

BHARATHIAR UNIVERSITY COIMBATORE
M.Sc ZOOLOGY (WILDLIFE BIOLOGY) COLLEGES – CBCS PATTERN
(For the students admitted during the academic year 2010 -11 Batch & onwards)

| Semester | Subject and Papers | Ins. Hrs/ week | University Examinations | | | | |
|------------|--|-------------------|-------------------------|-----|-----|-------|----|
| | | | Dur. Hrs. | CIA | EXT | Total | |
| I | Paper I Animal Physiology & Endocrinology | 6 | 3 | 25 | 75 | 100 | 4 |
| | Paper II Cell & Molecular Biology | 6 | 3 | 25 | 75 | 100 | 4 |
| | Paper III Animal Biodiversity | 6 | 3 | 25 | 75 | 100 | 4 |
| | Paper IV Genetics | 6 | 3 | 25 | 75 | 100 | 4 |
| | Practical I (comprises of Papers I, II & III) | 2 | - | - | - | - | - |
| | Practical II (comprises of Papers IV, V & VI) | 2 | - | - | - | - | - |
| | Practical III (comprises of Papers VII & VIII) | 2 | - | - | - | - | - |
| II | Paper V Biochemistry & Bioinformatics | 6 | 3 | 25 | 75 | 100 | 4 |
| | Paper VI Biophysics & Biostatistics | 6 | 3 | 25 | 75 | 100 | 4 |
| | Paper VII Ecology | 6 | 3 | 25 | 75 | 100 | 4 |
| | Paper VIII Developmental Biology & Immunology | 6 | 3 | 25 | 75 | 100 | 4 |
| | Practical I (comprises of Papers I, II & III) | 2 | 4 | 40 | 60 | 100 | 4 |
| | Practical II (comprises of Papers IV, V & VI) | 2 | 4 | 40 | 60 | 100 | 4 |
| | Practical III (comprises of Papers VII & VIII) | 2 | 4 | 40 | 60 | 100 | 4 |
| III | Paper IX Vertebrate biology I | 5 | 3 | 25 | 75 | 100 | 4 |
| | Paper X Vertebrate Biology II | 4 | 3 | 25 | 75 | 100 | 4 |
| | Paper XI Forestry Silviculture and Forest Entomology | 5 | 3 | 25 | 75 | 100 | 4 |
| | Paper XII Wildlife management techniques | 3 | 3 | 25 | 75 | 100 | 4 |
| | Practical IV Covering paper IX & X | 5 | - | - | - | - | - |
| | Practical V Covering paper XI | 3 | - | - | - | - | - |
| | Practical VI Covering paper XII & XIII | 3 | - | - | - | - | - |
| | Practical VII Covering paper XIV | 2 | - | - | - | - | - |
| IV | Paper XIII Management of Zoos Sanctuaries and National Parks | | 3 | 25 | 75 | 100 | 4 |
| | Paper XIV Ethology of wildlife | | 3 | 25 | 75 | 100 | 4 |
| | Project & viva – voce | | - | | | 200 | 8 |
| | Practical IV Covering paper IX & X | | 4 | 40 | 60 | 100 | 4 |
| | Practical V Covering paper XI | | 4 | 40 | 60 | 100 | 4 |
| | Practical VI Covering paper XII & XIII | | 4 | 30 | 45 | 75 | 3 |
| | Practical VII Covering paper XIV | | 4 | 30 | 45 | 75 | 3 |
| | Total | | | | | 2250 | 90 |

SEMESTER – I - PAPER I - ANIMAL PHYSIOLOGY & ENDOCRINOLOGY

Unit –I

Nutrition: Nutritive requirements – General. Organization of alimentary canal – Role of salivary glands, liver, pancreas and intestinal glands in digestion.

Unit – II

Digestion and Excretion: Absorption of digested food-hormonal control of digestion - Introduction to intermediate metabolism –Structure of mammalian kidney – Urine formation –acid base regulatory mechanisms; endocrine regulation of water and mineral balance.

Unit – III

Circulation, Respiration and Reproduction: Composition of blood, blood groups in man, coagulation – Structure of mammalian heart, open and closed system of circulation, blood pressure and its regulation. Functional morphology of reproductive organs, reproductive cycles – Pheromones.

Unit – IV

Nature, function and classification of hormones – Feedback control of hormone secretion – Organisation and functions of neuroendocrine systems.

Unit – V

Role of hormones in sex accessory gland growth and functions. Thyroid gland – Structure, function and biosynthesis of thyroid hormone

REFERENCE :

1. **Ganong, H**, Review of Medical Physiology, 1989. 14th edition, *Appleton & Lange publisher*, New York
2. **Fleur, and Strand, (1978)**. Physiology: A regulatory system approach, *Macmillan Publishing Company, New York; Collier Macmillan Publishers*, London.
3. **Shier, D., Butler, J. and Lewis, R., Hole's, 2003**. Human Anatomy and Physiology, (10th edition) *WCB/McGraw Hill*, Boston. 2003.
4. **EcKert, R and W.H. Freeman. 2002**. Animal Physiology, (5th edition).
5. **Williams S. Hoar (1991)** General and Comparative Physiology 3rd edition. *Prentice Hall of India- New Delhi*.
6. **Neilson, K.S., 1997**. Animal Physiology, *Cambridge University Press*, Pergamon Press, Oxford.
7. **Knut Schmidt – Nielsen, 2005**, Animal Physiology, 5th Edition, *Cambridge University Press*.
8. **Barrington, E.J.W. (1975)**: An Introduction to General & Comparative endocrinology 2nd ed., *Clarendon press*, Oxford.
9. **Williams, R H. 1981**. Text book of Endocrinology, Ed. 6th W. B. Saunders Company, Philadelphia, London.
10. **De Groot. 1979**. Endocrinology, Vol. 1-3, Grune and Stratton, New York.
11. **Astwood, E. B. 1968**. Clinical Endocrinology, Grune and Stratton, New York.
12. **Bondy P.K. and Rosenberg L.E. 1974**. Duncan's disease of Metabolism – Genetics, Metabolism and Endocrinology. W. B. Saunders Co., Philadelphia, London.

PAPER II - CELL AND MOLECULAR BIOLOGY

Unit – I

Prokaryotic and eukaryotic cells. Plasma membrane – models and functions. Nucleus: ultra structure and Function. Cell division: mitosis and meiosis.

Unit - II

Ultra structure, types and functions of Ribosomes, Endoplasmic reticulum, Golgi complex, Mitochondria and Lysosome.

Unit - III

Chromosomes – structure and types. **DNA** - Watson and Crick model of double helix, different forms of double helix – A, B & Z forms. **DNA replication**: types, enzymology and mechanism of semi-conservative mode of replication.

Unit-IV

RNA structure and functions of rRNA, tRNA, and mRNA. Protein synthesis - Transcription, translation and post translation modifications.

Unit-V

Regulation of the Eukaryotic cell cycle, Cell birth, Lineage and cell death. Biology of aging. Cancer/ oncogenes, Cell markers, Cellular morphology, Kinetics of cell growth, Stem cell culture, embryonic stem cells and their applications.

REFERENCE:

1. De Robertis ED P *et al* 1987 Cell and Molecular Biology
2. Alberts B *et al* 1986 The molecular biology of the cell
3. Watson J D *et al* 1987 Molecular Biology of the Gene

PAPER III – ANIMAL BIODIVERSITY

UNIT I

Biodiversity and species concept

Components of Biodiversity – Ecosystem, Genetic and Species diversity
Species Concept – Biogeography and Speciation; Principles of Taxonomy

Animal Diversity

Animal – Distribution, Population inventory, Species richness (Dominance)

Biodiversity Hot spots – Mammals, Birds, Reptiles, Amphibians, Fishes and Invertebrates of Western GHAT region

Indo – Burma regions

Domestic Animals of India –cattle, birds, carnivores like dogs and cat

UNIT II

Loss of animal Diversity (Extinctions)

Past rate of Extinctions – Geological

Island biogeography and extinction rates of islands – Island Fauna

Human induced extinctions – Habitat loss, Degradation, Fragmentation, Population reduction, Threats

Status of Species

Isolated species – Rate, Endemic and Threatened towards extinctions

Wild species – Measurement, IUCN Red list of Indian wild life

UNIT III

Conservation Biology

Case Studies – In situ and Ex situ conservation of Indian animals

Population management – Project Tiger and Elephants;

Communities and Conservation – People participation; Success and failures of conservation action.

Tools in Conservation

Wild life data (Statistics) and methods of interpretation

Wild life maps

Remote sensing in wild life and study of Landscape

Human demography – PVA, CAMP

UNIT IV

Animal Laws and Policies in India

Protected area network Programme

Forest Policy

SPCA Act

Economics of Bioconservation

Convention on biodiversity: Objectives, principles, use of terms in situ and ex situ conservation, sustainable use of components

Convention on International Trade in endangered species – principles, regulation, exemption, signatories

Negative list of exports – Animals only

Zoo policy

Economics of biodiversity conservation

UNIT V

Conservation Education

Wild life / Animal Magazines

Writing of Popular and Scientific articles on conservation

Information on wild life – Mass media

Conservation awareness

Wild life celebration days – Games on the conservation of Wild life global programmes on

Nature and Environment

Biotechnology in conservation

REFERENCES:

1. Glimpses of Biodiversity- B.Blosetti.
2. Environmental biodiversity- P.R.Yadav
3. Biodiversity of microbial life- Stanely Reysenbach
4. Ecology & Env. Biology Sathyanarayana Books & Allied (P) Ltd

PAPER IV - GENETICS

Unit:I

Mendalism

Biography of Mendel and his experiments with pea plant

Law of Segregation :Monohybrid cross, back and test cross, Dominance and Recessive, Co-dominance and Incomplete dominance.

Law of Independent Assortment

Dihybrid crosses in Drosophila, back and test cross.

Unit II

Sex determination

Chromosomal theory of sex determination, Environment and Sex determination. Hormonal control of sex determination (free martin) Gynandromorphs / Intersexes, Supersexes in Drosophila. Sex differentiation and dosage compensation.

Gene Mutation

Definition , Types of mutations, Physical & Chemical Mutagens, Measurement of mutation rate in Bacteria, Drosophila and Human. Types of gene mutations.

Reverse mutation in bacteria, insects and human.

Unit III

Inheritance

Gene concepts classical theory – Modern theory

Multiple alleles – blood group inheritance

Extra chromosomal inheritance.

Genetic recombination

Types of recombination, molecular events during recombination

Genetic recombination in Bacteria (Transformation, conjugation, transduction, episomes and plasmids.)

Unit IV

Mapping of chromosomes

Eukaryotic, Bacterial, Viral, Bar loci, Complex locus and complementation mapping.

Gene Regulation

Operon concept – The repressor, operator and promoter genes. Developmental genes – control of gene expression and sequential gene expression in eukaryotes.

Unit V

Chromosomal aberrations

Numerical and Structural aberrations. Evolutionary significance of chromosomal aberrations.

Extra Chromosomal Inheritance / Cytoplasmic Inheritance.

Cancer Genetics

Regulation of mitotic cell cycle in eukaryotes and intercellular communication in multi cellular eukaryotes. Properties of cancer cells. Proto oncogenes, Oncogenes, Cellular oncogenes, Tumor suppressor genes, Viral oncogenes.

REFERENCES:

1. Mitra Sardhya 1994 Genetics
2. Stickberger 1974 Genetics
3. Gardiner E J *et al* 1984 Principles of Genetics
4. Sarin C 1985 Genetics

5. Dobzhansky Th 1969 Genetics and Origin of species
6. Hart D L Population Genetics

SEMESTER - II
PAPER V - BIOCHEMISTRY AND BIOINFORMATICS

Unit I

Classification, structure and metabolism

Carbohydrates: Glycolysis, [Glycogenesis](#), [Glycogenolysis](#), Glyconeogenesis, TCA cycle, Cori cycle.

Proteins: Deamination, Transamination, Amino acid synthesis.

Lipids: Lipolysis, Beta oxidation, Steroidogenesis

Unit II

Nucleic acids

Structure and Synthesis. Degradation of Purines and Pyrimidines.

Enzymes, Isoenzymes and co-enzymes

Classification

Mechanism of action

Significance

Unit – III

Vitamins-Fat soluble and water soluble vitamins-structure and function. Coenzymes and their structures. **Antibiotics**-Structure and functions of Pencillin, Streptomycin and Chloromycetin

Unit IV

Bioinformatics

Introduction to Bioinformatics: Overview, Internet and bioinformatics, Applications.

Databases: Various biological databases, Protein and Nucleotide sequence data bases. Protein sequence, structure and Classification of databases.

Unit V

Gene prediction

Gene prediction methods: Signal sites Predictions.

Protein Computational Biology - Structural classification of proteins.

Protein structure prediction, Active site prediction, Protein modeling and drug design.

REFERENCE:

Biochemistry

1. Stryar.L. 1988 Biochemistry
2. Lehnigar. A.L. 1982 The Principles of Biochemistry
3. Abraham Mazur. 1966 Text Book of biochemistry.
4. Voet.D & Voet.J.G. 1997 Biochemistry
5. Hawk 1996 Practical Physiological Chemistry
6. Garrett.R.H. *et al* 1996 Biochemistry

Bioinformatics

1. Yaswant Khanitkar 1992 Computer Languages
2. Christopher Cavanaugh 2001 Computer Hints & Tips
3. Bipin C Desai *et al* 1999 Database Management
4. Mani.K & Vijayaraj.N. 2001 Bioinformatics.

PAPER VI - BIOPHYSICS AND BIO STATISTICS

Unit I

Bioelectricity

Membrane, Resting and action potential. Ionic distribution and membrane potential, Recording of action potential.

Radiation

Electromagnetic radiation. Laws of light absorption - Beer Lamberts law, Biological applications of X-rays, infra red rays, Ultra violet rays.

Unit -II

Bioenergetics Laws of thermodynamics, concept of free energy, oxidation reduction (redox) reactions. Energy coupling reactions, energy rich compounds, ATP cycle, standard free energy and negative entropy changes in living systems, enzyme catalysis.

Unit – III

Biological data

Source, Collection – Classification – Tabulation, Diagrammatic representation. Frequency curves, Frequency Polygon, Ogive.

Measurements and variables

Central tendency, Arithmetic mean – Median – Mode
Dispersions, Deviations, Co – efficient of variance.
Standard Deviations and standard Error.

Unit IV

Test of Samples

Sampling, distribution of samples and sampling errors.
Student “t” test, Chi – square test, f test, ANOVA one way and two way.

Unit V

Correlation & Regression

Types, Karl Pearson’s co – efficient
Calculation of regression co – efficient and Significance test.

Probability

Definition, Types, Additional and Multiplication theorems.

REFERENCE:

Biophysics

1. Giese. A.C. 1969 Cell Physiology
2. Casey. 1993 Biophysics
3. Deb.A.C. 1983 Fundamentals of biochemistry.

Biostatistics:

1. Gupta S P Statistical Methods Chand & Co, Delhi.
2. Sokal R R & Rohlf F J Biostatistics Freeman, San Francisco
3. Snedecor G W & et al Statistical Methods East-West Press, Delhi.
4. Zar J H Biostatistical Analysis Prentice Hall, London.
5. Shiv Kumar Practical Statistics Chand & Sons, Delhi.
6. Rama Krishnan P Biostatistics Saras Pub., Nagarcoil.

PAPER VII - ECOLOGY

Unit I

Ecosystems

Fresh water ecosystem, Marine ecosystem, Estuarine ecosystem, Forest ecosystem
Energy flow in these ecosystems.

Habitat Ecology

Aquatic – Fresh water, Marine, inter tidal, Rocky, Muddy sandy – deep sea – Estuary –
Terrestrial – grass land, desert & forest. Remote sensing techniques.

Unit II

Community Ecology

Organization, Stratification – Community stability. Food chain, Food Web, Ecological pyramids,
Ecological Succession, Eutrophication, ecological niche, ecotone, biological magnification.

Unit III

Population Ecology

Population measurements, Growth, Fluctuations, Cycle and Equilibrium.
Intraspecific and interspecific relationships.

Factoral Ecology

Physico – chemical factors – Light, Temperature, Salinity and Oxygen.
Biogeochemical cycles – Water, Nitrogen, Carbon, Sulphur and Phosphorus.

Unit IV

Natural resources

Types of resources – Mineral, Forest, Agriculture, Wild life and Fishery resources.
Principles of conservation, Management of natural resources, Afforestation, Wild life Management, Fresh
water fish culture.

Unit V

Pollution Ecology

Sources, effects and control of Air, Noise, Water, Land, Thermal and radioactive pollutions.

REFERENCE:

1. Odum, E. Fundamentals of Ecology W.B. Saunders, London.
2. Clarke, S. Ecology
3. Krebs, C.J. Ecology
4. Pielon, E.C. Population and Community Ecology
5. Knight, F. Concept of Ecology. Kings Pub. Co. Victoria.
6. Dash.M.C. Fundamentals of Ecology.
7. Batschelet E Introduction to mathematics for life
Scientists Springer-Verlag, Berlin
8. Sokal R R & Rohlf F J Biometry Freeman, San Francisco
9. Jorgenson S E Fundamentals of Ecological Modeling Elsevier, New York.

PAPER VIII – DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY

UNIT I

Fertilization

Theories of fertilization,
Process and significance of fertilization
Artificial insemination
Collection and cryopreservation of gametes & embryos
Embryo transfer technology
Invitro fertilization
Induced ovulation
Teratology – causes types & events

UNIT II

Embryonic nutrition

Yolk utilization
Types of placenta, Placental hormones
Physiology of placenta
Hormonal control of pregnancy and lactation

Induction and Organizer

Nature of induction and organizer
Physiology of induction
Experiments on inductions
Nucleoplasmic interactions

UNIT III

Outlines of Immunology

Basics of immunity – Types of immunity – Lymphoid organs – Structure and types of Immune system.
Immunoglobulin – Structure, biological properties and functions

UNIT IV

Cells, tissues and organs of immune system

Primary and secondary lymphoid organs structure and their functions.
Cells of Immune system: Their maturation, activation, differentiation and functions.

Types of Immunity:

- a. Innate immunity
- b. Humoral immunity: Antigen their types; adjuvananes, epitopes as antigenic determinants; Process of antigenicity.
Antibodies (Immunoglobulins) classes and structure, Antigen and Antibody interations.
Theories of antibody formation.
- c. Cellular immunity: Major and minor histocompatibility (MHC) complexes: HLA system; clinical significance of MHC & HLA

UNIT V

Immunoresponse and its regulation

Primary and secondary immunoresponse.
Immunocompetence of embryo
Hypersensitivity I, II, III & IV types with suitable examples.
Transplantation immunity – skin graft rejection
Immunoresponse to tumour antigens

Immunodiagnostic assays – ELISA, RIA; Vidal tests and their applications.
Vaccines: Types; preparation; Active and passive immunization

REFERENCE:

Development biology and Experimental Embryology

1. Balinsky B L 1970 An Introduction to Embryology
2. Reven Ch P 1858 Morphogenesis
3. Barth L G 1959 Embryology
4. Reven Ch P 1959 An outline of developmental Physiology
5. Rugh R 1952 Experimental Embryology
6. Robert *et al* 1957 Experimental in developmental biology

Immunology

1. Pawar *et al* 1984 General Microbiology
2. Roitt I 1986 Essential Immunology
3. Boyd W C 1981 Fundamental of Immunology
4. Wieser R S *et al* 1971 Fundamentals of Immunology

PRACTICAL – I

Animal Physiology & Endocrinology :

1. Determination of the rate of activity of salivary amylase (Human saliva) activity by titration method.
Ptyalin Activity in relation to temperature and calculation of Q10.
Ptyalin activity in relation Ph and calculation of Q10.
Recording of diastolic and systolic pressure during, standing, sitting & lying posture.
2. Biological responses of animals to various osmotic concentrations and their effects.
 - a. Change in weight of Earthworm in heterosmotic media.
 - b. Pattern of osmotic responses of crab in heterosmotic media.
 - c. Active uptake of Na⁺ and Cl⁻ of a fish from the environmental water and change in salinity.
3. Determination of uptake and excretion of ammonia in the given medium by a fish.
4. Determination of the specific gravity of the blood of a vertebrate animal-by copper sulphate method.
5. Effect of temperature on the Oxygen consumption of fish and calculation on Q10.
6. Determination of total count of RBC in Human Blood.
7. Determination total and differential count of WBC in Human Blood.

Molecular Cell Biology:

1. Mounting of Polytene chromosome from the salivary gland of Chironomous Larva.
2. Squash preparation of testis of grasshopper to study the stage of Meiosis.
3. Isolation of DNA and RNA from an animal tissue (Demonstration only)
4. Study of different cells from the vertebrate animal. (Brain, Liver, Gonad, Kidney and Muscle)

Animal Biodiversity

1. Fossils Characteristics and identification of,
 - a) A Coelenterate

- b) A Molluscan
- c) An Echinoderm and
- d) A Vertebrate.

2. Measurement of Biodiversity in a Terrestrial and an Aquatic Ecosystem.

Visit to Zoological parks, wildlife sanctuaries and biosphere reserves.

PRACTICAL – II

Genetics:

1. Genetic characteristics of a class room sample. Finger print, ear lobe, tongue rolling, mid digital hairs, widow's peak, inward bending of little finger.
2. Culture of *Drosophila* and identification of mutant characters. (from the given sample).
3. Blood Grouping of man to study multiple allelism and inheritance.

Biochemistry:

1. Qualitative study of Carbohydrates, Proteins and Lipids from the given samples.
2. Preparation of Haemin crystals.
3. Quantitative estimation of Haemoglobin.
4. Separation of plasma, Serum and cells from blood.
5. Colorimetric estimation of glucose from blood

Bioinformatics:

1. Use of excel sheet for data processing.
2. Acid and protein sequence databases.

Biostatistics:

1. Calculation of (a) Frequency polygon (b) Histograms from the Data given
(The basic data may be from any material available around)
2. Calculation of (a) Standard deviation and (b) Correlation and (c) Student's test from the given data.

Biophysics:

1. Determination of viscosity of the given liquid (Ostwald's Method)
2. Determination of Glucose content of a given sample. (Calorimeter method)

PRACTICAL – III

Ecology:

1. Water analysis and estimation of the following parameters:
a. Calcium b. Magnesium c. Phosphate d. Silicate e. Nitrate
2. Quantitative analysis of Planktons (Fresh water / Marine)
3. Identification of Marine and Freshwater Plankton from the slides.
4. Effect of salinity on oxygen consumption of fish.

Developmental biology:

1. Induced Ovulation in Frog (Demonstration only)
2. Effect of Thyroxin on the growth of tadpoles. (Demonstration only)
3. Study of Embryonic developmental stages (Frog and Chick)

Immunology:

1. Study of Antigen and Antibody reaction through the study of Blood grouping.
2. Study of Rh factor through the study of Blood grouping.

A study tour to various places of ecological importance is essential. A tour report should be submitted along with the record.

Paper IX
VERTEBRATE BIOLOGY I

Unit I

Taxonomy of Fishes, Amphibians and Reptiles – Classification up to families with examples - Characters to identify Class, Sub class, super order and order need to be stressed. Distribution of Teleosts, Anura & Squamata in India.

Unit II

Brief account of economically important elasmobranches, clupeoids, salmonoids, scombroids, gadoids, heterosomata, sciaenids, carangids, Trichiurids and cat fishes. Food and feeding habits of fishes (general account), reproduction and spawning (general account): fish eggs and larvae. Age determination in fishes - Marking and tagging – Fish migration (General account) – Hill stream adaptations.

Unit III

Origin and evolution of amphibians – Brief account and biogeography of Caecilians – Proteus - Salamandra – Tylotriton – Newts - Ambystoma - Axylotyl - Mud puppy – Congo eels – Sirens – Giant Salamander – Hell blender – Toads (Indian, African and South American) – Tree frogs – Liopelma – Rana. Reproduction development and parental care in amphibians (General account).

Unit IV

Origin and evolution and adaptive Radiation of reptiles – Brief account, varieties, nomenclature, description and biogeography of Gecko – Sphenodon - Varanus – Uromastix – Chameleon – Phrynosoma – Iguano – Heloderma – Typhlops – Him snakes –Uropeltis – Xenopeltis – Boas & Pythons – Vipers – Cobras – Coral snakes – Rattle snakes –Crocodyles – Alligator –Gharial – Tortoise & Turtles.

Unit V

Comparison & types of Vertebrate skull, Jaw suspension, Vertebrae and girdles – Carapace - Plastron – Identification of species by scale counting – Feathers of Birds – Dentition in Mammals –claws, nails & hoofs – Locomotion of mammals- Reproduction and development of reptiles - Extinct Vertebrates – Economic importance of reptiles.

References:

1. Romulus whitaker & Ashok captain, Snakes of india: the field guide, Natraj Publications
2. Kartik shanker & B.C Choudhury, Marine turtles of the indian subcontinent Natraj Publications
3. Indraneil Das, Snakes and other reptiles of India Natraj Publications
4. S.H. Prater, The book of Indian animals Natraj Publications
5. A thangamani, S Prasanna kumar, L M Narayanan, N Arumugam Chordate Zoology, Saras publication
6. Ekambaranathan Iyer & Anantha Krishnan Manual of Zoology

PAPER X - VERTEBRATE BIOLOGY II

Unit I

Identification features of birds - Taxonomy of birds and mammals – Classification up to families with examples - Characters to identify each Class, Sub class, Super order and Order need to be stressed. Passeriform birds - Primates – Carnivores – Ungulates (Detailed study on systematics upto family).

Unit II

Origin and evolution and affinities of Birds – Brief account on distribution, Varieties, nomenclature and identifying features of Water fowl – Swifts – Humming Birds – Indian Hornbills – Frog mouths – Night jays – Plover – Turns – Gulls – Herons –Strokes – Ibis – Spoon Bills – Doves – Hoopoe – King fishers – Bee eater – Vultures - Rollers – Cookoos –Coucals – Fowls – Quails – Pelicans – Cormorants – Flamingo – Woodpeckers –Bee eaters – Fly catchers – Bush chat – Fan tails -Wag tails – Parrots & Parakeets – Cockatoos – Owls – Trogons – Tits – Larks – Prinia – Shrike – Drongo – Finches – Swallow – Thrushes – Bulbul – Sun bird – Pitta – Warbler – Barblers – Endemic in NBR.

Unit III

Bird watching : equipments – Field guides - Photography – Birding sites of south India. Nest: Function – choice - building & types - laying - clutch – incubation & hatching -sanitation & defense. Feet and beak modification in Birds. Bird migration: Reasons – Adaptation – Patterns - Physiology & Control - Exogenous and endogenous factors – Orientation & Navigation – Timing –Irruption & Dispersal. Methods to study migration – Common migrants of south India. Flight adaptation of birds – Birds as pest.

Unit IV

Origin and evolution and affinities and adaptive radiation in Mammals – Brief account on distribution, varieties, nomenclature and identifying features of Echidna - Platypus – Tasmanian wolf – Kangaroo – Shrew – Hedgehog – Bats – Lemur – Loris – Rats – Squirrels – Hare – Dolphins – whales – Wild dog, wolf & foxes – Otter – Bear – Panthera – Felis – Civet – Mongoose – Hyena – Phoca – Ant eaters – Monkeys & Langurs – Apes, Gibbons & Baboons – Deers & Antelopes – Thar – Gaur - Elephants – Rhinoceros – Tapir – Hippopotamus – Wild Ass.

Unit V

Economic value of birds & mammals - Placental dichotomy in marsupials – Oestrus cycle in mammals - Marsupial diversity - Insectivorous mammals –Energetic & nutritional strategies - Endemic & endangered mammals in India. Breeding biology & feeding ecology of Elephants, rhino, primates, bats & Felids.

Books for reference:

1. Anderson J and Slater D L, 1981. Catalogue of Mammals, Vols. I and II. Cosmo Publications, New Delhi.
1. Clegg P C and Clegg A G, 1978. Biology of the Mammal. The ELBS and William Heinmann Medical Books Ltd., London.
2. David MacDonald, 1984. Encyclopaedia of Mammals, Vols. I and II. George Allend and Unwin , London.
3. Prater S H, 1988. The Book of Indian Animals. Bombay Natural History Society, Bombay.
4. S.H. Prater, The book of Indian animals Natraj Publications
5. Salim Ali, Book of Indian Birds, Bombay natural Historical Society
6. Salim Ali and S. Dillon Ripley, Handbook of the Birds of India and Pakistan (8 volumes)
7. Chinna Sathan & Bal Pandey, The Nesting behaviour of Indian Birds Sugeeth Publications

PAPER –XI- Forestry, Silviculture and Forest Entomology

Unit I

Ecological and physiological factors influencing vegetation - natural and artificial regeneration of forests - methods - nursery and planting techniques-water budgeting - grading and hardening of seedlings - Clear felling, uniform shelter wood selection, coppice and conversion systems.

Unit II

Silviculture management of temperate, subtropical, humid tropical, dry tropical, coastal tropical forests - Mangroves- Cold desert & Plantation . Tree improvement & Seed Technology – Natural forest and stand improvement, - Cost benefit ratio - economic evaluation. Non timber forest products – Wood seasoning and preservation - Anatomical structure of wood, defects and abnormalities of wood, timber identification

Unit III

Forest management techniques – Forest planning - Methods of measuring - diameter, girth, height and volume of trees - form-factor - volume estimation of stand -current annual increment - mean annual increment. Sampling methods and sample plots. Yield calculation - forest cover monitoring through remote sensing - GIS management and modeling - Forest survey - map reading.

Unit IV

Forest types in India, identification of species, composition and associations; dendrology, taxonomic classification, principles and establishment of herbaria and arboreta. Clonal parks - Agro forestry systems - Social/Urban Forestry – Joint Forest Management. Tribes & forestry programmes - Forest Soils classification & Conservation Methods - Watershed management - Deforestation & Impacts. Decentralization and Forestry Public Administration. - Application of Indian Penal Code to Forestry - Forest Inventory.

Unit V

Classification of insects up to order with example. Insect structure & function – growth development and adaptive features. Feeding and reproductive behaviour of Bark beetles - wood borers - Gall makers - defoliating insects – Fluid feeding insects - Terminal and root insects -Seed and cone pests. Monitoring, Forecasting, assessing risk of insect outbreaks. Insect Management- Chemical, Physical & Biological. Insect Collection – Methods – Preservation - Insect Plant interaction.

Books for reference:

1. Agarwala V P, 1980. Forests in India. Oxford and IBH Publishing Co., New Delhi.
2. Puri G S, Meher V M, Gupta R K and Puri S, 1981. Forest Ecology. Oxford and IBH Publishing Co., New York.
3. Stebbin E P, 1977. A Manual of Elementary Forest Zoology For India. International Book Distributors, Dehra Dun.
4. Sukachev V and Dlis N, 1964. Fundamentals of Forest Biogeocoenology, Oliver and Boyd, Edinburgh.
5. Tiwari K M and Singh R V, 1980. Social Forestry Plantations. Oxford and IBH Publishing Co., New Delhi.
6. Warning R H and Schlesinger W H, 1985. Forest Ecosystems: Concepts and Management. Academic Press, New York.
7. Imms A D, 1965. A General Textbook of Entomology, ELBS, London.
8. Lefroy H M, 1909. Indian Insect Life. Today and Tomorrow's Printers and Publishers, New York.
9. Metcalfe C L and Flint W P, 1973. Destructive and Useful Insects, McGraw-Hill, New York.
10. Stebbins E P, 1965. Indian Forest Insects of Economic Importance. Eyre and Spottiswords Ltd., Loncon.

PAPER XII- WILDLIFE MANAGEMENT TECHNIQUES

Unit I

Making observations and records – field notes & datasheets - Planning wildlife management investigations and projects – funding agencies. Wildlife Photography - types of cameras & binoculars - camera traps – altimeter – pedometer - field compass. Sound recording & Media players - activity recording - weight measurement - Radio isotopes - radio collaring – GPS –GIS & Remote sensing.

Unit II

Molecular methods in Wildlife: Biomolecules – collection of DNA – separation of mitochondrial DNA - blotting techniques – restriction enzymes – PCR – RFLP – RAPD – bar coding – gene libraries – germplasm conservation – Animal cell culture – cryopreservation.

Unit III

Planning census – sample counts – Block counts – Roadside counts – Dung count – Pugmark & waterhole census – Identifying animals based on indirect signs – Capture recapture techniques – tiger, co-predator monitoring census methods & data entry software (WII) – Distance software: data import – survey design – Data structure – GIS data Usage – Analysis (Arch view/ Map Info).

Unit IV

Survey & mapping water sources – rain gauge setting – supplementary water source – providing access to natural & artificial water sources – Floristic inventory – Ground cover sampling – Shrub & tree layer measuring - Vegetation mapping – Fire as a tool. Wildlife damage control – assessment methods – reasons for conflicts – Fences – trenches & other methods – Human pressure classification – Trail survey in boundary – Forest product collection – Village survey – Anti poaching operations –VFC.

Unit V

Chemical restraints: Advantage & Disadvantage – Basic considerations –safe usage – Drug delivery – syringes & darts – ideal drugs - classes, properties – planning operation – Chemical restraints of Elephant, rhino, Gaur, Sambar, Panthera, small herbivores – post capture medical care & treatment. Wildlife health monitoring – Body condition evaluation – Monitoring infection – Postmortem – External examination – internal examination – examination of abnormalities – Preservation & diagnosis of specimen. Infectious diseases.

Books for reference:

1. Dasmann R F, 1964. Wildlife Biology, John Wiley & Sons, New York, p 231.
2. Gilas R H Jr.(ed.), 1984. Wildlife Management Techniques, 3rd ed. The Wildlife Society, Washington D.C., Nataraj Publishers, Dehra Dun, p 547.
3. Robinson W L and Eric G Bolen, 1984. Wildlife Ecology and Management, Maxmillan Publishing Company, New York, p 478.
4. Rodgers W A, 1991. Techniques for Wildlife Census in India - A Field Manual:
5. Technical Manual - T M - 2. WII.
6. Saharia V B, 1982. Wildlife of India, Nataraj Publishers, Dehra Dun.
7. Teague R D (ed.), 1987. A Manual of Wildlife Conservation (The Wildlife Society, Wsashington D.C.). Nataraj Publishers, Dehra Dun, p 206.
9. WII. A Guide to Chemical Restraint of Animals.

PAPER -XIII MANAGEMENT OF ZOOS, SANCTUARIES AND NATIONAL PARKS

Unit I

Biosphere Reserves in India –significance & concept, detailed study of (including protected areas and sanctuaries) Nilgiri – Nandadevi – Agasthiamalai – Greater Nicobar – Sunderban – Gulf of mannar – Simlipal & Pachauri - UNESCO MAB programme

Unit II

Declaration, formation of sanctuaries & national parks – protection - administrative setup (Central and State) - Statutory bodies and annual budgets - National parks in India- Interpretation centers. Detailed case study of National parks : Rajaji (Research) – Khana (Interpretation centre)– Silent valley (Hotspot) – Bannerghatta (Rehabilitaion & Rescue)– Nagerhole (Ecotourism) – Bandipur (Faunal diversity & tiger)- Gulf of Kutch (Marine habitat & birds) – Corbet (First National park) - Kaziranga (Heritage) -Gir (Lion) – Iravikulam (Thar).

Unit III

Projects, Conservation & Indian distribution: Project Tiger - Lion - Hangul & Elephant. Concept of Tiger reserves – Field implementation issues – detailed case study of Mudumali (Habitat & Conflicts) – Parambikulam (Fragmentation / Poaching) – Anamalai (Elephant conservation) – Periyar (Tribal involvement & ecotourism) – KKMTR (Tribal relocation & tiger depletion) – Sariska (reintroduction) – Manas (Insurgency)- Pench (Habitat heterogeneity) – Rathambore (Tiger sighting) – Panna (Wild safari). Tiger & elephant task force.

Unit IV

Zoo Management – Record keeping – General layout – management – Animal exhibits design & signage- Animal handling, transport & training - mixed species exhibit -; food and feeding-National zoo policy 1998 - Diseases of zoo animals- their prevention and cure- zoo sanitation; Marketing, conservation education & public relations .

Unit V

Eco tourism – sustainable tourism –environmental impact – visitor management- role of field Biologist. Rehabilitation - tribal issues & measures – NGOs in wildlife conservation. Indian Forest Policy of 1894, 1952 and 1990. National Forest Policy, 1988. Indian Forest Act 1927; Forest Conservation Act, 1980; Wildlife Protection Act 1972 and its amendments; Biological diversity Act 2002; Forest right Act 2008- HACA 2002 –CRS 2011

Books for reference

1. Saharia V B, 1982. Wildlife in India, Natraj Publishers, Dehra Dun.
2. Seshadri B, 1986. India's Wildlife Reserves, Sterling Publishers Pvt. Ltd., New Delhi.
3. S. K Singh, Wildlife management, International Book Distributing Co
4. P.C. Sinha, Wildlife and forest conservation Anmol Publications
5. Vivek Menon Wildlife Crimes, Natraj Publications
6. Surender Mehra Study and Practice of wildlife laws in India, Natraj Publications
7. Anand S. Khati, Indian National Parks and Sanctuaries, Pelican Creations

PAPER –XIV- ETHOLOGY OF WILDLIFE

Unit I

Behaviour : Sensory filtering, responsiveness, sign stimuli. Instinctive behaviour-classical and modern concepts-fixed action pattern and ritualization. Learning-Imprinting-habituation. Conditioning-trial and error learning-reasoning and insight learning. Neural basis of learning, memory, cognition, sleep and arousal. Analysis of behaviour pattern- taxis, kinesis and reflexes.

Unit II

Physiological mechanism of behaviour – reflex arc – hormonal action – Perceptual mechanism - Role of hormones in drive; role of pheromones in alarm spreading; crypsis, predator detection, predator tactics. Altruism and evolution-group selection, kin selection, reciprocal altruism; migration, domestication and behavioral changes. Methods of studying behaviour (Field, laboratory studies- Behavioural sampling methods).

Unit III

Biological rhythms-circadian, lunar, tidal and animal rhythms. Animal communication visual, auditory, chemical and vocalisation. Foraging behaviour - habitat selection and optimality in foraging - group foraging. Origin and significance of play.

UNIT IV

Reproduction: Breeding seasons - factors influencing breeding seasons - courtship, display - sexual selection - pair bond - sexual dimorphism - polymorphism - polyandry, polygamy - promiscuity - cooperative breeding - brood parasites – parental care.

Unit V

Aggression – Competition – Social spacing – Territory – Dominance: determinants - intergroup – interspecies. Social commensalism – mutualism – Parasitism – Social insects -. Social behaviour of Ungulates, Wild dogs, primates, elephants and lion.

Books for reference:

1. Leshner A I, 1978. An Introduction to Behavioural Endocrinology, Oxford University Press, New York.
1. Mc Farland D (ed.), 1981. The Oxford Companion to Animal Behaviour, Oxford University Press, Oxford.
2. Ridley M, 1968. Animal Behaviour - A concise Introduction, Blackwell Scientific Publications, Oxford.
3. Slater P J B, 1985. An Introduction to Ethology, Cambridge University Press, Cambridge.
4. Wallace R A, 1979. The Ecology and Evolution of Animal Behaviour, Goodyear Publishing Company Inc., Santa Monica, California.
7. Wilson E O, 1978. Sociobiology, The Belknap Press, Harvard University Press, Cambridge, MA.
5. Devayani Khemka, Animal Behaviour, Dominant publishers

Core Practical IV

1. Identification of fishes (minimum 10) based on key.
2. Identification of reptiles (minimum 15).
3. Identification of amphibians (minimum 15).
4. Identification of birds (minimum 30).
5. Identification of mammals (minimum 30).
6. Age determination in fishes.
7. Identification of exo-skeleton of vertebrates
8. Identification of bones and land marks of mammalian skull.
9. Identification of bones and land marks of Post cranial skeleton.
10. Identification of the different types of teeth in the mammals & determination of dental formulae.
11. Identification of different cusps on molars of identifying how it modified for different diets.
12. Marking and tagging & recapturing of a vertebrate (preferably guppies).
13. Internal submission
 - a. Field study to an area of wildlife importance and submission of report about various mammalian species observed.
 - b. Group project (4 members) has to be undertaken and should be presented in a state level/ national conference.
 - c. Study report of birds in an area.
 - d. Study report of breeding biology/nesting of a vertebrate species
 - e. Study report of feet & beak modification/ parental care/habitat.

Core Practical V

1. Identification of insects other than lepidoptera (minimum 15).
2. Identification of butterflies (minimum 30).
3. Identification of family of given forest plants (minimum 20)
4. Identification of damage caused by insect feeding
5. Preparation of quadrats and counting.
6. Estimation of alpha diversity, evenness index & Beta diversity
7. Collecting and setting traps for insects.
8. Comparative morphology of insect mouthparts.
9. Identification of the insect larva & identification of the instars.
10. Estimation of tree height, log volume, canopy volume & stand and annual increment.
11. Forest covers monitoring, forest map reading & surveying of forest area.
12. Identification of soil types.
13. Focal animal sampling & preparation of ethogram
14. Instantaneous scan, all occurrence & one-zero behavioural sampling.

15. Preparation of time activity budgets & social interaction matrices
16. Identification, Silviculture Methods and seed identification of *Acacia catechu*, *Acacia nilotica*, *Acacia auriculiformis*, *Albizia lebbek*, *Albizia procera*, *Anthocephalus Cadamba*, *Anogeissus latifolia*, *Azadirachta indica*, *Bamboo spp*, *Butea monosperma*, *Cassia siamea*, *Casuarina equisetifolia*, *Cedrus deodara*, *Chukrasia tabularis*, *Dalbergia sisoo*, *Dipterocarpus spp.*, *Emblica officindils*, *Eucalyptus spp*, *Gmelina Arborea*, *Hardwickia binata*, *Largerstroemia Lanceolata*, *Pinus roxburghi*, *Populus spp*, *Pterocarpus marsupium*, *Prosopis juliflora*, *Santalum album*, *Semecarpus anacardium*, *Shorea robusta*, *Salmalia malabaricum*, *Tectona grandis*, *Terminalis tomemta*, *Tamarindus indica*.
17. Internal submissions:
 - a) Report of biodiversity analysis of an area
 - b) Report of silviculture management/forest restoration/plantation in an area
 - c) Report of visit of a nursery.
 - d) Preparation of EIA report.
 - e) Herbarium of any 10 common plants.
 - f) Report of communicative English usage.

Practical VI

1. Recording of the call of a bird or mammal.
2. Identification of the call of a bird or mammal
3. Mapping of sanctuaries/national parks.
4. Population Viability Analysis (software)
5. Identification of ecto-parasites
6. Identification of helminth parasite by dung/scat analysis
7. Preparation of a microbial culture to identify the microbial parasites.
8. Designing of animal captive facilities
9. Designing food preparation and presentation of zoo animals.
10. Designing the animal housings, enclosures, moats, kraal etc.
11. Identification of different types of cages.
12. Review of zoo working plans and maps.
13. Marketing of ecotourism of an area.
14. Preparation of route maps to important National parks and sanctuaries of India.
15. Preparation of information procedure about wildlife tourist spots in India.
16. Internal submissions
 - a. Study tour has to be undertaken to study the details of a biosphere reserve.
 - b. Report of nature camp
 - c. Report of two day training in Zoo management
 - d. Report of two day study report about interpretation centre, ecotourism & structure of a National park.

Practical VII

1. Collection of literature and preparation of proposal of a research project
2. Identification of instruments of wildlife usage
3. Construction of line transect using pedometer & field compass
4. Identification of location and altitude using GPS
5. Identification / Recording the location or distance using map reading.
6. Recording the angle of animal citing.
7. Separation of DNA / Plasmid / mitochondrial DNA
8. PCR amplification of DNA
9. PAGE & identification of molecular weight of given protein sample
10. Construction of GIS maps by overlay
11. Estimation of animal population by block counting

12. Identification & counting of indirect signs
13. Pugmark tracing and identification of sex.
14. Setting of the camera traps & estimation of number of tigers using camera traps
15. Estimation of the density and abundance of a biological population by distance software
16. Identification of prey species by carnivore scat analysis.
17. Internal submissions
 - a. Report of tiger census protocol
 - b. Report of participation in a wildlife census
 - c. Report of training in Wildlife Photography
 - d. Report of three day training in GIS tools

Candidates have to submit a dissertation related to wildlife at the end of the IV semester and the viva voce will be an open presentation with the aid of multimedia.

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