

Annexure No.	27 B
SCAA Dated	29.02.2008

BHARATHIAR UNIVERSITY :: COIMBATORE – 641 046

**REGULATIONS FOR M. Sc., WILD LIFE BIOLOGY DEGREE COURSE WITH
COMPULSORY DIPLOMA IN CELL AND MOLECULAR BIOLOGY
Semester System
(with effect from 2007-2008)**

1. Eligibility for Admission to the Course

A candidate who has passed the B.Sc. Zoology / Animal Science & Biotechnology / Animal Sciences / Advanced Zoology and Biotechnology / Applied Sciences / Life Sciences Degree Examination as main subject of study of this University or an examination of some other University accepted by the syndicate as equivalent thereto shall be eligible for admission to the Master Degree of this University.

2. Duration of the Course

This Course of Study shall be based on Semester System. This Course shall consist of four Semesters covering a total of two Academic Years. For this purpose, each Academic Year shall be divided into two Semesters; the first and third Semesters; July to November and the second and the fourth Semesters; December to April. The Practical Examinations shall be conducted at the end of even Semester.

3. Course of Study

The Course of the Degree of Master of Science/Arts/Commerce shall be under the Semester System according to the Syllabus to be prescribed from time to time. This Course consists of Core Subjects and Elective Subjects. There shall be one Paper on applied Skill Oriented, subject preferably in each semester as part of the adjunct Diploma Programme.

4. Requirement to appear for the Examinations

- a) A candidate will be permitted to take the University Examination for any Semester, if
 - i) he/she secures not less than 75% of attendance out of the 90 instructional days during the Semester.

- b) A candidate who has secured attendance less than 75% but 65% and above shall be permitted to take the Examination on the recommendation of the Head of the Institution to condone the lack of attendance as well as on the payment of the prescribed fees to the University.

- c) A candidate who has secured attendance less than 65% but 55% and above in any Semester, has to compensate the shortage of attendance in the subsequent Semester besides, earning the required percentage of attendance in that Semester and take the Examination of both the Semester papers together at the end of the latter Semester.

d) A candidate who has secured less than 55% of attendance in any Semester will not be permitted to take the regular Examinations and to continue the study in the subsequent Semester. He/she has to re-do the Course by rejoining the Semester in which the attendance is less than 55%.

e) A candidate who has secured less than 65% of attendance in the final Semester has to compensate his / her attendance shortage in a manner to be decided by the Head of the Department concerned after rejoining the Course.

5. Restriction to take the Examinations

a) Any candidate having arrear paper(s) shall have the option to take the Examinations in any arrear paper(s) along with the subsequent regular Semester papers.

b) Candidates who fail in any of the papers shall pass the paper(s) concerned within 5 years from the date of admission to the said Course. If they fail to do so, they shall take the Examination in the revised Text / Syllabus, if any, prescribed for the immediate next batch of candidates. If there is no change in the Text / Syllabus they shall take the Examination in that paper with the Syllabus in vogue, until there is a change in the Text or Syllabus.

In the event of removal of that paper consequent to the change of Regulations and / or Curriculum after a 5 year period, the candidates shall have to take up an equivalent paper in the revised syllabus as suggested by the chairman and fulfill the requirements as per Regulations/Curriculum for the award of the Degree.

6. The Medium of Instruction and Examinations

The medium of instruction and Examinations shall be in English.

7. Submission of Record Notebooks for Practical Examinations

Candidates taking the Practical Examinations should submit bonafide Record Note Books prescribed for the Practical Examinations. Otherwise the candidates will not be permitted to take the Practical Examinations.

8. The Minimum (Pass) Marks

A candidate shall be declared to have passed in a paper if a student obtains not less than 50% of marks in that paper. A candidate shall be declared to have passed the whole Examination if the student passes in all the papers.

9. Improvement of Marks in the subjects already passed

Candidates desirous of improving the marks secured in their first attempt shall reappear once within the subsequent Semester. The improved marks shall be considered for classification but not for ranking. If there is no improvement there shall not be any change in the original marks already awarded.

10. Classification of successful candidates

A candidate who passes all the Examinations in the first attempt within a period of two years securing 75% and above marks in the aggregated shall be declared to have passed with First Class with Distinction.

Successful candidates passing the P.G. Degree Examinations, securing 60% marks and above shall be declared to have passed the examination in First Class. All other successful candidates shall be declared to have passed the Examination in Second Class.

11. Ranking

A candidate who qualifies for the PG Degree Course passing all the Examinations in the first attempt, within the minimum period prescribed for the Course of Study from the date of admission to the Course and secures 1st or 2nd Class shall be eligible for ranking and such ranking will be confined to 10% of the total number of candidates qualified in that particular subject to a maximum of 10 ranks.

The improved marks will not be taken into consideration for ranking.

12. Conferment of the Degree

No candidate shall be eligible for conferment of the Degree unless he / she has undergone the prescribed Course of Study for a period of not less than four Semesters in an Institution approved of by and affiliated to the University or has been exempted there from in the manner prescribed and has passed the Examinations as have been prescribed.

13. Evening College

The above Regulations shall be applicable for candidates undergoing the respective Courses in the Evening Colleges also.

14. Revision of Regulations and Curriculum

The above Regulation and Scheme of Examinations will be in vogue without any change for a minimum period of three years from the date of approval of the Regulations. The University may revise /amend/ change the Regulations and Scheme of Examinations, if found necessary.

15. Transitory Provision

Candidates who have undergone the Course of Study prior to the Academic Year 2007-2008 will be permitted to take the Examinations under those Regulations for a period of four years i.e. up to and inclusive of the Examination of April 2012 thereafter they will be permitted to take the Examination only under the Regulations in force at that time.

M.Sc. WILDLIFE BIOLOGY (Semester Pattern)
(LAB. ORIENTED COURSE WITH PROJECT WORK)
SCHEME OF EXAMINATIONS

Sem	SUBJECT AND PAPER	Instruc- tional Hrs Per Week	University Examinations	
			Duration in Hrs	Max * Marks
I	Paper I Ichthyology and Herpetology	5	3	100
	Paper II Ornithology	4	3	100
	Paper III Mammalogy	5	3	100
	Paper IV Wildlife Ecologys and Genetics	5	3	100
	Practical I (covering papers I – IV)	3		----
	Practical II (Covering papers V-VIII)	3		----
	Diploma – Paper I Cytology Diploma Practical I	3 2	3	100 ----
II	Paper V Forestry and Silviculture	4	3	100
	Paper VI Physiology and Healthcare of Wildlife	5	3	100
	Paper VII Forest Entomology	5	3	100
	Paper VIII Biometry, Computer applications and Bioinformatics	5	3	100
	Practical I (covering papers I – IV)	3	3	100
	Practical II (Covering papers V-VIII)	3	3	100
	Diploma – Paper II Molecular Biology Diploma Practical I	3 2	3	100 ----
III	Paper IX Wildlife Management Techniques	5	3	100
	Paper X Management of Zoos, Sanctuaries and National Parks	4	3	100
	Paper XI Ethology of Wildlife	5	3	100
	Paper XII Research Methology	3	3	100
	Paper XIII Animal Biotechnology	5	3	100
	Practical III (Covering papers IX-XII)	3		----
	Diploma – Paper III Immunology Diploma – Practical II	3 2	3	100 -----
IV	Practical III (Covering papers IX-XII)		3	100
	Project and <i>Viva Voce</i>			200
	Field Report			50
	Field training/workshops/seminars			50
	Human Excellence (Leadership/ethics/soft skills)			50
	Communication skills (Spoken English/Paper presentation, etc.)			50
	Diploma – Practical I Diploma – Practical II		3 3	50 50

* Includes 25% continuous internal assessment marks.

DIPLOMA IN CELL AND MOLECULAR BIOLOGY
(Compulsory Diploma course)

SEM.	SUBJECT AND PAPER	DISTRIBUTIONAL HRS. PER WEEK	UNIVERSITY EXAMINATIONS	
			Duration in hours	Max. Marks ¹
I	Paper I Cytology	3	3	100
	Practical I	2		
II	Paper II Molecular Biology	3	3	100
	Practical I	2		
III	Paper III Immunology	3	3	100
	Practical II	2		
IV	Practical I		3	50
	Practical II	2	3	50
	TOTAL	17	15	400

M.Sc. Wildlife Biology

SEMESTER –I

PAPER -I ICHTHYOLOGY AND HERPETOLOGY

Unit I

Characteristics and classification of fishes upto order with suitable examples-Economically important marine, estuarine, lentic, lotic, game and aquarium fishes in South India.

Unit II

Characteristics and classification of amphibia upto orders with suitable examples-Salient features and distribution of South Indian amphibians-Economic importance of amphibians.

Unit III

Classification and characteristic features of Reptilia upto orders with suitable examples-Economic importance of reptiles- Common South Indian poisonous and non-poisonous snakes - distinctive features and distribution.

Unit IV

Distinctive features and distribution of common Indian Lizards-Distinctive features and distribution of Indian crocodiles-Breeding biology of Indian crocodiles.

Unit V

Distinctive features and distribution of Indian turtles, Indian tortoises and Indian terrapins-Variou aspects of migration in sea turtles-Breeding biology of marine turtles.

Books for reference:

1. Das I, 1985. Indian Turtles, A Field Guide. WWF, India.
2. Day F, 1958. The Fishes of India, Vols. I and II. William Dawson and Sons Ltd., London.
3. Deoras P J, 1965. Snakes of India. National Book Trust, New Delhi.
4. Goin G J and Goin O R, 1971. Introduction to Herpetology. W H Freeman and Co., San Francisco.
5. Lagler K F, Raradoh J F and Miller R R, 1962. Ichthyology, The Study of Fishes. John Wiley and Sons, New York.
6. Lowe M S and Galliet G M, 1979. Readings in Ichthyology. Prentice-Hall of India, New Delhi.
7. Murthy T S N, 1986. The Snakes of India. International Book Distributors, Dehra Dun.
8. Osellariors, Augue A and Attridge J, 1975. Reptiles. Hutchinson University Library, London.
9. Robinson D, 1976. Tortoises, Turtles and Terrapins. John Bartholomew and Sons Ltd., Edinburgh.
10. Sedgwick A, 1962. A Students Textbook of Zoology, Vol. II, Vertebrata. Central Book Depot, Allahabad.
11. Young J Z, 1950. The Life of Vertebrates. Clarendon Press, Oxford.

SEMESTER -I

PAPER -II ORNITHOLOGY

Unit I

Classification of birds up to orders with examples-Economic values of birds: Food and other products from birds - birds of agricultural importance - bird hazards in airports - recreation - aesthetics - hunting - bird watching.

Unit II

Habitat ecology of Indian birds: coastal birds - inland water birds - birds of high altitudes and deserts-Feeding ecology of birds- Insectivores - frugivores -nectarivores - graminivores - carnivores and scavengers.

Unit III

Bird migration: Mechanics of migration - timing of migration - physiology of migration - orientation and navigation. Nests: Functions of nests - choice of nest sites - colonial nesting - forms of nests - multiple nests - nest materials - nest building.

Unit IV

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

Unit V

Egg laying: Timing of egg laying _ clutch size - incubation patterns - hatching-Parental care: Feeding the young -nest sanitation - brooding the young - defence of young.

Books for refernce:

1. Ali S and Ripley S D, 1969. The Handbook of the Birds of India and Pakistan. Oxford University Press, New Delhi.
2. Farner D S and King J K, 1971-75. Avian Biology, 5 Vols., Academic Press , New Delhi.
3. Welty J, 1983. The Life of Birds. Saunders College Publishing, New York.

SEMESTER -I

PAPER -III MAMMALOLOGY

(Distinctive characteristics, status, distribution, habitat and habits of selected Indian mammals)

Unit I

Classification of mammals upto orders with suitable examples- Economic importance of Mammals-Common *Marine Mammals* of India. *Order Primata*- Apes-Gibbon, Monkeys - Bonnet, Rhesus, Assamese, Lion-tailed,

Langurs - Common, Capped, Golden, Nilgris. Loris - Slender and Slow Loris. *Order Pholidota*: Pangolins - Indian.

Unit II

Order Carnivora: Major cats - Tiger, Lion, Leopard and Snow Leopard. Lesser cats - Golden, Leopard, Fishing, Jungle. Civets - Tiger Civet, Large Indian Civet, Small Indian Civet, Palm Civet, Binturong or Bear Cat

Hyena - Striped. Mongoose - Common Mongoose, Small Indian, Striped necked, Crab-eating. Dogs - Wolf, Jackal, Red Fox, Indian Fox, Dhole. Bears - Sloth Bear, Himalayan Black Bear, Brown Bear. Weasels - Common and Smooth Indian Otter.

Unit III

Order Perissodactyla: Horses - Wild Ass. Rhinoceros - One-horned Rhinoceros. *Order Artiodactyla*: Deer - Kashmir Stag, Brown-antlered Deer, Swamp Deer, Hog Deer, Spotted Deer, Barking Deer, Musk Deer, Mouse Deer, Sambhar Deer. Antelope - Black Buck, Four-horned Antelope. Goats - Himalayan Tahr, Nilgiri Tahr. Oxen - Gaur. Pig - Wild Boar.

Unit IV

Order Rodentia: Squirrel - Common Indian Giant, Malayan Giant, Grizzled Giant, Himalayan Striped, Flying Squirrel. Marmots - Himalayan. Rats - Gerbilles and Mice - Indian Gerbilles and Field Mouse. Porcupine *Order Proboscidae*: Elephant - Asian Elephant

Unit V

Order Lagomorpha: Hares - Indian Hare, Himalayan Mouse Hare. *Order Chiroptera*: Bats - Flying Fox, False Vampire, Bat and Microchiroptera. *Order Insectivora*: Shrews - Tree Shrew, Hedgehog, Moles.

Books for reference:

1. Anderson J and Slater D L, 1981. Catalogue of Mammals, Vols. I and II. Cosmo Publications, New Delhi.
2. Clegg P C and Clegg A G, 1978. Biology of the Mammal. The ELBS and William Heinmann Medical Books Ltd., London.
3. David MacDonald, 1984. Encyclopaedia of Mammals, Vols. I and II. George Allend and Unwin, London.
4. Prater S H, 1988. The Book of Indian Animals. Bombay Natural History Society, Bombay.
5. Roonwal M L and Mohnot S M, 1977. Primates of SouthEast Asia: Ecology, Sociobiology and Behaviour. Harvard University Press, Cambridge.

SEMESTER -I

PAPER -IV WILDLIFE ECOLOGYS AND GENETICS

Unit I

Ecosystem: Aquatic ecosystem - pond, terrestrial ecosystem - forest trophic relations in ecosystems, food chain, food web, ecological pyramids - productivity of ecosystem - primary and secondary production - factors influencing the primary production, cybernetics, energy flow in an ecosystem - ecological niche. Biotic community: Organization and characteristics of community. Ecological Dominance, ecotone and edge effect, stratification, community succession - examples, types, successional pattern, trends in succession.

Unit II

Population ecology: Population - definition, equilibrium, natality, mortality, fluctuations with density, intraspecific competition, density dependence - optimum foraging theory, limiting factors. Carrying capacity, natural regulation of numbers. Population analysis and population dynamics, population ecology in plants. Population analysis: Survivorship curves, life tables, critical parameters - density, sex ratio, age distribution, fecundity by age - survival by age. Population parameters from harvesting: reduction culling, reintroduction and restocking.

Unit III

Environmental pollution- Noise and thermal pollution-Environmental impact assessment techniques-Remote sensing- Animal-habitat interaction - Food, water, minerals, shelter and their effects on distribution: limiting factors. Patterns of habitat utilization and dispersion, including home range - migration and corridors; and methods of study, use of ecotones. Predator-prey interaction.

Unit IV

Biodiversity: Examples - biological , genetic, species, ecosystem - estimation and monitoring of diversity - indices –threats to biodiversity – loss and vulnerability to extinction - causes of depletion - habitat destruction, fragmentation and degradation- exotic species introduction, diseases and overexploitation. Value of biodiversity – direct and indirect economic values, ethical values. Conservation biology – conservation at the population level – problems of small population – population biology of endangered species. Conservation and human societies – legal protection of species and habitat.

Unit V (Genetics)

Linkage and crossing over-Multiple alleles: examples - rabbit and Drosophila- Interaction of genes - complementary, supplementary, inhibitory, polymeric, lethal, duplicate and cumulative factors-Sex determination and sex-linked inheritance- Mutation: Genomatic mutation, chromosomal aberration-Non-disjunction-Fine structure of gene and Genetic Code-Microbial Genetics- genetic engineering-Pedigree analysis and karyotyping.

Books for reference:

1. Ananthkrishnan T N, 1982. Bioresources ecology. Oxford and IBH Publishing Co., New Delhi.

2. Andrewartha H C and Birch L C, 1974. The Distribution and Abundance of Animals. The University of Chicago Press, London.
3. Clarke G C, 1954. Elements of Ecology. John Wiley and Sons Inc., New York.
4. Elton C, 1953. Animal Ecology. MacMillan Co., London.
5. Kannan K, 1991. Fundamentals of Environmental Pollution. S Chand and Co. Ltd., New Delhi.
6. Kormondy E J, 1969. Concepts of Ecology. Prentice-Hall Inc., Engelwood Cliffs, New Jersey.
7. Krishnan N T, 1994. Environmental Biology. J J Publications, Madurai.
8. Odum E P, 1971. Fundamentals of Ecology. W B Saunders Co., Philadelphia.
9. Verma S R, Sharma R S and Rani G , 1988. Ecology and Animal Behaviour. Jayaprakashanth and Co., Meerut.
10. Sinnott E W and Dunn I C, 1958. Principles of Genetics.
11. Veer Bala Rastogi. A Textbook of Genetics.
12. Verma P S and Agarwal V K. Genetics. Strickberger M W, 1996. Genetics. MacMillan Pub. Co., New York.

SEMESTER I

PRACTICAL I (Covering papers I to IV)

1. Identification of selected South Indian species of Vertebrate classes.
2. Study of the cycloid, ctenoid and placoid scales of fishes by making temporary glycerine mounts.
3. Preparation of skeleton and study of skeletal parts of vertebrates (frog/Calotes/rat).
4. Study of exoskeleton in Chelonia (Reptilia) and Mammalia.
5. Study of beak and feet modifications in birds.
6. Quantitative estimation of the natural water content of different soil types.
7. Capillary action of different types of soil.

8. Estimation of nitrates, phosphates, iron and carbonates of water samples.
9. Estimation of alkalinity of water in an ecosystem.
10. Estimation of animal population by any two sampling techniques.
11. Study of abundance of animal species in a natural community. Study of biome.
12. Study of a plant community in an ecosystem by species area method.
13. Study of a plant community by quadrat method.
14. Quantitative analysis of a plant community.
15. Study of net productivity of trees by leaf punch method.
16. Study of plant community using Raunkier's frequency method.
17. Study of meiosis in grasshopper testis.
18. Study of the salivary gland chromosomes of Chironomus larva.
19. Karyotyping of any animal cell.

SEMESTER –II

PAPER -V FORESTRY AND SILVICULTURE

Unit I

Major vegetation types of India-Basis of classification- their physiognomy and seasonal characteristics- Phenology- species composition- distribution. Production forestry- Actual production- uses of wood- potential productivity- planning increased production - non-wood products. Forest soils and their conservation- Classification- factors affecting the soil formation- physical and chemical properties- causes of soil erosion and conservation methods. Watershed management- Objectives and methods.

Unit II

Forest mensuration: Methods of measuring - diameter, girth, height and volume of trees- form factor- Volume estimation of stand- sampling methods- yield education- current annual increment- mean annual increment- sample plots- yield and stand tables- scope and objectives of forestry inventory- aerial survey and remote sensing techniques- Forest survey and engineering-Different methods of surveying- chain, prismatic, compass, paintable and topographic surveys- area calculation- maps and map reading.

Unit III

Forest management- Objectives and principles- techniques- methods of yield rotation- regulation of yield- factors injurious to forests- means of protection. Forest laws- Necessity-general principles- Indian Forest Act,1927: Forest Conservation Act, 1980. Forest economics- Fundamental principles- cost-benefit - estimation of demand and supply - economic analysis of forest productivity.

Unit IV

Social forestry- Objectives of social forestry programmes and their implementation in India- tree farming on wastelands - afforestation of hills, slopes, wastelands, riverbanks and water tanks - cultivation of fodder trees - roadside avenues and fuel wood farming.

Unit V

Silvicultur- General silvicultural principles- ecological and physiological factors influencing vegetation- natural and artificial regeneration of forests- nursery techniques- seed technology - collection, storage, pre-treatment and germination- silvicultural systems - clear felling uniform, shaft wood, selection, coppice and conversion systems.

Books for reference:

1. Agarwala V P, 1980. Forests in India. Oxford and IBH Publishing Co., New Delhi.
2. FAO, 1992. Conservation and Development of Tropical Forest Resources, FAO Publications, Rome.
3. Puri G S, Meher V M, Gupta R K and Puri S, 1981. Forest Ecology. Oxford and IBH Publishing Co., New York.
4. Stebbin E P, 1977. A Manual of Elementary Forest Zoology For India. International Book Distributors, Dehra Dun.

5. Sukachev V and Dlis N, 1964. Fundamentals of Forest Biogeocoenology, Oliver and Boyd, Edinburgh.
6. Tiwari K M and Singh R V, 1980. Social Forestry Plantations. Oxford and IBH Publishing Co., New Delhi.
7. Warning R H and Schlesinger W H, 1985. Forest Ecosystems: Concepts and Management. Academic Press, New York.

SEMESTER -II

PAPER -VI PHYSIOLOGY AND HEALTHCARE OF WILDLIFE

Unit I

Nutrition: The energy content of foods - the nutritional contribution of minerals to animals - digestive system - digestability of food - absorption of food nutrients - nutrition in relation to growth and health of wildlife. Metabolism- Basal metabolic rate - factors affecting BMR - climatic effects on metabolism - influence of reproductive cycle on metabolism.

Unit II

Water regulation : Drinkers and non-drinkers - regulation of food intake - wet food - dry food. Thermoregulation- Physiological responses to heat and cold-Physiology of moulting in vertebrates.

Unit III

Reproduction in birds- Physiology of egg formation - physiological changes during incubation. Mammals-Secondary sexual characters - reproductive cycles - physiology of gestation - physiology of the foetus - lactation and hormonal control - weaning.

Unit IV

Infectious wildlife diseases: Viral - bacterial - protozoan - helminths and their impact on the wildlife populations-Factors of disease dissemination in wildlife-Effect of pesticides and metals on wild birds and mammals - food poisoning.

Unit V

Non-infectious diseases of wild animals- Diseases of the digestive - respiratory - excretory - nervous system - skin diseases - disorders in mammary glands and gynaecological disorders. Animal health monitoring- Condition, health and nutritional assessment for free ranging animals.

Books for reference:

1. Campbell J R and Lasley J F, 1977. The Science of Animals That Serve Mankind. TMH Publishing Co., New York.
2. Davis *et al.*, 1981. Infectious Diseases of Wild Mammals. The Iowa State University Press, USA.
3. Marshal P T and Hughes G M, 1980. Physiology of Mammals and Other Vertebrates, Cambridge University Press, New York.

SEMESTER -II

PAPER -VII FOREST ENTOMOLOGY

Unit I

Organization of a typical insect-Characters and classification of the following orders upto families with examples-Orthoptera- Hemiptera- Coleoptera- Lepidoptera- Hymenoptera- Isoptera- Diptera.

Unit II

Bionomics of any two destructive insects for each of the above orders: Biology - life cycle - control measures - damage caused. - Insect pests of a) teak b) sandalwood c) bamboo.

Unit III

Mode of insect attack on trees: leaf eaters - sapsuckers - meristematic tissue feeders - wood destroyers Beneficial insects and their role in forest economy- productive insects and useful insects.

Unit IV

Reproductive potential of forest insects: rate of multiplication - sex ratio - calculation of reproductive potential with examples.Plant-insect interaction- environmental resistance to insect attack- physical factors - nutritional factors -plant physiological factors - biotic factors.

Unit V

Detection and evaluation methods of insect infestation: Survey - estimation of insect abundance - devices for evaluation - methods for determining degree of hazard - biological evaluation-Control of forest insects; direct and indirect methods.

Books for reference:

1. Graham S A and Knight F B,1965. Principles of Forest Entomology. McGraw-Hill Back Co., New York.
2. Imms A D, 1965. A General Textbook of Entomology, ELBS, London.
3. Lefroy H M, 1909. Indian Insect Life. Today and Tomorrow's Printers and Publishers, New York.
4. Metcalfe C L and Flint W P, 1973. Destructive and Useful Insects, McGraw-Hill, New York.
5. Stebbins E P, 1965. Indian Forest Insects of Economic Importance. Eyre and Spottiswords Ltd., Loncon.

SEMESTER -II

PAPER -VIII BIOMETRY, COMPUTER APPLICATIONS AND BIOINFORMATICS

Unit 1

Concepts of biostatistics - types of data-collection of data-Classification and tabulation of data-Diagrammatic and graphical representation of data-Correlation analysis (Karl Pearson's, Spearman's rank)-Regression analysis.

Unit II

Sampling methods-Probability and theoretical distributions: normal- Binomial- Poisson-Tests of significance (F test, T test)-Chi square and goodness of fit - non-parametric test (Newman-keol's test)-Analysis of variance.

Unit III

Introduction to computers: history of computers - components of a computer - CPU, auxillary memory-Types of computers - mini, macro, PC, mainframe-Computer programming-BASIC,FOXPRO. Working environment: DOS, UNIX.

Unit IV

Software packages:Word processor – Microsoft Word. Data processor – MS-DOS. Graphics-Harvard graphics, EXCEL graph. Statistics packages - SYSTAT, SPS, KWKSTAT. Application of computer: Remote sensing – GPS, GIS. Database search - databank.Computer communication- e-mail- internet.

Unit V

Introduction and history of bioinformatics-Biological databases-Homology and diversity-Searching the database-Multiple sequence alignment-Phylogenetic analysis, gene finding and protein prediction-Molecular visualisation, target searching and drug designing.

SEMESTER II

PRACTICAL II (covering papers V to VIII)

1. Measurement of trees: Measurement of height, girth and basal area of individual trees; measurement of crown width and length, measurement of volume of felled trees, volume of stumps; estimation of volume of standing trees.
2. Visit to plantations; study of clear felling, shelter belts, selection and coppice system; management practices.
3. Identification of seedlings of species of industrial utility - Eucalyptus, Bamboo, Teak and Rubber; visit to state forest plantation; for study of management practices.
4. Quantitative determination of protein, carbohydrate and fat.
5. Estimation of glucose in the blood of rat.

6. Estimation of salt loss or salt gain in fish.
7. Study of respiratory rate in an aquatic and terrestrial animal.
8. Gut content analysis in a herbivore and a carnivore.
9. Enzyme analysis in selected vertebrates.
10. Collection, identification and preservation of ectoparasites.
11. Collection, identification and preservation of endoparasites in vertebrates.
12. Examination of faecal samples: Detection , recovery of helminth eggs and their identification.
13. Blood smear preparations: Thick and thin smears; examination of blood smears of frog, Calotes and rat for parasites.
14. Identification of common insects.
15. Mountings:
 - a) Wings, antenna, mouthparts and legs of the orders of insects studied in theory.
 - b) Stridulating organs of Orthopterans.
 - c) Genitalia and salivary glands of honey bee.
16. Collection and rearing of larvae and pupae - study of life cycle of few pests and vectors.
17. Damage identification: Collection of different parts of plants damaged.
18. Dissections: Digestive, nervous and reproductive systems of an Orthoptera and Lepidoptera.

Bio-statistics

20. Construction of bar diagrams, histogram, pie diagram, ogive curves using biological data.
21. Methods of constructing frequency distribution tables using biological data.
22. Calculation of arithmetic mean, median, mode, standard deviation and coefficient of variation by using biological data.
23. Calculation of Pearson's product moment, correlation coefficient for biological data.
24. Fitting a simple linear regression for biological data.
25. Test of significance using biological data - Chi-square test, T test and F test.

Computer applications

26. Flow charts.
27. Programming in BASIC.
28. EXCEL graph generation.
29. SYSTAT operations.
30. MICROSOFT WORD.
31. WINDOWS operations.

SEMESTER -III

PAPER -IX WILDLIFE MANAGEMENT TECHNIQUES

Unit I

Wildlife management-concepts and principles- Planning wildlife management investigations and projects. Damages caused by wildlife- identification and control.

Unit II

Evaluation of wildlife habitat-reconnaissance type techniques (including remote sensing technique) and vegetative analysis techniques-forest range evaluation and evaluation of wetland habitat.

Unit III

Habitat manipulation-Food production, water development and cover improvement-wetland improvement. Food habit analysis- Sampling method- equipment- kinds of study materials-preservation and analytical procedures.

Unit IV

Capturing and marking techniques- Live trapping of birds and mammals- chemical immobilization-methods of marking captured birds and mammals.

Determination and age and sex in birds and mammals- Determination of age and sex in Gallinaceous birds, water birds, Canidae, Lagomorphs and big game.

Unit V

Estimating the number of wild animals in a population: Direct count - Total counts, Drive counts, Time Area counts, Transect methods: Indirect counts - Call counts, Track counts, Pellet counts: Mark-recapture method - Peterson or Lincoln index method.

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: 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.

SEMESTER -III

PAPER -X MANAGEMENT OF ZOOS, SANCTUARIES AND NATIONAL PARKS

Unit I

Sanctuaries and National Parks: Declaration - Formation and Management-protection-administration and annual budgets. Interpretation techniques in National Parks, Sanctuaries and Zoos.

Unit II

National parks of India- Kaziranga-Gir-Bandipur-Kanha-Guindy-Corbett-Silent Valley-Marine National Parks of India- Mannar-Gulf of Kutch. Biosphere reserves in India and their concept.

Unit III

Important sanctuaries in India: Periyar-Mudumalai-Mundanthurai-Point Calimere-Indira Gandhi-Kalakad-Vedanthangal-Parambikulam and Mukkurthi. Zoological Parks-Formation-management exhibition; food and feeding- Diseases of zoo animals- their prevention and cure- zoo sanitation.

Unit IV

Captive breeding-aims, principles and methods.Rehabilitation programmes: 1) Project Tiger 2) Gir Lion Project 3) Project Hangul 4) Project Elephant 5) Musk Deer Project .Introduction to exotic animals- principles and problems in general.

Unit V

Role of government and voluntary organizations in wildlife conservation.Wildlife administration and legislation-Administrative setup (Central and State)-Statutory bodies (IBWL)-Wildlife Protection Act - 1972 and its amendments.

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.

SEMESTER -III
PAPER -XI ETHOLOGY OF WILDLIFE

Unit I

Methods of studying behaviour (Field, laboratory studies- Behavioural sampling methods). Instinctive behaviour-classical and modern concepts-fixed action pattern and ritualization.

Unit II

Learning-Imprinting-habituation. Conditioning-trial and error learning-reasoning and insight learning. Analysis of behaviour pattern- taxis, kinesis and reflexes.

Unit III

Biological rhythms-circadian, lunar, tidal and animal rhythms. Animal communication-visual, auditory, chemical and vocalisation.

Unit IV

Foraging behaviour-optimal foraging theory and group foraging. Origin and significance of play.

Unit V

Reproductive behaviour- sexual selection, mating pattern and parental care.
Social behaviour of deer, primates, elephants and lions.

Books for reference:

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.

SEMESTER -III

PAPER -XII RESEARCH METHODOLOGY

Unit I

Thesis writing : Collection of literature-Components of an thesis - preparation of research documents (abstracts, papers, etc).

Unit II

Principles, types and applications of Colorimetry- Calorimetry- pH meter- Electrophoresis- Chromatography- Centrifuge, Manometry.

Unit III

Audio, visual, activity recording- weight and distance location measuring instruments in wildlife studies- radio telemetry- radars in wildlife research - radioisotopes in wildlife studies - mapping techniques - GPS - remote sensing.

Unit IV

Making observations and records: field diary- filing and filing systems: photographic recording.

Unit V

Post mortem examinations: equipment - autopsies of birds and mammals.
Museum techniques-wet and dry preservation; taxidermy procedure.

Books for Reference:

- 1.Anderson J, Durston B and Poole M, 1991. Thesis and Assignment Writing. New Age International Pvt. Ltd., New Delhi.
2. Conference of Biological Editors. 1972. Style Manual for Biological Journals, American Institute of Biological Science, Washington D. C.
3. Van Norman R W, 1971. Experimental Biology, Prentice Hall, New Delhi.

SEMESTER -III

PAPER XIII ANIMAL BIOTECHNOLOGY

Unit I

Definition-Introduction, scope and products-Cell and tissue culture-Primary and established cell lines-kinetics of cell growth-Applications of animal tissue culture- Techniques of cell culture-substrates, media-primary culture, cell lines and cloning-somatic cell fusion- organ culture-Whole embryo culture.

Unit II

Genetic engineering-promoters and enhancers-gene silencing-Enzyme-restriction endonucleases-ligases-alkaline phosphatase-polynucleotide kinase-terminal deoxynucleotidyl transferase-SI nuclease-DNA polymerisus-Rnase-Reverse transcriptase-deoxyribonuclease-blotting techniques-DNA sequeneing-cDNA library-hazard of genetic engineering- GMOs.

Unit III

Recombinant DNA technology-Isolation of DNA –Nucleic acid hybridization-Labelling of nucleic acids-Probing and cloning-Mapping of genes-Genomic library-Serological tests and diagnosis of animal diseases-Hybridonia technology-somatic cell fusion-Production of monoclonal antibodia-ELSA-Vaccines-Microencapsulation

Unit IV

Gene cloning-recombinant DNA-Cloning in eukaryotes-PCR techniquies-gene transfer technology-particle bombardment-Artificial animal breeding-Artificial insemination and germ cell storage-Amniocentesis-Transplantation-Gene therapy-in vitro fertilization-Embryo Transfer-superovulation-Frizen embryo-Cell transplantation-Nucler transplantation-Selective animal breeding.

Unit V

Transgenic Animal technology-transfecgenic and somatotransgenic animals-applications-Production and therapeuties-Use of trasgenics in Animal agriculture and research-production of transgenic cattle by pronuclear injectaion-Sheeo transgenic for growth genes-Stem cell research and potential applications-patents-Intellectual Property Rights-Ethical issues-Gene Banking conservation and exchange.

Books for Reference

1. Ranga M M. Animal Biotechnology. Student Edition Publications, Jodhpur.
2. Prave P, Faust V, Sitting W and Subatcen D A(Eds.), 1987. Fundamentals of Biotechnology. VCH Publishers, Germany.
3. Higgins I J, Best G J and Jones J, 1985, Biotechnology Principles and applications. Blackwell Scientific Publication, New York.
4. Brown C.H., Campbell I and Priost F.G,1987. Introduction to Biotechnology. Blackwell Scientific Publication, Oxford.
5. Rev.Fr. Ignacimuthu, 2004. Basic Biotechnology. Tata McGraw Publishing Co. Ltd, New Delhi.
6. Chander Kanth, 2003. Biotechnology. Himalaya Publishing House, Mumbai.
7. Dubey R.C. Textbook of Biotechnology.

SEMESTER III
PRACTICAL III (covering papers IX to XII)

1. Data sheets used in wildlife management:
 - a) Collection and recording of data of capture, place of capture, weight, morphometric features, etc.
 - b) Census data.
 - c) Marking and recapture data.
2. Study of tracks and signs of wildlife in a sanctuary, pugmark tracing technique and plaster casting.
4. Morphometric analysis of wildlife - Mammal, bird type study.
5. Collection, preservation and identification of pellets/droppings.
6. Identification of hairs of wild mammals.
7. Examination of stomach and faecal contents for food habit studies.
8. Estimation of bird and squirrel population using one or more techniques.
9. Banding and marking techniques.
10. Preparation of the map of a zoo (with reference to the location of exhibits, pathways, children's playgrounds).
11. Recording of feeding times, kinds of food, cleaning procedures of the enclosures of zoo animals.
12. Focal and scan sampling techniques on selected animals.
13. Recording of breeding seasons and behaviour of animals.
14. Field instruments used in wildlife studies' photographic techniques used in wildlife studies.
15. Post mortem examination.
16. Taxidermy.
17. Preparation of index cards.
18. Demonstration of working of electrophoresis, chromatography, colorimeter and calorimeter.
19. Field report.

DIPLOMA IN CELL AND MOLECULAR BIOLOGY
DIPLOMA PAPER I Cytology

Unit I

The cell – prokaryotic and eukaryotic cells. Nature and properties of cytoplasm. Fine structure and functions of plasma membrane.

Unit II

Fine structure and functions of endoplasmic reticulum, golgi, mitochondria, lysosomes and ribosomes.

Unit III

Fine structure and functions of nucleus and chromosomes. Molecular structure, chemical composition and functions of DNA and RNA.

Unit IV

Biosynthesis of proteins, lipids and carbohydrates.

Unit V

Cell division – mitosis, meiosis and their significance. Ageing and programmed cell death.

References

1. Ambrose, E J and Easty, D M, 1978. Cell Biology. University Park Press.
2. De-Robertis, D E, 1980. Cell and Molecular Biology. Holt-Saunders, Japan.
3. Karp, G C, 1984. Cell Biology. McGraw-Hill.
4. Verma, P S and Agarwal, P K, 1988. Cytology. S Chand and Co., New Delhi.

DIPLOMA IN CELL AND MOLECULAR BIOLOGY
DIPLOMA PAPER II Molecular Biology

Unit I

The gene and gene concept: chemical nature, RNA genes, functional structure (promoters, enhancers, silencers, operons, consensus sequence, etc.), chromosomes.

Unit II

Gene expression – genetic code, transcription and translation. DNA replication and inheritance. Regulation of gene expression. Genetic recombination - Linkage and crossing over. Mutation.

Unit III

The Genome: Types – plasmid, mitochondrial, chromosomal DNA. Genome size – comparison of different genome sizes - genome projects – sequenced eukaryotic genomes.

Unit IV

Techniques in molecular biology – Expression cloning, PCR, Gel electrophoresis, Blotting techniques (Southern, Northern and Western blotting), Arrays.

Unit V

Pedigree analysis and karyotyping. Genetic engineering. Cloning techniques – prokaryotic and eukaryotic cloning, ethical considerations.

References

1. Ambrose, E J and Easty, D M, 1978. Cell Biology. University Park Press.
2. Bresler, S E, 1971. Introduction to Molecular Biology. Academic Press.
3. Clark, D P, 2005. Molecular Biology. Elsevier Science.
4. De-Robertis, D E, 1980. Cell and Molecular Biology. Holt-Saunders, Japan.
5. Karp, G C, 1984. Cell Biology. McGraw-Hill.
6. Verma, P S and Agarwal, P K, 1988. Cytology. S Chand and Co., New Delhi.

DIPLOMA IN CELL AND MOLECULAR BIOLOGY **DIPLOMA PAPER III Immunology**

Unit I

Immune system – organs of the immune system. Antigen – antibody interaction. Antibodies – structure, types, specificity. Immunoglobulins – IgM, IgG, IgA, IgD and IgE.

Unit II

Innate immunity: Humoral and chemical barriers – Inflammation, complement system. Cellular barriers of the innate system – leucocytes, phagocytes, mast cells, natural killer cells.

Unit III

Adaptive immunity: Lymphocytes – Killer T cells, helper T cells, $\gamma\delta$ T cells, B lymphocytes and antibodies. Physiological regulation of immunity – hormones, diet, stress.

Unit IV

Disorders of human immunity: Immunodeficiency – causes, congenital (examples) and acquired (examples including AIDS). Autoimmunity: causes, immunological tolerance, systemic and local, autoimmune disorders – examples. Hypersensitivity. Apoptosis.

Unit V

Tumour immunology: Tumour antigens and sources. Immunotherapy - immunosuppressive, anti-inflammatory and cytotoxic drugs. Immunological memory – passive memory, active memory and immunization. Immuno-informatics.

References

1. Paul, W E, 1993. Fundamental Immunology. Raven Press.
2. Reeves, G and Todd, I, 2000. Lecture Notes on Immunology. Blackwell Publishing.
3. Roitt, I M and Delves, P J, 2006. Roitts Essential Immunology. Blackwell Publishing.
4. Roitt, I M, 1984. Essential Immunology. 5th Ed. Blackwell Scientific Publication, Oxford.

DIPLOMA IN CELL AND MOLECULAR BIOLOGY
DIPLOMA PRACTICAL I (Cytology)

1. Culture of Prokaryotes – bacterial and yeast cells.
2. Plotting of bacterial growth curves.
3. Grams staining of bacteria.
4. Study of mitosis – Squash preparation of onion root tip.
5. Study of meiosis – Squash preparation of grasshopper testes.
6. Study of salivary gland chromosomes of Chironomous larva/ Drosophila.
7. Qualitative detection of proteins, carbohydrates and lipids.

Spotters

1. Yeast
2. Coccus
3. Bacillus
4. Stages in cell division – prophase, metaphase, anaphase and telophase.
5. Polytene chromosomes.
6. Lampbrush chromosomes.
7. Electron microscopy – SEM & TEM.
8. Cytochemical stains.

DIPLOMA IN CELL AND MOLECULAR BIOLOGY
PRACTICAL II (Molecular Biology and Immunology)

1. Immunology of blood grouping – ABO and Rh grouping.
2. Staining and identification of different types of leucocytes.
3. Differential leucocyte count.
4. Calculation of number of viable and dead cells by microscopic cell counting.
5. Isolation of bacterial DNA.
6. Culture of Drosophila to observe mutant types.
7. Estimation of protein by Lowry *et al* method.
8. Gel electrophoresis – demonstration.

Spotters

1. Thymus.
2. Types of leucocytes – Lymphocytes, eosinophils, basophils, monocytes, neutrophils.
3. Immunosuppressant drugs.
4. Genome of a prokaryote and a eukaryote.
5. Gel electrophoresis – principle and uses.
6. Blotting techniques – Northern, Southern and Western blotting.
7. Human karyotype.