

BHARATHIAR UNIVERSITY COIMBATORE
M.Sc. ZOOLOGY (WILDLIFE BIOLOGY) COLLEGES – CBCS PATTERN
(For the students admitted during the academic year 2017 -18 Batch & onwards)

Semester	Subject and Papers	Ins. Hrs/ week	University Examinations				
			Dur/Hrs.	CIA	EXT	Total	
I	Animal Physiology & Endocrinology	6	3	25	75	100	4
	Cell & Molecular Biology	6	3	25	75	100	4
	Animal Biodiversity	6	3	25	75	100	4
	Genetics	6	3	25	75	100	4
	(Comprises of Papers I, II & III)	2	-	-	-	-	-
	(Comprises of Papers IV, V & VI)	2	-	-	-	-	-
	(Comprises of Papers VII & VIII)	2	-	-	-	-	-
II	Biochemistry & Bioinformatics	6	3	25	75	100	4
	Biophysics & Biostatistics	6	3	25	75	100	4
	Ecology & Environmental Nanotechnology	6	3	25	75	100	4
	Developmental Biology & Immunology	6	3	25	75	100	4
	(Comprises of Papers I, II & III)	2	4	40	60	100	4
	(Comprises of Papers IV, V & VI)	2	4	40	60	100	4
	(Comprises of Papers VII & VIII)	2	4	40	60	100	4
III	Paper IX Vertebrate biology I & conservation	6	3	25	75	100	4
	Paper X Forestry, Silviculture and Entomology	5	3	25	75	100	4
	Paper XI Wildlife management techniques	6	3	25	75	100	4
	Paper XII Ethology	5	3	25	75	100	4
	Core Practical IV	2	-	-	-	-	-
	Core Practical V	2	-	-	-	-	-
	Core Practical VI	2	-	-	-	-	-
	Core Practical VII	2	-	-	-	-	-
IV	Paper XIII Field Training	5	3	75	0	75	3
	Paper XIV GIS Training	5	3	75	0	75	3
	Paper XV Project & viva – voce	12	-	0	200	200	8
	Core Practical IV	2	5	40	60	100	4
	Core Practical V	2	5	40	60	100	4
	Core Practical VI	2	5	40	60	100	4
	Core Practical VII	2	5	40	60	100	4
	Total					2250	90

***Same syllabus as that of M.Sc. I year Zoology**

SEMESTER – I
PAPER – I ANIMAL PHYSIOLOGY & ENDOCRINOLOGY

UNIT- I: Nutrition and Digestion:

Nutritive Requirements – Carbohydrates, proteins, lipids, Vitamins and minerals. Physiology of Digestion - role of salivary glands, liver, pancreas and intestinal glands in digestion. Absorption and Assimilation - hormonal control of digestion.

UNIT-II: Respiration and Circulation:

Respiratory organs-integument, gills and lungs. Respiratory pigments. Transport of gases- Bohr's effect, Chloride shift, Structure of mammalian heart. Heart beat- mechanism of circulation -origin and conduction of heart beat - Blood coagulation.

UNIT- III: Excretion and Osmoregulation: Structure of mammalian kidney- urine formation- acid-base regulation-Role of hormones in excretion -osmotic and ionic regulation in freshwater, marine and terrestrial organisms. Thermoregulations

UNIT- IV: Muscle and Nerve Physiology: Ultra Structure of skeletal muscle. Mechanism of muscle contraction- theories. Physico-chemical changes during muscle contraction. Structure of neuron – Origin and conduction of nerve impulse. Synaptic transmission -neuromuscular junction. Biological Clocks.

UNIT- V: Endocrine regulation and reproduction: Structure and functions of different endocrine glands of man- pituitary, Thyroid, Parathyroid, Adrenal and Pancreas. Structure and functions of reproductive organs in man. Hormonal regulation of reproduction.

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 Genera& 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. Significance of crossing over - Chromosomal movement during cell division.

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

Cell signaling-Cell receptors and cell signaling molecules. Cell birth, Lineage and cell death. Apoptosis and its pathways. Biology of aging. Kinetics of cell growth, Stem cells-types,significance and 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

- Biodiversity - components, types, and significance.
- Species concept, speciation, species richness.
- Biodiversity hot spots in India – significance of Western-Ghats & Indo-Burma region.

Unit II: Indian biodiversity and Loss of animal biodiversity

- Endemic terrestrial biodiversity of India.
- Marine biodiversity of India.
- Agro biodiversity of India.
- Past rate of Extinction - Geological.
- Human induced extinction.
- Isolation of species
- Endemic and Endangered species.

Unit III: Conservation biology

- In-situ and Ex-situ conservation.

- Project Tiger, project Elephant.
- Biotechnology in conservation.
- IUCN – Red list category.
- Success and failures of conservation.
- Protected area network programme.

Unit IV: Legal aspects in biodiversity conservation

- Forest policy.
- Zoo policy.
- SPCA act.
- Legal instruments relevant to biological diversity in India.
- Animal ethics, ethical committee.
- Discontinuation of dissections in educational institutions.
- CITES.
- Convention on biodiversity.

Unit V: Future strategies for India

- Research impetus – Thrust areas in environmental research
- Strategies, opportunities and options of animal biodiversity
- Future strategy for conservation of biological diversity – Environmental awareness programmes – wild life week and days of environmental importance
- Genetically modified organisms (GMOs) - promise and danger for biodiversity.
- Institutional mechanism and modalities.

References:

1. Textbook of Biodiversity - K V Krishnamurthy, by Science Publishers.
2. Glimpses of Biodiversity- B.Blosetti.
3. Environmental biodiversity- P.R.Yadav
4. Biodiversity of microbial life- Stanely Reysenbach.
5. Ecology & Env. Biology - Sathyanarayana Books & Allied (P) Ltd.,
6. Biodiversity: An Introduction, 2nd Edition- Kevin J. Gaston, John I. Spicer, Wiley-Blackwell.
7. Agrobiodiversity - David Wood, Jillian M. Lenné, CABI Pub., Nature

PAPER IV - GENETICS

Unit:I

Mendelism

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.

Sex determination

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

Unit II

Mutation

Definition and types of gene mutations,
Physical & Chemical Mutagens,
Measurement of mutation rate in Bacteria, Drosophila and Human
Reverse mutation in bacteria, insects and human
Numerical and structural chromosomal aberrations and their evolutionary significance

Inheritance

Gene concepts classical theory – Modern theory
Multiple alleles – blood group inheritance
Extra Chromosomal inheritance/Cytoplasmic inheritance

Unit III

Genetic recombination

Types of recombination, molecular events during recombination
Genetic recombination in Bacteria (Transformation, conjugation, transduction, episomes and plasmids.)

Mapping of chromosomes

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

Unit IV

Gene Regulation

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

Human genome project

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.

Unit V

Population Genetics and Speciation

Mendelian population, gene pool, gene frequency
Hardy-Weinberg law of Genetic Equilibrium
Patterns of isolating mechanism
Models of speciation (Allopatric, Sympatric & Parapatric)

REFERENCE:

1. Mitra Sardhya 1994 Genetics
2. Stickberger 1974 Genetics
3. Gardiner E J *et al* 1984 Principles of Genetic
4. Sarin C 1985 Genetics
5. Dobzhansky Th 1969 Genetics and Origin of species
6. Hart D L Population Genetics
7. Klug and Cummins. Concepts in Genetics
8. Pielon, E.C. Population and Community Ecology

SEMESTER - II
PAPER V - BIOCHEMISTRY AND BIOINFORMATICS

Biochemistry

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 Penicillin, Streptomycin and Chloromycin

Bioinformatics

Unit IV

History and scope of Bioinformatics

Internet browsers and search engines

Biological Databases

- NCBI, EMBI, DDBJ, PDB and Genbank

BLAST and FASTA format

Sequence analysis – DNA, RNA and proteins.

Unit V

Gene prediction methods

- Sequence similarity search method

- Ab initio gene prediction method

Molecular docking and drug designing

Computational DNA sequencing techniques

- Sanger radio labeling method

- Dye terminator sequencing method

Human Genome Project

- History, techniques and applications

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

Biophysics

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, and 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.

Biostatistics

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.
Chi – square test, Student “t” test, f test, ANOVA one way and two way.

Unit V

Correlation & Regression

Types, methods of studying correlation- Karl Pearson's co – efficient
Calculation of regression co – efficient and Significance.

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 & ENVIRONMENTAL NANOTECHNOLOGY

Unit I

Ecosystems and Habitat Ecology

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

Unit II

Community Ecology

Organization, Stratification – Community stability. Ecological pyramids, Ecological Succession,
Eutrophication, ecological niche, ecotone, biological magnification.
Population ecology

Unit III

Pollution Ecology

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

Unit IV

Zoogeography and paleontology

Major terrestrial biomes

Theory of Islands

Zoogeography and Biogeographical zones in India

Dating, fossils and geological time scale

Unit V

Nanotechnology for environment

Nanomaterials for soil and ground water remediation

Uses of nanomaterials

- Nanosensors, Nanobioreactor, Nanofilters and Nanoporous materials

Environmental risks of nanotechnology

- Social justice, health issues and nanoweapons of war

Risks for the health of aquatic organisms and residual problems

REFERENCE:

1. Odum, E. Fundamentals of Ecology *W.B. Saunders*, London.
2. Clarke, S. Ecology
3. Krebs, C.J. Ecology
4. Knight, F. Concept of Ecology. *Kings Pub. Co.* Victoria.
5. Dash. M.C. Fundamentals of Ecology.
6. Batschelet E Introduction to mathematics for life *Scientists Springer-Verlag*, Berlin
7. Sokal R R & Rohlf F J Biometry *Freeman*, San Francisco
8. Jorgenson S E Fundamentals of Ecological Modeling *Elsevier*, New York.
9. Mark R. Wiesner and Jean-Yves, Bottero. Environmental Nanotechnology: Applications and impacts of nanomaterials. Mc Graw Hills; New York.

PAPER VIII – DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY

Developmental Biology

UNIT I Fertilization

Theories of fertilization,

Process and significance of fertilization

Induced ovulation

Artificial insemination

Collection and cryopreservation of gametes & embryos

Invitro fertilization

Embryo transfer technology

Teratology – causes types & events

Cloning-Application and ethical issues

UNIT II

Embryonic nutrition

Yolk utilization

Types of placenta, Placental hormones

Physiology of placenta

Hormonal control of pregnancy and lactation

Embryonic Induction and Organizer

Nature of embryonic induction and organizer

Physiology of induction

Experiments on induction

Nucleocytoplasmic interactions

UNIT III

Cells, tissues and organs of immune system

Cells of Immune system: Their maturation, activation, differentiation and functions.

Primary and secondary lymphoid organs structure and their functions.

Immunology

Unit IV

Types of Immunity:

Innate immunity and acquired immunity

Humoral immunity: Antigen their types; adjuvananes, epitopes as antigenic determinants; Process of antigenicity.

Antibodies (Immunoglobulins) classes and structure and functions.

Antigen and Antibody interactions

Theories of antibody formation

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 & V 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. Experiments 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
5. Abdul K Abbas *et al*. 2014. Basic Immunology Elsevier Prosby Saunders

PRACTICAL – I
(Comprises Theory Papers I, II & III)

Animal Physiology & Endocrinology:

(Use any two cultured species which are not in endangered list)

1. Determination of the rate of activity of salivary amylase (Human saliva) activity.
Ptyalin Activity in relation to temperature and calculation of Q10.
Ptyalin activity in relation pH.
Recording of diastolic and systolic pressure during, standing, sitting & lying posture.
2. Biological responses of animals to various osmotic concentrations and their effects (**any one experiment**).
 - a. Change in weight of Earthworm in heterosmotic media (or)
 - b. Pattern of osmotic responses of crab in heterosmotic media (or)
 - c. Active uptake of Na⁺ and Cl⁻ of a fish from the environmental water and change in salinity.
3. Determination of the specific gravity of the blood of a vertebrate animal-by copper sulphate method.
4. Effect of temperature on the opercular movement of fish and calculation of Q10.

Cell and Molecular Biology:

1. Mounting of Polytene chromosome from the salivary gland of a selected species.
2. Squash preparation of onion root tip to study the stages of Mitosis.
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.

Field trip

Visit to Zoological parks, wildlife sanctuaries and biosphere reserves etc.

PRACTICAL – II
(Comprises Theory Papers IV, V & VI)

Genetics:

1. Genetic characteristics of a class room sample. Dermatoglyphic patterns (Finger print), ear lobe, rolling of tongue, 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. Estimation of allelic Frequency based on ABO Blood Group.

Biochemistry :

1. Qualitative and quantitative estimation 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. Nucleic Acid and protein sequence databases.

Biophysics:

1. Working principles of SEM and TEM.

2. Determination of Glucose content of a given sample. (Calorimeter method)

Biostatistics:

1. Construction 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 (b) Correlation and (c) Student's test from the given data.

PRACTICAL – III
(Comprises Theory Papers VII&VIII)

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.
5. Construction of ecological pyramid using plastic animal toys

Evolution

1. Study on the Homology of a group of vertebrates on the limb skeleton
2. Study of Mimicry, Colouration among animals

Developmental biology:

1.Regeneration study in Tadpole/Earth-worm

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.
3. Widal Test

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 & CONSERVATION

Unit I

Taxonomy & Identifying Characters of Fishes, Amphibians and Reptiles (up to orders). Fish migration- Hill stream adaptations. Parental care in amphibians & Fishes – Poisonous & Non poisonous snakes – Economic importance of Reptiles & fishes.

Unit II

Taxonomy & Identifying Characters of Birds (up to orders) and Mammals (up to family) with examples. Migration of birds – Bird watching – Feet and beak modifications – Nesting behavior – Endemic birds of Western Ghats- Economic value of birds

Unit III

Endemic & endangered mammals in India & Conservation. Breeding biology & feeding ecology of Felids, Elephants, rhino, primates, and bats – Economically important mammals.

Unit IV

Biosphere reserves in India – Sanctuaries and National park in India – Project tiger, elephant, lion & hangul. Ecotourism – Wildlife Protection Act & amendments.

Unit V

Zoo Management - Animal exhibits design & signage - Animal handling, transport & training - food and feeding - National zoo policy - Diseases of zoo animals- their prevention and cure- zoo sanitation; Marketing.

References:

1. Romulus whitaker & Ashok captain, Snakes of india: the field guide, Natraj Publications
2. Indraneil Das, Snakes and other reptiles of India Natraj Publications
3. S.H. Prater, The book of Indian animals Natraj Publications
4. A thangamani, S Prasanna kumar, L M Narayanan, N Arumugam Chordate Zoology, Saras publication
5. Ekambaranathan Iyer & Anantha Krishnan Manual of Zoology
6. Salim Ali, Book of Indian Birds, Bombay natural Historical Society
7. Chinna Sathan & Bal Pandey, The Nesting behaviour of Indian Birds Sugeeth Publications
8. Saharia V B, 1982. Wildlife in India, Natraj Publishers, Dehra Dun.
9. P.C. Sinha, Wildlife and forest conservation Anmol Publications
10. Anand S. Khati, Indian National Parks and Sanctuaries, Pelican Creations

PAPER –X- Forestry, Silviculture and Entomology

Unit I

Natural and artificial regeneration of forests - nursery and planting techniques. Clear felling, uniform shelter wood selection, coppice and conversion systems. Silviculture management - Mangroves- Cold desert & Plantation . Tree improvement & Seed Technology – Non timber forest products – Wood seasoning and preservation - Anatomical structure of wood, defects and abnormalities of wood, timber identification

Unit III

Forest management techniques - Methods of measuring - diameter, girth, height and volume of trees - form-factor - volume estimation of stand 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 - dendrology, Establishment of herbaria and arboreta. Agro forestry systems - Social/Urban Forestry – Joint Forest Management. Watershed management - Deforestation & Impacts. Forest Inventory.

Unit V

Classification of insects up to order with example. Feeding and reproductive behaviour of insects, Forecasting, assesses risk of insect outbreaks. Insect Management - Insect Plant interaction.

References

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, NewYork.
11. Stebbins E P, 1965. Indian Forest Insects of Economic Importance. Eyre and Spottiswords Ltd., Loncon.

PAPER XI- 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.

Unit II

Radio isotopes - radio collaring – GPS – GIS & Remote sensing. Q GIS – Map Info –Arch view (outlines only). Molecular methods in Wildlife

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. – Distance software – Creation of capture matrix and softwares used in wildlife sciences

Unit IV

Survey & mapping water sources – rain gauge setting – supplementary water source – providing access to natural & artificial water sources –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 – Postmortem.

References

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: Technical Manual - T M - 2. WII.
5. Saharia V B, 1982. Wildlife of India, Natraj Publishers, Dehra Dun.
6. Teague R D (ed.), 1987. A Manual of Wildlife Conservation (The Wildlife Society, Washington D.C.). Nataraj Publishers, Dehra Dun, p 206.
7. WII. A Guide to Chemical Restraint of Animals.

PAPER –XII- ETHOLOGY

Unit I

Instinctive behaviour-classical and modern concepts-fixed action pattern and ritualization. Learning-Imprinting-habituation. Analysis of behaviour pattern- taxis, kinesis and reflexes.

Unit II

Physiological mechanism of behaviour – Perceptual mechanism - Role of hormones - pheromones -predator detection, predator tactics. Altruism and evolution- Methods of studying behavior.

Unit III

Biological rhythms. Animal communication in Mammals, Birds and Insects. Foraging behaviour. Origin and significance of play.

UNIT IV

Courtship, display - sexual selection - pair bond - sexual dimorphism - polymorphism - polyandry, polygamy - promiscuity - cooperative breeding - brood parasites – parental care in Mammals & Birds.

Unit V

Aggression – Competition – Social spacing – Territory – Dominance. Social commensalism – mutualism – Parasitism . Social behaviour of elephants and lion.

References

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

Paper XIII Field Training

Unit I

Training of basic field techniques – inventories –survey – identification of fauna and flora – handling of basic wildlife instruments.

Unit II

Apprentice ship as a biologist in a Sanctuary/ National park / Tiger Reserve – collecting information about various administrative setup –preparation of plans /projects – disaster management – laws & regulations

Unit III

Training in conducting population survey / census –sign survey – transects – grids – vegetation analysis – herbivore abundance – covariance – occupancy – Habitat survey.

Unit IV

Training of Usage of camera traps / statistical techniques /softwares including capture recapture –matrix preparation – analysis using DISTANCE, CAPTURE, MARK or other software of relevance.

Unit V

Training in Analysis of data and preparation of report – Writing reports –presentation – Analysis of data – Ecological statistics – Boolean Algebrae – Boot strapping - Convex Polygons – Distribution analysis – Home range prediction - Habitat modeling – Prediction models & Projection of Data.

(At the end of the semester the candidate is evaluated internally by the HOD and senior faculty member. Mark allocation Report :20, Attendance:10, Performance in training: 20, Student evaluation:25)

Paper XIV GIS Training

Unit I

Training in usage of computer and internet – Various browsers – networking – accessing data – collection of literature & relevant data – Google earth – Various websites of GIS
Importance

Unit II

Training in usage of Excel, Access and GPS

Unit III

Training in Q GIS

Unit IV

Training in Usage of Archview / Mapinfo

Unit V

Self preparation and submission of a GIS map

(At the end of the semester the candidate is evaluated internally by the HOD and senior faculty member. Mark allocation Report :20, Attendance:10, Performance in training: 20, Student evaluation:25)

Core Practical IV

(Collection of animals for identification is unethical, hence usage of photographs suggested)

1. Identification of fishes.
2. Identification of amphibians.
3. Identification of reptiles.
4. Identification of birds.
5. Identification of Mammals.
6. Identification of birds and animals based on call / cry/ roar or sound.
7. Identification of individual elephants based on morphology.
8. Identification of feeding habit of fish based on position of mouth.
9. Identification of feet and beak modification in birds.
10. Identification of Nest and nesting behavior in Birds.
11. Study of troupe / heard composition and sex identification in elephants, deer, monkeys, boar & Wild dogs.
12. Age determination based on exo-skeleton of Vertebrates (live animals should not be used).
13. Capture, Mark and Recapture Method (Colour beads may be used).

Submissions at the time of Practical Examination (Should not exceed 20% of total Marks)

1. Report of Photographic training
2. Checklist of Birds/Mammals/Reptiles/Amphibians/Fishes of a Locality
3. Report of Migratory birds/Nesting patter of a locality
4. Report of Nature camp

Core Practical V

(Collection of insects for identification is unethical, hence usage of photographs suggested)

1. Identification of important Insects.
2. Identification of important butterflies.
3. Identification of plants of silviculture importance.
4. Preparation of quadrats and counting.
5. Invertebrate sampling protocols.
6. Construction of transect lines and sampling.
7. Estimation of Vegetation in an area.
8. Identification of various forest types.
9. Estimation of tree height.
10. Estimation of log volume.
11. Calculation of canopy volume.
12. Forest cover monitoring, forest map reading and surveying of forest area.
13. Focal animal sampling (Do not use caged animals instead videos are suggested)

Submissions at the time of Practical Examination (Should not exceed 20% of total Marks)

1. Report of Visit to a Social forestry area/Nursery.
2. Checklist of butterflies / insects / invertebrates of a locality.
3. Report of visit to a timber depot.
4. Report of sample survey of vegetation of a forest area.

Core Practical VI

1. Mapping of sanctuaries and National parks.
2. Identification of fecal parasites.
3. Designing of animal cages.
4. Designing of Zoo animal food preparation.
5. Presentation of animals in Zoo.
6. Marketing of ecotourism by preparing brochure.
7. Estimation of carrying capacity of a sanctuary.
8. Population Viability analysis.
9. Identification buffer areas for a sanctuary / tiger reserve.
10. Identification of elephant corridor.
11. Preparation of EIA.
12. Designing the interpretation centre in sanctuary.

Submissions at the time of Practical Examination (Should not exceed 20% of total Marks)

13. Report of case study of a sanctuary / National Park / Reserve.
14. Study Report of management and marketing of ecotourism from a reserve.
15. Training report of Zoo Management.
16. Report of visit to a Biosphere reserve with special emphasis to MAB programme or study report about a wet land ecosystem.

Core Practical VII

1. Identification of instruments of Wildlife importance.
2. Estimation of diversity and species richness of an area.
3. Usage of pedometer and field compass.
4. Usage of GPS.
5. Marking boundary of an area using GPS

6. Geo referencing of an image file to create vector image (Q GIS / Map info / Arch view).
7. Overlaying GPS points over vector image and construction of GPS (Q GIS / Map info / Arch view).
8. Estimating Population using Distance Software.
9. Map reading.
10. Recording angle of animal citation.
11. Population estimation by block counting.
12. Identification of indirect signs.
13. Pug mark tracing and sex identification.

Submissions at the time of Practical Examination (Should not exceed 20% of total Marks)

1. A survey report of indirect signs of a locality /reserve
2. GIS training report
3. A training report of various software's used in wildlife Biology
4. Report of participation in tiger census /animal census

M.Sc. dissertation based a topic of Wildlife importance has to be submitted at the end of final semester and viva voce examination is an open presentation with the aid of multimedia (Dissertation 150 marks and Viva 50 Marks for Project).