollusca : General anatomy and nervous system of : *Mytilus*, *Aplysia*, *Sepia* and *Loligo*.
- 3 Arthropoda : Nervous system of *Squilla*, *Vespa* and *Apis*. General anatomy, alimentary canal nervous system and reproductive system of *Schistocerca*.
- 4 Echinodermata: *Holothuria*: Flag labelling of various organs. *Echinus*: Aristotle's lantern.

Ethology and Evolution

- 5 Antennal grooming behavior of Cockroach
- 6 Learning in rat/mice.(Trial and Error and latent learning)
- 7 Food preference in stored product pests.

- 8 Maternal Behaviour in rat/mice.
- 9 Habituation in Rat/Mice.
- 10 Exploratory Behaviour in Rat/Mice.
- 11 To study the orientational responses of larvae to volatile and nonvolatile stimuli .
- 12 Estimation of gene and genotype frequency in the light of Hardy Weinberg Law based on facial traits, blood group (ABO) and PTC
- 13 Demonstration of density dependent selection in plants and animal population.
14. Pedigree analysis (autosomal, X linked and Y linked traits only).

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Course code-MI ZOO 06CP-02 No of Credits-4

Practical- II

(Paper –III and IV)

1. Demonstration of practical usage of :
 - a. Colorimeter
 - b. Spectrophotometer
 - c. Centrifuge
 - d. Fluorescence microscope
- 2 Preparation of paraffin blocks of given tissue: sectioning and staining
- 3 Preparation of cryostat section and staining
- 4 Preparation of molar solutions, buffers, mounting media, fixatives
- 5 Fixation methods and cryopreservation.
- 5 Exercise related to animal breeding and rearing.
- 6 Single double staining of paraffin sections
- 7 Preparation of different stains
- 8 Permanent slides: Mitosis, Meiosis, cancer, Bone marrow etc.
- 9 Preparation of human Karyotype
- 10 Euchromatin and heterochromatin staining in onion cells.
- 11 Transportation across RBC membrane using isotonic, hypotonic and hypertonic solution.
- 12 Sex chromatin in squamous cell epithelium of oral cavity

Recommended books:

K. Wilson and K.H. Goulding: A biologist's guide to principles and techniques of Practical biochemistry, ELBS Pub.

Robert Braun: Introduction to instrumental analysis, McGraw Hill Intern.

Nigel Jenkins: Animal cell biotechnology, methods and Protocols, Humana Press

R. Ralph: Methods in experimental Biology. Blackie Pub

M. Sc. ZOOLOGY: 2018–2019

(CBC System)

Course code-M2 ZOO 01CT-05 No of Credits-4

Paper I: Biodiversity and Conservation Biology

UNIT – I

Concepts of biodiversity; Levels of biodiversity – genetic biodiversity, intraspecific diversity, species richness, ecosystem and biome diversity; Hotspots of Biodiversity; India as a mega-diversity nation.

UNIT – II

Habitat degradation, fragmentation and destruction; Climate change; poaching of wildlife and man-wildlife conflicts; Over exploitation and over abundance, environmental impact assessment.

UNIT – III

Introduction to Conservation Biology; Characteristics of endangered species; Endangered species of India; Conservation of biodiversity: in-situ and ex-situ conservation; Conservation categories of taxa according to IUCN, CITES and WPA.

UNIT – IV

Plant animal interactions: Herbivory, plant defenses and food selection. Ecology of seed dispersal and pollination by animals. Plant animal interactions in the context of population ecology and community ecology.

UNIT – V

Introduction to Restoration Ecology: Captive breeding and Propagation; Human factors leading to extermination/extinction of species. Traditional values of tribals and local people around protected area. Species reintroduction programs: Rhino and Tiger reintroduction.

M. Sc. ZOOLOGY: 2018–2019

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Course Code-M2 ZOO 02 CT06 No of Credits-4

Paper II Environmental Toxicology

UNIT – I

Environmental stress and their management, global warming, ozone depletion, acid and nitrogen deposition. Agro- chemical and pesticide pollution and their control.

UNIT – II

General principles toxicology. Bioassay of toxicants using different models. Dose determinations

UNIT – III

Bioindicators and biomarkers of environmental health. Basic concept of bioaccumulation and biodegradation of pollutants. Basic survey of environmental toxicants.

UNIT – IV

Routes of exposure of toxicants; absorption of toxicants – site mechanism and kinetics of absorption. Distribution of toxicants – plasma concentration and storage and excretion of toxicants.

UNIT – V

Safety evaluation of toxicants – environmental hazards and risk assessment; risk management and monitoring, criteria for safety evaluation.

M. Sc. ZOOLOGY: 2018–2019

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Course code-M2ZOO03CT-07 No of Credits-4

Paper III -Developmental Biology

UNIT-I

Differentiation of gonads in Mammals. Production of male and female gametes and its hormonal control. Organization of egg cytoplasm. Types of Ova and sperm and their basis.

UNIT-II

Fertilization, Biochemistry of fertilization. Cell surface molecules in sperm-egg recognition. Parthenogenesis. Cleavage, Blastulation and Gastrulation. Fate maps.

UNIT-III

Commitment, specification, Embryonic Induction (induction of primitive nervous system and eye lens induction), Competence, determination and differentiation. Establishment of symmetry. Axes and pattern formation.

UNIT-IV

Morphogenesis of Brain. Neural crest cells and their derivatives. Differentiation of neurons. Development of eyes, heart, alimentary canal and its accessory organs. Metamorphosis in Amphibia and Insects and its hormonal control.

UNIT-V

Evolution of cleidoic egg and viviparity. Extra embryonic membranes. Implantation and Placentation. Stem cells and potency. Environmental regulation of normal development. Animal cloning and its socio-ethic issues. Modern techniques of developmental biology: their uses and misuses.

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(CBC System)

Course Code-M2ZOO 04CT08 No of Credits-4

Paper IV--Animal Physiology and Immunology

UNIT-I

Thermoregulation and cold tolerance

- 1 Heat balance and exchange
- 2 endotherms and ectotherms
- 3 counter current heat exchangers
- 4 torpor, hibernation and aestivation.

UNIT-II

Ionic and Osmotic balance

- 1 Osmoregulators Vs osmoconformers
- 2 Osmoregulation in aquatic and terrestrial environments,
- 3 Counter current mechanism (mechanism for concentration of urine and its excretion)
- 4 Hormonal control of regulation of water and salt balance

UNIT-III

Gas exchange and acid base balance

- 1 Mechanism of inspiration and expiration in aquatic and terrestrial animals
- 2 O₂ and CO₂ transport in blood
- 3 role of Haemoglobin in regulation of body pH,
- 4 Chloride shift, Haldane Effect.

UNIT-IV

- 1 Innate and Adaptive Immunity,
- 2 Cells and organs of immune system: B-lymphocytes, T-Lymphocytes, Null-cell, Mononuclear cell, granulocytic cells, mast cells, dendrite cells.

- 3 Primary and Secondary Lymphoid organs.
- 4 Antigens and Immunogens (Antigenicity and Immunogenicity Epitopes and Heptanes).
- 5 Antibody classification and function.

UNIT-V

- 1 Humoral and cell mediated immunity
- 2 Major histocompatibility complex: Types and Structures
- 3 Immunodeficiency disease and autoimmunity
- 4 Hypersensitivity
- 5 Brief idea of vaccines.

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(CBC System)

Course Code-M2 ZOO05- CP03 No of Credits-4

Practical – I

(Paper I and II)

1. Visit to natural habitats and protected areas and wetlands of Rajasthan for detailed study: Student should submit the report on the study covering major fauna, flora and geography.
2. Locating the hotspots and biosphere reserves on the map of the world.
3. Determination of population density of animals, species dominance and frequency using quadrant/plot method.
4. Analysis of habitat characteristics (gbh/dbh, tree height, canopy volume).
5. Analysis of species diversity using diversity indices.
6. Study of various modes of seed dispersal.
7. Study of various modes of pollination.
8. Identification and comments on spots of endangered species: Leatherback sea turtle, gharial, great Indian bustard, long billed vulture, Siberian crane, Nilgiri langur, Royal Bengal tiger, Asian elephant, blue whale, Indian Rhinoceros .
9. Preparation of serial dilution of doses
10. Determination of LC50 and LC 90 using insect as a model
11. Bioassay of different bio-pesticides with different mode of actions against pests/vectors
12. Persistency test of synthetic chemical against pest
13. Residual toxicity test with bio insecticide.
14. Effect of heavy metals on mammalian tissues

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(CBC System)
Course code-M2 ZOO6CP-04 No of Credits-4

Practical- II
(Paper III and IV)

- 1 Study of permanent slides :
 - (a) T.S. of mammalian ovary and testis
 - (b) Chick embryo w.m. and T.S. of 18 hours, 24 hours, 36 hours, 48 hours and 72 hours.
 - (c) W.M. of mammalian sperm
 - (d) Cleavage, blastula and gastrula of frog.
- 2 Extraction and observation of cauda epididymal sperms of mammals.
- 3 Preparation of permanent mount of chick embryo of different hours stages.
- 4 Perpetration of Permanent Mount Cleavage, Blastula, Gastrula of Frog.
- 5 Study of permanent slides of various cells of immune system.
- 6 Study of permanent slides of various immune organs viz spleen, thymus, bone-marrow, kidney, lymph nodes, MALT.
- 7 Demonstration of Vital capacity.
- 8 Dissection of various organs and glands associated with immune system.
- 9 Demonstration of clotting time, bleeding time.
- 10 Preparation of haematin crystals.
- 11 Determination of ESR under various disease conditions.
- 12 Determination of PCV and MCV
- 13 Determination of health status of self on the basis of analysis of blood smear.

M. Sc. ZOOLOGY: 2018–2019

(CBCS System)

Course code-M3ZOO01CT-09 No of Credits-4

Paper-I Vertebrates

UNIT - I

- 1 Outline Classification of the Chordates and characters
- 2 Origin and adaptive radiation of chordates
- 3 Origin and Evolution of Agnatha: Ostracoderms and Cyclostomes, and early gnathostomes (Placoderms), Phylogeny of Vertebrate,

UNIT- II

- 1 Origin and evolution of Pisces, Fish Migration
- 2 Origin, evolution and adaptive radiation of Amphibia
- 3 Neoteny and Paedogenesis
- 4 Parental care

UNIT – III

- 1 Origin and evolution of Reptiles.
- 2 Mesozoic reptiles
- 3 Dinosaurs
- 4 Living reptiles, Rhynchocephalia, Chelonia, Crocodilia and Squamata
- 5 Archaeopteryx

UNIT- IV

- 1 Origin and evolution of Aves,
- 2 Flightless birds
- 3 Origin of flight, Flight Adaptation
- 4 Types of beaks and palate in birds.

UNIT- V

- 1 Origin, evolution and adaptive radiation of Mammals (Prototheria nad Metatheria).
- 2 Evolution of Placenta.
- 3 Cenozoic Mammals.

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(CBC System)

Course Code-M3 ZOO 02 CT-10 No of Credits-4

Paper II - Computational biology ,Biostatistics and Bioinformatics

UNIT-I

Data collection and tabulation, Frequency distribution, Diagrammatic and graphical representation of statistical data, Sampling techniques, measures of central tendencies.

UNIT-II

Standard deviation and standard error, Correlation and regression, Basic idea of testing significance, level of significance, Students T test, Chi-Square test, F test, analysis of variance, Basic knowledge of computer statistical programs – Prism, SPSS.

UNIT-III

Probability distributions (Binomial, Poisson and Normal). Statistical designing of experiments, purpose of research design and characteristics of good research designing, Setting up of experiments. Factorial design, Variables, Controls and standards.

UNIT-IV

Definition and characteristics of different type of computers (Desktop, Note book, Workstation, Server and Mainframe) Major Operating systems, Internet tools, Web services, email services, Viruses and antivirus tools, Important features of word processing software's. Brief idea of following:

Adobe acrobat, MS excel, MS Power point and its important features, Search engines-Google, Google Scholar, E-journals, E-books, digital library, INFLIBNET, Abstract service, Accessing scientific databases.

UNIT-V

Introduction to Bioinformatics, Principals of bioinformatics- useful sites for researchers, Bioinformatics in life sciences, biological data bases- Nucleic

acid sequence data base: Gene bank, brief idea of Microarray, introduction to genomics and proteomics. Bioinformatics in India.

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Course Code-M3ZOO 03 ET-01A No of Credits-4

Entomology and Insect Toxicology

Paper- I SYSTEMATIC ENTOMOLOGY AND INSECT ECOLOGY

UNIT-I

Taxonomy and classification of Insects

Origin and Evolution of insects with special reference to fossil insects; causes of success of insects, An introduction to insect classification, Classification of insect's up to orders. Use of identification keys.

UNIT II

Classification of insects up to super families in economical important groups:

Orthoptera, Lepidoptera, Diptera and Hymenoptera

UNIT-III

Knowledge and use of equipment for the collection and preservation of insects, insect net, killing bottle, spreading board, insect box device for inflating larva, light trap, etc.

Insect society: Evolution of Sociality, Social organization and social behavior in honey bee, ants, termites and wasps. Altruism in relation to social insects.

UNIT-IV

Ecology of insects

Ecology of insects in the ecology of the earth.

Population dynamics. Population growth and fluctuation and population regulatory mechanisms .Plant resistance to insects and types of resistance.

UNIT-V

Biochemical adaptations to environmental stresses (Metamorphosis; Diapause, polymorphism etc.)

Effect of physical factors: Intra and interspecific relations

Insects and humans interactions.

Suggested Literature:

1. A general text book of entomology, Imms , A. D., Chapman and Hall, UK
2. Introduction to the study of insects, Borror, D. J., Triplehorn, C. A., and Johnson, N. F.,M Saunders College Publication, USA
3. Principles of Insect Morphology, Snodgrass, R. E., Cornell Univ. Press, USA
4. The Insect Societies, Wilson, E. O., Harward Univ. Press, UK
5. Host Selection by Phytophagous insects, Bernays, E. A., and Chapman, R. F., Chapman and Hall, New York, USA
6. Insect Plant Biology, Schoonhoven, L. M., van Loop, J. A., and Dicke. M. Pub. Oxford Univ. Press. USA

M. Sc. ZOOLOGY: 2018–2019

(CBC System)

Course Code-M3ZOO-03 ET01B No of Credits-4

Wildlife Biology-I : Biodiversity and Wildlife Ecology

UNIT I

Concepts of biodiversity, levels of biodiversity – biological, genetic, species and ecosystem diversity, Types of species: Key stone species, Umbrella species, Indicator species, Flagship species, Exotic and introduced sp., and Indigenous sp. Value of biodiversity; Threats to biodiversity. Ecosystem services

UNIT II

Biotic community – organization and characteristics of community, ecological dominance, niche, ecotone and edge effect.

Intra- and inter-specific relation. Optimum foraging theory, carrying capacity,

Population ecology – density, natality, mortality, sex ratio, age distribution, fecundity by age, survival by age, population dispersion, population growth (types, measurement and theories). Other aspects: guilds, resource partitioning, and competitive exclusion.

UNIT III

Ecology of major habitats: Deserts, Grasslands and Forests

Patterns of habitat utilization and dispersion, including home range – migration and corridors. Predator – prey interaction

Physical factors influencing terrestrial habitats: Drought, flood, soil erosion, grazing, fire

UNIT IV

Major vegetation types of India- basis of classification, phenology and distribution.

Forest soils: classification of soils, factors affecting soil formation, physical and chemical properties, causes of soil erosion and conservation methods

UNIT V

Forest mensuration – methods of measuring diameter/girth, height and canopy cover

Silviculture – general principles, ecological and physiological factors influencing vegetation, natural and artificial regeneration of forests – nursery techniques, seed technology – collection, storage, pre-treatment and germination

M. Sc. ZOOLOGY: 2018–2019

(CBC System)

Course Code-M3ZOO 03ET01C No of Credits-4

Limnology and Fisheries- I: Limnology

UNIT-I

Definitions of lakes. Benefits of lakes. Origin of Lakes. Lake classification

Morphometric features of Lake and their importance in trophogenicity of lakes

UNIT-II

Physical factors of Lake water with particular reference to- Temperature: Thermal stratification and heat budget; Light; Turbidity; Density; Waves and currents (a brief account)

UNIT-III

Chemical factors of Lake water with particular reference to-pH; Dissolved gases, BOD and COD; Nitrates and Nitrogen Cycle; Phosphates and Phosphorus cycle;CO₂ and carbon cycle.

UNIT-IV

Definition, classification, distribution and limnological significance of plankton, nekton and benthos. Biological productivity and Energy flow.

UNIT-V

Indices of Lake Productivity, Eutrophication- causes and control. Water purification techniques. Wet lands – definition, brief account and conservation measures.

M. Sc. ZOOLOGY: 2018–2019

(CBC System)

Course Code-M3ZOO04 ET02A No of Credits-4

Entomology and Insect Toxicology

Paper-II Insect Organization and Physiology

UNIT I

External Morphology of insects: Integument: Structure, composition , functions Functional morphology of head, thorax and abdomen .

Head segmentation and appendages.

Wing development and Wing venation in insects.

Physiology of Insects

UNIT-II

Muscular system cephalic, thoracic abdominal and flight muscles, mechanism of flight in insects.

Digestive system: Alimentary canal and physiology of digestion.

Nutrition: Nutritional requirement of insects, adaptations to liquid diet Role of micro organisms (Bacteria, Protozoa, Fungi) in digestion.

UNIT III

Circulatory system: Morphology and physiology including. Composition of haemolymph

Respiratory system: Structure of respiratory organs and physiology. Adaptations for aquatic respiration

Excretory system: Structure of excretory organs Cryptonephridial system and physiology of excretion.

UNIT-IV

Nervous system: Morphology and physiology

Neuro -endocrine system: Morphology and physiology.

Sense organs: auditory organs, sound and light producing organs, visual

organs and physiology of vision

UNIT-V

Reproductive systems: Structure and physiology. Male and female reproductive organs; Spermatogenesis and Oogenesis,.Structure of insects egg, Types of larvae, pupae and metamorphosis, role of endocrines in growth and development, .parthenogenesis.

M. Sc. ZOOLOGY: 2018–2019

(CBC System)

Course Code-M3ZOO 04ET02B No of Credits-4

Wildlife Biology-II : Conservation Biology

UNIT I

Introduction to conservation biology, conservation of biodiversity – patterns and processes – *in situ* and *ex situ* conservation, international conservation bodies – IUCN, UNDP, FAO, WWF

Ex situ conservation – role of zoos and aquariums, introduction/reintroduction and translocation

In situ conservation – national parks and wildlife sanctuaries – formation and management, protection and administration

UNIT II

National parks of India – Ranthambore, Gir, Kaziranga, Kanha, Bandipur, Corbett, Silent Valley; Marine National Parks of India – Mannar, Gulf of Kutch

Biospheres of India and their concept

Wildlife Sanctuaries in India – Periyar, Mudumalai, Sariska, Jaisamand, Kumbhalgarh, Sitamata, Phulwari ki Nal,

UNIT III

Zoological Parks – formation, management – food and feeding; zoo sanitation

Community reserves and sacred groves

IUCN categories in context to Indian Wildlife (Extinct, Extinct in wild, critically endangered, endangered, vulnerable, near threatened, least concern, data deficient and not evaluated)

UNIT IV

Endangered and threatened animals - Mammals (*Panthera tigris*, *Panthera pardus*, *Tetraceros quadricornis*, *Manis crassicaudata*, *Gazella gazelle bennetti*, *Bos gaurus*, *Elephas maximus*), Birds (*Pavo cristatus*, *Grus leucogeranus* – Siberian white crane, *Choriotis nigriceps* – Great Indian Bustard, *Gyps bengalensis*), reptiles (*Crocodylus palustris*, Python, *Kachuga kachuga*),

UNIT V

Captive breeding and propagation: rehabilitation, gene banks

Wildlife forensics: DNA banks for endangered animals; Pug mark analysis, Hair analysis

Conservation ethics and values.

M. Sc. ZOOLOGY: 2018–2019

(CBC System)

Course Code-M3ZOO04 ETC No of Credits-4

Limnology and Fisheries- II : Fresh Water Aquaculture

UNIT-I

Aquaculture: Introduction and scope in India Extensive, intensive and semi intensive culture. Biology of Indian major carps- *Labeo rohita*, *Catla catla* and *Cirrhinus mrigala*. Biology of exotic carps in India– *Cyprinus carpio*, *Ctenopharyngodon idella*, *Hypophthalmichthys molitrix*

UNIT-II

Biology and culture of indigenous and exotic freshwater prawns in India: *Macrobrachium malcolmsonii*, *Macrobrachium rosenbergii* and *Penaeus indicus*.

Cold water fishes- Trout, tench and golden Mahseer. Brackish water fishes- mullets, *Lates calcarifer* and *Chanos chanos*.

UNIT-III

Indigenous crafts and gears.

Freshwater weeds- Importance, harmful effects and methods of eradication.

Predatory fishes, weed fishes and their control. Blue revolution

UNIT-IV

Planning, construction and maintenance of fish farm. Different type of hatcheries.

Site selection and culturable fish selection. Fish Preservation and conservation. Fishes in culture and mythology. Aquatic plants culture

UNIT-V

Composite fish culture, Integrated Fish Farming, Monosex culture, Pen culture and Cage culture. Induced breeding- Hypophysation. Ovaprim, cryopreservation of gametes and embryos. Aquarium culture

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(CBC System)

Course Code-M3ZOO05CP05 No of Credits-4

SEMESTER – III

Practical- I

(Paper I & II)

1 Dissections/Labeling:

(a) Cranial nerves and electric organs of *Torpedo*, Accessory respiratory organs of *Anabas*, *Channa*, *Clarias*.

2 Mounting of oral hood, velum, pharyngeal wall and endostyle of *Amphioxus*.

3 Museum specimens and slides-

Protochordata : *Salpa*- sexual and asexual, *Botrylus*, *Herdmania*.

Fishes : *Rhinobatus*, *Chimaera*, *Acipensor*, *Amia*, *Periophthalmus*, *Echeneis*, *Exococtus*, *Notopterus*, *Trichures*, *mastacembalus*, *Diodon*, *Protopterus*, *hemiramphus*

Amphibians : *Ichthyophis*, *Necturus*, *Triturus*, *Alytes*, *Pipa*, *Ambyostoma*, *Hyla*, *Rhacophorus*

Reptiles : *Draco*, *Varanus*, *Calotes*, *Mobuia*, *Ophiosaurus*, *Helodema*, *Typhlops*, *Naja*, *Vipera*, *Bungarus*, *Hydrophis*, *Eryx*, *Natrix*

Birds : *Bubo*, *Malvis*, *Eudynamis*, *Corvus*, Model of *Archaeopteryx*, *Antegone*,

Mammals : *Ornithorhynchus*, *Manis*, *Pteropus*, *Hystrix*, *Felis domesticus*

- 4 Comparison of axial skeleton of *Labeo*, *Rana*, *Varanus*, *Columba* and Rabbit.
- 5 Exercise based on data collection and tabulation.
- 6 Exercised based on diagrammatic and graphical representation of statistical data
- 7 Exercised based on determination standard deviation, standard error , testing of significance
- 8 Student T test, Chi-Square test, F Test and analysis of variance- basic knowledge of these tests.
- 9 Exercise based on Probability distributions (Binomial, Poisson and Normal).
- 10 Exercise based on designing of animal experiments
- 11 Exercises based on use of MS power point, MS excel, Adobe-acrobat, Google.
- 12 Analysis of data using statistical software
- 13 Exercises based on bioinformatics
- 14 Data mining for sequence analysis.
- 15 Wet based tools for sequence researches and homology screening.

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Course Code -M3ZOO 05 EP01A No of Credits-4
Practical-II
Entomology and Insect Toxicology

- 1 Field trips for collection and preservation of insects of various orders.
- 2 Knowledge and use of equipment for the collection and preservation of insects, insect net, killing bottle, spreading board, insect box device for inflating larva, light trap, etc.
- 3 Collection and preservation .of insects and their different stages.
- 4 Collection of seasonal insects, nocturnal insects, aquatic insects, crop pests, stored grain pests and insects .of medical and veterinary importance.
- 5 Identification of insects from various orders prescribed far study in the syllabus. .
- 6 Collection of various types of social insects and their nests
- 7 **Dissections (Digital)**
- 8 Cockroach- Digestive. Circulatory, Reproductive systems and Neuro endocrine complex.
- 9 Grasshopper- Digestive, Circulatory, Reproductive systems and Neuroendocrine complex
- 10 Honey bee/Wasp: Disgestive and Nervous system and sting apparatus.
- 11 Permanent preparation of Different types of mouth parts, antennae, legs and wings.
- 12 Sting apparatus of honey bee
- 13 Pollen basket of boney bee
- 14 Tympanum and spiracle of grasshopper
- 15 Whole mounts (w.m.) of various small insects
- 16 Study of prepared slides:
- 17 Microtomy (Internal organs of insects):

M. Sc. ZOOLOGY: 2018–2019
(CBC System)
Course Code-M3ZOO05 EP01B No of Credits-4
PRACTICAL-II

Biodiversity, Wildlife Ecology and Conservation Biology

1. Visit to a zoological garden. Student should submit the report on the study covering various aspects like animals observed, their food preparation and presentation
2. Identification of mammalian species using hair imprinting and scat analysis.
3. Determination of population density of animals using transect and random survey methods.
4. Population density determination on the basis of mark recapture technique.
5. Determination of species dominance and frequency using quadrant/plot method.
6. Analysis of habitat characteristics (gbh/dbh, tree height, canopy volume).
7. Analysis of vegetation in given area.
8. Analysis of species diversity using diversity indices.
9. Study of light intensity using Lux Meter.
10. Soil analysis: Physical: temperature, colour, texture, Chemical: moisture content, carbonates, nitrates, pH.
11. Localization of different Grassland, deserts, forests on the world map.
12. Analysis of forest soil.
13. Vegetation of India to be marked and shown on map
14. Maintenance of nurseries

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Course Code-M3ZOO05EP01C No of Credits-4
Practical-II

Limnology and Fisheries

1. Measurement of the area of the lake.
2. To calculate shoreline and shore line development index of a lake.
3. To measure following parameters.
 - (a) Water temperature
 - (b) Depth of visibility
 - (c) pH
4. Estimation of total alkalinity in a water sample.
5. Estimation of chlorides in the water sample
6. Estimation of dissolved oxygen in the water sample
7. Estimation of gross primary productivity of water by dark and light bottle method
8. Estimation of BOD of the given lake water/waste water
9. Identification of various fishing crafts and gears
10. Identification of various aquatic insects
11. Identification of various freshwater planktons
12. Identification of various freshwater aquatic weeds
13. Qualitative analysis of plankton sample
14. Report on freshwater weeds of a lake
15. Report on freshwater benthos of a lake
16. Identification and writing comments on various limnological instruments, weeds, phytoplankton, zooplankton benthos and insects.
- 13 Visit to various lakes and polluted streams.

Suggested reading

1. Cryostat and vibratome sectioning, mounting and staining. Wild A. Soils and the Environment An Introduction. Cambridge University Press, Cambridge. .1993.
2. Cunningham W.P. and Saigo B.W. Environmental Science A global concern Win. C. Brown Publishers, London, 1995.
3. Goel MM.. Sharma M.C. and Purohit N.K. Problems of Environment Management in India. Anupriya Publishing House, Jaipur, 1999.
4. Enger E.D. and Smith B.F. Environmental Science (A study of interrelations) Win. C. Brown Pub. (Latest Edition).
5. Botkin D. And Keller E. Environmental Science. Earth as a Living Planet, Keller.
6. Smith RL. : Ecology and Field Biology. Harper and Reo. Publishers.
7. Berwick S.H. and Saharia, V.B.: The Development of international Principles and Practicals of wildlife research and Management: Asian and American Approaches Eds. Oxford Univ. Press, Delhi.
8. VB. Saharia, Wildlife in India, Natraj Publishers, Dehradun.
9. Ali S. and Ripley D.RA pictorial Guide to the birds of the'Indian Sub-continent BNHS Publications, 1995.
10. Prater S.H. The Book of Indian Animals, BNHS Publication.
11. Sharma,VD.: Wild wonders of Rajasthan. Prakash Books, New Delhi, 1998.
12. Ali S. Hand Book of Indian birds, BNHS Publications.
13. Giles R.H. and Toschik: Wildlife Management Techniques. The Wildlife Society Washington D.C.
14. SK Sharma. Ethno-Zoology.Himanshu Publication.Udaipur1998.
15. A.Verma. Conserving biodiversity of Rajasthan (With emphasis on Wild Fauna and Flora) Himanshu Publication, Udaipur. 2008.
16. Eric Kendel, J.H. Schwartz, T.M.Jessel: Principals of Neural Science, Mc Graw-Hill.
17. Susan Standing: Gray's Anatomy: The anatomical basis of clinical practice 39th Ed. Elsevier, 2005.

18. M.J.T.Fitzgerald: Clinical neuroanatomy and related Neuroscience. 4th Ed. CRC Press.
19. Richard S Snell.: Clinical Neuroanatomy for medical students. 5th Ed. Lippincott-Williams and Wilkins, 2001.
20. A.Longstaff: Instant Notes-Neuroscience, Viva books.
21. H.Lyons: Theory and strategy in histochemistry. Springer Verlag.
22. J.D. Bancroft and A. Stevens. Theory and Practice of Histological techniques, Churchill Livingstone
23. J.D.Bancroft. Histochemical Techniques, Butterworth.
24. AGE Pearse, Principles of histochemistry Vol I and II.
25. M. Pagano and K. Gauvreau, Principals of Biostatistics, Duxbury Press.
26. D.W.Mount: Bioinformatics: Sequence and Genome analysis, 2nd Ed. Cold Spring Harbour Lab. Press.
27. C.S.V.Murthy: Bioinformatics. Himalya Pub.

M. Sc. ZOOLOGY: 2018–2019

(CBC System)

Course Code-M4ZOO01CT11 No of Credits-4

Applied Zoology

UNIT – I

Concepts of applied Zoology: Protozoans and human diseases, Helminthes and human diseases, Insects and human diseases

UNIT - II

Beneficial insects and Agro industry, Apiculture–Different species and life cycle of honey bees. Behaviour and communication in bee colony, Bee keeping: Modern methods and industries in India

Sericulture – Life cycle of silk worm. Types of silk moth and silk. Cultivation of mulberry, Grainage and rearing of silk worm. Post harvest and cocoon production, Silk yarn reeling. Silk industry in India.

UNIT- III

Introduction to Vector Biology, Vector borne diseases in relation to climate change and human health. Control of Insect vectors and National vector borne programs. Changing scenario of pests of agricultural importance.

UNIT - IV

Habit,habitat and culture of fresh water fishes (Major carp). Fish harvesting and fish products . Fish industry in India. Pearl cuture and pearl industries in India.

UNIT - V

Sustainable agriculture and organic farming, Principles, objectives and component of organic farming, Vermicomposting and Agriculture business management: an overview.

M. Sc. ZOOLOGY: 2018–2019

(CBC System)

Course Code-M4ZOO02CT-12 No of Credits-4

Animal Biotechnology

UNIT- I

An over view of biotechnology, history, definition of recombinant DNA technology, milestones in development of r-DNA technology , tools of genetic engineering, Restriction endonucleases, cloning vectors, expression vectors, insertion vectors

UNIT-II

Isolation of genes, synthesis of genes, sequencing of gene, gene amplification, labeling of nucleic acid, molecular probes, Cloning techniques, formation of recombinant DNA, gene transfer methods, transgenic, transfection, Recombination – selection and screening.

UNIT-III

Nucleic acid hybridization, genomic and c-DNA library, FISH, Electrophoresis, blotting techniques, dot blots, slot blots, RFLP, RAPD, DNA finger printing, Chromosome walking , Reporter genes, marker genes,

UNIT-IV

Studying transcript of a cloned gene, posttranscriptional and translational processing, gene targeting, studying regulation of gene expression. Human genome project, Gene therapy.

UNIT-V

Role of biotechnology in health care - Vaccine production, biotechnology in diagnosis, Ethical and social implications of gene technology, patenting laws, IPR, bio-safety regulations.

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Course Code-M4ZOO03 ET -01 A No of Credits-4

Paper-I ECONOMIC AND COMMERCIAL ENTOMOLOGY

UNIT-I

PESTS OF ECONOMIC IMPORTANCE AND THEIR MANAGEMENT

Identification, damage symptoms, life cycle and management of important insect pests of vegetables fruits ,and stored grains .

Synthetic Insecticides: Classification and nomenclature, Assessment of pest status; EIL and ETL and chemical control of pests

Pheromones and other Attractants, Repellents, Chemosterillants

Biological characteristics of parasitoids, predators and pathogens and their role in nature

UNIT-II.

Biological control of insects as a component of IPM

Biopesticides:Herbal and Microbial ,their production and applications

Biotechnology in insect control..

Nanotechnology in Crop Protection.

UNIT-III

Medical Entomology

Flies – Types, Role in disease transmission, Case studies – Myasis.

Fleas- Morphology, Life cycle, Role in plague transmission, Control strategy

Ticks : General consideration, Soft and Hard ticks - External morphology, , Life cycle, Disease relationship and control measures.

Mites- Morphology, Life cycle, diseases and Control strategy

UNIT-IV

Life cycle of different species of mosquitoes

Identification of various mosquito borne diseases. Surveillance and outbreak of vector borne diseases in tropical countries.

Global warming and disease outbreak.

Integrated vector management

WHO guide lines for vector surveillance and control.

UNIT-V

Commercial Entomology

Different species of honeybees, their identification, life cycle and division of labour in the colony Modern beekeeping Management of apiary and Beekeeping in India.

Types of silkworms, their nature and life cycle Brief idea of sericulture and silk industries in India

Brief idea of lac culture and lac industries in India

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Course code-M4ZOO 03ET -01B No of Credits-4

PAPER I

Wildlife Biology : Indian Wildlife

UNIT I

Zoogeographical regions of India and their fauna: Himalayan, Eastern and Western ghats, Thar, Deccan plateau, Gangetic plains

Fauna of Thar Desert (Chinkara, Desert fox, Black buck, Great Indian Bustard, Indian Peafowl, Desert *Agama*)

UNIT II

Status, distribution, physical characteristics and ethology of: Tiger, Lion, Rhinoceros, Elephant, Mugger, Four-horned Antelope

Status, distribution, physical characteristics of some threatened plants: *Prosopis cineraria*, *Albizia lebbek*, *Azadirachta indica*, *Withania somnifera*, *Commiphora wightii*

UNIT III

Special Wildlife programs: Project Tiger, Project Elephant, Operation Rhino, Project Crocodile,

Wildlife of Rajasthan

Ramsar convention, Ramsar sites of India (Chilka lake, Bhoj Wetland, Wular Lake, Deepor Beel, Point Calimere Wildlife and Bird Sanctuary), Ramsar sites of Rajasthan (Keoladeo National Park, Sambhar lake)

Important Bird Areas (IBAs) of India and Rajasthan

UNIT IV

Wildlife Institutes in India: WII, BNHS, ZSI, IIFM, FSI, CAZRI, Central Zoo Authority of India

Wildlife legislation: Wildlife Protection Act, 1972; National Wildlife Action Plan, 2002; National Biodiversity Act, 2002

UNIT V

Wildlife trade and trafficking

Damages caused by wildlife- their identification and control

Animals in Indian mythology (symbols, vehicles, divinities)

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Course Code-M4ZOO03ET -01C No of Credits-4

Paper I

Limnology and Fisheries

Fisheries Management

UNIT – I

Fisheries and classification of fisheries; Lacustrine fisheries; Riverine fisheries – Ganga river system; Coastal and Deep sea fisheries.

UNIT – II

Fisheries of Rajasthan

Fisheries of economically important fishes: Sardine; Bombay duck; Mackerel; Hilsa.

UNIT – III

Pre and Post-harvest Technology: Food of culture fishes, supplementary feed. Probiotics; live-fish transport; Fish spoilage; Fish preservation; Fishery by-products.

UNIT – IV

Fish Biotechnology: Application of genetics and biotechnology in fisheries; Importance of fish genetics and hybridization; Androgenesis. Gynogenesis, Production of transgenic fishes

UNIT – V

Aquatic Pollution: Types and sources; Impact of pollution on fishes; Treatment of waste water; Bioremediation.

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Course Code-M4ZOO04ET -02A No of Credits-4
Paper II

Insect Toxicology and Forensic entomology

UNIT-I

INSECT TOXICOLOGY

Toxicological parameters Acute and chronic, oral and dermal toxicity, ,

Biomagnifications, maximum residue limit.

Labeling, packing, storage and disposal

Impact of insecticide misuse

Mode of action of organophosphates and carbonates on target organism

UNIT-II

Bioassay of insecticide in laboratory

Methods of diluting insecticide to a recommendation level

Safe use of insecticides, Application equipments

Host Plant Resistance-Resistance mechanisms

Transgenic crops in pest management

UNIT-III

Research methodology

Insect laboratory and rearing equipments

Experimental Designs in field and laboratory

Observation techniques and mortality correction

Use of statistics

- Descriptive statistics, Chi-square test, Student t-test
- Transformation of data: square root transformation,
- Analysis of variation
- Probit analysis

UNIT-IV

Forensic Entomology

Use of insects and other arthropods in investigations of human and animal deaths, thefts, illegal drug trade and in court-of-law proceedings that may result from such investigations.

Forensic application of Entomology

UNIT-V

Entomological Evidence identification, recording and recovery skills at a crime scene

Entomological Evidence identification, and recording in the laboratory

Familiarization with ACPO protocol for collecting entomological evidence.

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Course Code-M4ZOO 04ET -02B No of Credits-4

Wildlife Biology : Wildlife Management

UNIT I

History and cultural background of Indian Wildlife, Needs and values of wildlife protection, Types of wildlife management. Management policies and their implementation: goals of management, hierarchies of decision and feasible option. Factors injurious to wildlife and forests.

UNIT II

Wildlife counting: background, preparation and methods (Total count, sample count and index count). Other census methods or techniques: trapping, direct count (Block counts by drive count methods, and transects), indirect estimates (telemetry, fecal deposition, pellet count, call count and track count) and mark-recapture method.

Geographic Information System (GIS): Introduction, types of data, data inputs and organization, and uses. Introduction to Remote sensing

UNIT III

Forest management: Participatory Approach, Forest Laws in Relation to Tribal Land Conflict. Practices of forest management: water hole management, fire lines, grassland management, parapet covering of wells, Role of corridors in wildlife management. Conservation movements in India

Forest laws- Necessity general principles- Indian Forest Act, 1927, Forests Conservation Act, 1980, The National Forest Policy, 1988

UNIT IV

Social forestry- Objectives of social forestry programmes and their implementation in India, Types of social forestry: farm forestry, community forestry or rural forestry, extension forestry or urban forestry,

Need of Social forestry programs, Involvement of common people, Extension and education, tourism, finance in wildlife management

UNIT V

Biostatistics: Scope and objectives, terms, units, symbols, mean, mode and median, sample and sampling, collection and representation of data, tabulation, diagrammatic and graphical representation of data Tests of significance: Null hypothesis, Students T-test, Chi-Square test, Correlation and Regression.

M. Sc. ZOOLOGY: 2018–2019

(CBC System)

Course Code-M4ZOO 04ET -02C No of Credits-4

Paper II

Limnology and Fisheries- : Fish and Fisheries Biology

UNIT – I

Origin and Taxonomy of fishes: Origin and evolution of major groups of fishes; Classifications of fishes. Bio-geographical distribution of fishes. Extinct fishes

UNIT – II

Fish Physiology: Respiratory system: Gills and aerial respiration; Air Bladder in fishes; Weberian ossicles; Excretion and osmoregulation in fishes

UNIT – III

Fish Physiology: Reproductive system and its endocrine regulation; light and sound production in fishes; Electric organs and electro-receptors in fishes; Sense organs in fishes.

UNIT – IV

Fish pathology and Population studies: Bacterial diseases; Fungal diseases; Worm infections; Prevention and cure of fish diseases, Fish population dynamics. Age and growth in fishes, Types of fins and scales in fishes

UNIT – V

Fish Behavior: Migration in fishes; Reproductive and shoaling behavior; Parental care; Orientation and homing.

M. Sc. ZOOLOGY: 2018–2019

(CBC System)

Course Code-M4ZOO06-CP06 No of credits-4

Practical- I

(Paper I & II)

1. Rearing/ life cycle of stored product pest
2. Rearing/ life cycle of phytophagous pests
3. Rearing/ life cycle of medically important insects
4. Vermicomposting of waste by earthworm species.
5. Comparative toxicity test of synthetic insecticide and biopesticides
6. Life cycle of honey bee.
7. Study of permanent slides of disease causing protozoans
8. Study of permanent slides of Diseases causing helminthes.
9. Study of permanent slides of Diseases causing arthropods.
10. DNA isolation and DNA quantification
11. Agarose gel electrophoresis for DNA, RNA and protein.
12. Blotting techniques for DNA/RNA protein.
13. Preparation of dot blot- slot blots.
14. Extraction of genomic DNA from a mammalian tissue.
15. Techniques based on PCR.
16. Any other technique based on syllabus.

M. Sc. ZOOLOGY: 2018–2019

(CBC System)

Course Code-M4ZOO06-EP02A No of credits-4

Practical- II

Entomology and Insect toxicology

(Paper III and IV)

1. Mosquito Species ,identification and collection of mosquitoes
2. Collection ,identification and rearing of phytophagous pests
3. Testing of Inseticides : Bioassay.
4. Estimation of LD50 and LC 50 using insects.
5. Familiarity with techniques of appliances used for the application of insecticides
6. Sprayers including hand sprayers , Dusters
7. Knowledge of rearing insects and maintaining insectary
8. Study of seasonal abundance of crop pests in near by area.
- 9 To study antennal grooming in Cockroach.
- 10 To study the blood cells in insects
- 11 To study meiosis and Polytene chromosomes in insects
- 12 To study the food preference Tribolium of any other insect
13. Green house and insect rearing equipments
- 14 Experimental Designs in field and laboratory
- 15 Identification and characterization of agricultural chemicals in conventional and Nano formulations. Size determination and quality of Nano formulations.
- 16 A tour to visit important centers of entomological studies.

SUGGESTED READINGS(Entomology)

- (1) Textbook of Entomology By Packard, Publisher: New York, The Macmillan company; London, Macmillan and co., ltd.
- (2) Borror and DeLong's Introduction to the Study of Insects by Norman F. Johnson and Charles A. Triplehorn (May 19, 2004)
- (3) The Insects: An Outline of Entomology by Professor P. J. Gullan and P. S. Cranston (Mar 2, 2010)
- (4) Integrated Pest Management : Concepts, Tactics, Strategies and Case Studies Academic press. Edited by: Edward B. Radcliffe, University of Minnesota
- (5) Photographic Atlas of Entomology and Guide to Insect Identification [Spiral-bound] James L. Castner (Author)
- (6) How to Identify Insects to Order - How to Make an Awesome Insect . extension.entm.purdue. - United States
- (7) Introduction to Integrated Pest Management [Hardcover] Mary Louise Flint (Author), Robert van den Bosch (Author) Castner, published by Feline Press, Gainesville, FL (2000)
- (8) The Insects: An Outline of Entomology 4th Edition (2010) P.J. Gullan and P.S. Cranston ISBN# 978-1-4443-3036-6, Blackwell Publishing.
- (9) A Field Guide to the Insects of North America North of Mexico Peterson Field Guide Series, Borror and White.
- (10) Elementary Text-book of Entomology. Kirby, W.F. (1885) W. Swan Sonnenschein and Co. Paternoster Square. London.
- (11) Text Book Of Entomology :A.D.IMMS,
- (12) Biopesticides: A Biotechnological Approach::S.R.JOSHI ,New Age International.

Purdue Forensic Science Website:

<http://www.extension.entm.purdue.edu/forensics/>

Purdue Forensic Science Club Website:

<http://web.ics.purdue.edu/~pufsc/>

Patrick Jones Website:

13 Chemical Ecology of Insects, Carde, R. T., and Bell, W. J., Chapman and Hall, New York, USA

14 Entomology and Pest Management, Pedigo, L. P., Prentice Hall, New Jersey, USA

15. Concepts of IPM, Norris, Caswell-Chen and Kogan, Prentice-Hall, USA

16. Agricultural insects pests of the tropics and their control, Hill, D. S., Cambridge University Press, UK

M. Sc. ZOOLOGY: 2018–2019

(CBC System)

Course Code-M4ZOO06-EP02B No of credits-4

Practical- II

(Paper III and IV)

Indian Wildlife and Wildlife Management

1. Visit to natural habitats and wildlife sanctuaries, desert, mountain range, wetland and especially Rajasthan for the detail study: Student should submit the report on the study covering major fauna, flora and geography and management.
2. POP preparation of pugmarks and footprints
3. Designing the animal housing, enclosures and kraal.
4. Study of different types of cages.
5. Review of zoo-working plans and maps
6. Visit to a wetland for birding and identification of threats to wetlands. Student should submit the report on the study.
7. Limnological study of wetlands.
8. Permanent preparation of barbs of different avian feathers.
9. To observe foraging behavior in squirrels/mice.
10. Taxonomic identification and preparation of taxonomic key of given animals.
11. Statistical exercise
12. Project work

SUGGESTED READINGS (Wild Life Biology)

1. Wild A., Soils and the Environment An Introduction. Cambridge University Press, Cambridge. ..
2. Cunningham W.P. and Saigo B.W. Environmental Science A global concern Win. C. Brown Publishers, London.
3. Goel MM.. Sharma M.C. and Purohit N.K., Problems of Environment Management in India. Anupriya Publishing House, Jaipur.
4. Enger E.D. and Smith B.F., Environmental Science (A study of interrelations) Win. C. Brown Pub. (Latest Edition).
5. Botkin D. And Keller E. Environmental Science. Earth as a Living Planet, Keller.
6. Smith RL. : Ecology and Field Biology. Harper and Reo. Publishers.
7. Berwick S.H. and Saharia, V.B.: The Development of international Principles and Practicals of wildlife research and Management: Asian and American Approaches Eds. Oxford Univ. Press, Delhi.
8. VB. Saharia, Wildlife in India, Natraj Publishers, Dehradun.
9. Ali S. and Ripley D.RA pictorial Guide to the birds of the Indian Sub-continent BNHS Publications.
10. Prater S.H. The Book of Indian Animals, BNHS Publication.
11. Sharma,VD.: Wild wonders of Rajasthan. Prakash Books, New Delhi.
12. Ali S. Hand Book of Indian birds, BNHS Publications.
13. Giles R.H. and Toschik: Wildlife Management Techniques. The Wildlife Society Washington D.C.
14. SK Sharma. Ethno-Zoology.Himanshu Publication.Udaipur.
15. A.Verma. Conserving biodiversity of Rajasthan (With emphasis on Wild Fauna and Flora) Himanshu Publication, Udaipur.
16. Aaron, N.M. (1973). Wildlife ecology. W.H. Freeman Co. San Francisco, U.S.A.

17. Katwal/Banerjee, Biodiversity conservation in managed and protected areas. Agrobios, India.
18. Negi, S.S., Biodiversity and its conservation in India. Indus Publishing Co., New Delhi.
19. Anthony R.E. Sinclair, John M. Fryxell and Graeme Caughly, Wildlife Ecology, Conservation and Management, 2nd Edn. Blackwell Publishing, U.S.A.
20. Sharma, B.D. Indian Wildlife Resources, Ecology and Development. Daya Publishing House, Delhi.
21. Tiwari, S.K. Zoogeography of India and Asia. CBS Publisher and Distributors, New Delhi.
22. Ram Bramha Sanyal, A Handbook of the Management of Animals in Captivity.
23. Hosetti, B.B., Concepts in Wildlife Management, Daya Publishing House, Delhi.
24. Negi, S.S. Manual for Wildlife Management in India.
25. Gopal, Rajesh, Fundamentals of Wildlife Management, Justice Home, Allahabad, India.

M. Sc. ZOOLOGY: 2018–2019
(CBC System)
Course Code-M4ZOO06-EP02C No of credits-4
Practical- II
(Paper III and IV)

Practical- II: Limnology and Fisheries

- 1 Identification of fishes using morphometric characters and to fill up the fish identification chart
- 2 Bio-geographical distribution of major groups of fishes on world map.
- 3 Ova diameter measurement in the given sample of ovary.
- 4 Gut content analysis of any carp fish.
- 5 Dissection/Labeling of Weberian ossicles
- 6 Dissection/Labeling of pituitary gland.
- 7 Determination of fish age by scale method.
- 8 Calculation of fin formula
- 9 Identification of various cultivable fin fishes
- 10 Identification of various cultivable shell fishes
- 11 Identification of various predatory and weed fishes
- 12 Identification of common ornamental fishes
- 13 Identification of fish eggs, larvae, fry, fingerlings of fishes.
- 14 Biochemical and haematological studies.
- 15 Identification and writing comments on commercially important indigenous fishes, exotic fishes, Prawns, fishing nets, boat models, hapas, etc.

- 16 Visits to various lakes, fish farms, landing centres and polluted streams for limnological and fisheries study, preparation of field report.

SUGGESTED READINGS(Limnology and Fisheries)

Gerald Karp: Cell and Molecular biology II Eds. John Wiely.

David Fried felder: Molecular Biology II Ed. Narosa

T.A.Brown: Gene cloning IV ed. Chapman and Hall.

Benjamin Levine: Gene –I to X. Oxford Press

Robert Meyers: Molecular Biology and Biotechnology, VCH Pub.

Eric Kendel, J.H. Schwartz, T.M.Jessel: Principals of Neural Science, Mc Graw-Hill.

A.Longstaff: Instant Notes-Neuroscience, Viva books.

M. S., Gazzaniga, R. B. Ivy, G. R. Mangun : Cognitive Neuroscience, second Ed. WW Norton Press

C. A. Paul, B. Beltz, J. B-Sweeney: Discovering neurons, the experimental basis of neuroscience, Cold Spring Harbor Laboratory Press.

Nigel Jenkins: Animal Cell Biotechnology, methods and Protocols, Humana Press.

J. Freshney: Animal Cell Culture

C. T. Laurencin, L.S.Nair: Nanotechnology and tissue engineering. CRC Press.

J. Paul: Cell and Tissue Culture, Fifth Ed. Churchil Livingstone .