UNIVERSITY OF KOTA

FACULTY OF SCIENCE

SYLLABUS

M.Sc. (*Wildlife Science*)

(Semester Scheme)

Examination- 2013-14

M.Sc. (Wildlife Science) Exam – 2013-14

Eligibility: B.Sc. (under 10+2+3 scheme) with Botany/ Zoology/Agriculture/ Biotechnology/ Biochemistry /Microbiology/ Forestry/Nursing and Veterinary Science/equivalent graduate with science background from any University recognized by UGC with 50% marks.

(45% for candidates belonging to the reserved category SC/ST/OBC/SOBC)

Scheme of Examination and Courses of study

1. The numbers of paper and maximum marks for each theory paper/practical have been shown in the syllabus. It will be necessary for a candidate to pass in the theory part as well as in the practical part (wherever prescribed) separately.
2. The course of study for M.Sc. (Wildlife Science) examination shall spread over a period of four Semesters with written examination at the end of each semester, except IV semester where in he/she will be submitting a Project report/dissertation)
3. Syllabus of each first three semester will be divided into 5 units.
4. Scheme of examination-

M.Sc. Semester I - Wildlife science

Paper Code	Nomenclature of the Paper	Max. Marks	Min. Marks
WLS-01	Biogeography, Ecology, Animal and Vegetation Science	**100 (70+30)**	**36 (25+11)**
WLS-02	Biology of Indian Wildlife	**100 (70+30**	**36 (25+11)**
WLS-03	Population Ecology and Statistical Methods	**100 (70+30)**	**36 (25+11)**
WLS-04	Illegal Trade of Wildlife	**100(70+30)**	**36 (25+11)**
WLS-05	Laboratory and Computer Practical-**I**	**75**	**27**
WLS-06	Field Practical-I	**75**	**27**

M.Sc. Semester II - Wildlife science

Paper Code	Nomenclature of the Paper	Max.Marks	Min. Marks
WLS-07	Habitat Ecology	**100 (70+30)**	**36 (25+11)**
WLS-08	Wildlife Ecology and Conservation Biology	**100 (70+30)**	**36 (25+11)**
WLS-09	Wildlife Health	**100 (70+30)**	**36 (25+11)**
WLS-10	Environment Impact Assessment (EIA)	**100 (70+30)**	**36 (25+11)**
WLS-11	Laboratory and Computer Practical-II	**75**	**27**
WLS-12	Field Practical-II	**75**	**27**

M.Sc. Semester III - Wildlife science

Paper Code	Nomenclature of the Paper	Max. Marks	Min. Marks
WLS-13	Physiology, Adaptations & Management	**100 (70+30)**	**36 (25+11)**
WLS-14	Applied Wildlife Biology	**100 (70+30)**	**36 (25+11)**
WLS-15	Human Ecology	**100 (70+30)**	**36 (25+11)**
WLS-16	Biodiversity Conservation	**100 (70+30)**	**36 (25+11)**
WLS-17	Laboratory & Computer Practical-III	**75**	**27**
WLS-18	Field Practical-III	**75**	**27**

M.Sc. Semester IV - Wildlife science

1. Project report/dissertation which will be based on field work on any topic related to wildlife biology/ ecology/environment/habitat study etc. **400** Marks
   (200 Internal+ 200 External assessment)
2. Presentation/seminar (External) **75** Marks
3. Viva-voce examination based on project work done/Dissertation (External) **75** Marks

5. There will be four papers in theory, each of three hours duration, 70 mark each (External assessment), Internal Assessment of 30 marks (One hour duration) and two practical carrying 75 marks each. (10 marks are reserved for record, 10 for viva, 10 for project, 10 marks for one seminar in each examination and remaining 35 marks constitute Major and Minor questions).

6. A candidate for a pass at each of the semester examination shall be required to obtain (i) at least 45% marks in the aggregate of all the papers prescribed for the examination and (ii) at least 45% marks in practical wherever prescribed at the examination, provided that if a candidate fails to secure at least 36% marks in each individual paper at the examination and also in the Test/ Dissertation/ Survey Report/ Field works, wherever prescribed, he shall be deemed to have failed at the examination not withstanding his having obtained the minimum percentage of marks required in the aggregate for that examination.

No division will be awarded at the previous Examination. Division shall be awarded at the end of the final Examination on the combined marks obtained in all the semester Examinations taken together, as noted below

First division with distinction – 75% on the aggregate marks
First Division 60% of the aggregate marks and
Second Division 48% in all semesters.
Pass upto 45%

7. If a candidate clears any paper(s) prescribed at the Semester Examination after a continuous period of two years, then for the purpose of working out his division the minimum pass marks only viz. 36% (45% in the case of practical) shall be taken into account in respect of such papers(s)/ Practical(s) are cleared after the expiry of the aforesaid period of three years; provided that in case to reach the minimum aggregate as many marks out of those actually secured by him will be taken into account as would enable him/her to make up the deficiency in the requisite minimum aggregate.

8. A total of twelve theory papers (3 hours duration each) are prescribed in (4 in each semester). A combined practical Examination (10 hrs. duration two days) shall be conducted in each semester.

9. The pattern of examination will be similar as adopted in other. P.G. exams of university of Kota along with by means of dissertations / Project Report / Seminar as prescribed in the syllabus.

10. Pattern of Q. Paper will follow the adopted scheme i.e. the Q.P. will be divided in three sections A,B, & C. Section 'A" Will contain 10 short answer type questions and all will be compulsory. Section 'B' will contain 10 questions, 2 from each unit. Candidate will be required to attempt 5 questions selecting 1 from each unit. Section 'C' will contain 4 question set from different units. Candidate will be required to attempt any 2 questions.

11. A candidate may be promoted to III semester if he/she secures at least 36% marks in at least seven out of ten papers (8 theory papers + 2 practical's) prescribed at the I and II semester taken together provided that the aggregate marks in all theory papers of I and II semester taken together is at least 45%. Such candidate shall be required to appear in theory papers in which he/she has secured less than 36% marks of I and II semester along with the theory papers of III and IV (Project) semester respectively, as and when such examinations are held.

12. A candidate may be promoted to second year if he/she has secured at least 36% marks in each theory paper but has failed to secure 45% marks in aggregate (theory and practical separately). He shall be required to appear in some theory papers of I and II semester so as to make his aggregate at least 45% along with III and IV (Project) semester, whenever examination of these courses are held.

13. A candidate may be allowed grace marks at maximum two places up to the extent of 1% of the total marks prescribed for that examination.

Note-: Each Theory Paper –

External Assessment of 70 Maximum Marks (25 Minimum Marks)
Internal Assessment 30 Maximum Marks (Minimum marks- 11)

Semester-I 2013-14

Paper–WLS–01-Biogeography, Ecology,Animal and Vegetation Science

Min Pass Marks-36 Duration- 3 hrs MM - 100 marks

Unit – I-Biogeography

Bio-geographical realms and provinces, Neartic, Paleartic, Ethiopian, Neotropical, Australian and Oriental fauna. The origin of Indian fauna and flora and routes of faunal exchange and migration. Zoogeography of Indian mammals. Biogeography of India.

Unit – II-Fundamentals in Ecology

Communities, populations, groups and individuals. Functioning of ecosystem: energy flow and nutrient cycles, the establishment of trophic equilibrium; biogeochemical cycles. The concept of a system approach to ecological functioning. Ecosystem services: pollination, seed dispersal, insect and pest control. Population ecology, inter and intra-specific competition and mutualism. Density dependence-optimum foraging theory, carrying capacity. Corridors, eco-sensitive zones, tiger critical habitat.

Unit- III-General Silviculture

Silviculture- General principles, ecological and physiological factors influencing vegetation, natural and artificial regeneration of forest. Habitat improvement. Limiting factors and their role. Umbrella species, key stone species, Indicator species

Unit – IV-Introduction to Forest types

The major Forest types of India; structure, composition and function. Champion & Seth's classification of Indian Forest. Major Forest types of Rajasthan. Vegetation quantification: field sampling, mapping structural, ecological and floristic associations. Storeyfication in Forest area, Canopy density.

Unit- V-Introduction to Biological Diversity

Concept of Biodiversity, level of biodiversity, biological, genetic, species and ecosystem diversity. Indigenous and introduce species, alpha, beta, gamma diversity. Faunal diversity and biogeographic distribution of India. Animal conservation issues and strategies.

Practicals

Study of alpha diversity of Ramgarh Vishdhari wildlife sanctuary, Beta study of Shergarh and Darrah Wildlife Sanctuary. Study of French Institute's maps; Botanical excursions to Ranthambhor National Park or any other sanctuary/ National Park (Orientation tour); Qualification of vegetation sampling methods (Techniques tours). Forest Mensuration exercise. Determination of species, Dominance and frequency using quadrate/ plot method.

Paper – WLS – 02- Biology of Indian Wildlife

Min Pass Marks-36 Duration- 3 hrs MM - 100 marks

Unit – I-Mammalogy

Zoo-geography of mammals, zoo-geographic regions, continental drift and zoo-geography of India mammals. Adaption in mammals hibernation, torpor, aestivation, locomotion and water regulation. Metabolism and thermoregulation; Ectothermy, homeothermy and cold stress, body size versus homeothermy. Influence of body size on life history, metabolic rate, weight constraints, feeding behavior, niche and reproduction. Skin and its derivatives. Behavior and social organization in mammals; social patterns, mating system, territories; hierarchies, predatory behavior and communications. Impact of religious feeding to animals.

Unit – II - Ornithology and Indian Birds

History of Ornithology in Rajasthan. Review of Indian birds: Taxonomy, general natural history, literature. Biogeography patterns in India avifauna and their affinities. Emphasis on Forest/ Grassland/ Desert/ Aquatic/ Cultivation. Sexual selection in birds. Economic ornithology.

Bird migration: Migratory flyways, threats to migrant populations. Avian community ecology and habitat selection. Endangered and threatened birds; waterfowls: Black-necked Stork, bustards: Great Indian Bustard, floricans, crane: Siberian and Sarus, raptors/Vulture (Gyps genus). Bird census techniques, conservation of bird habitats. Avian extinctions past and present. Important Bird Areas (i.e. IBA) of Rajasthan.

Unit – III-Herpetology

Fresh water and marine turtles, crocodilians, lizards and snakes. Trampling, Zoo-phobia, etc,. Thermoregulation, its role, aestivation, Hibernation and other eco-physiological adaptations. Herpato-phobia and Public Awareness. Role of temperature in sex determination in reptiles. Management of natural crocodilian egg laying region of Chambal Zone. An overview of conservation problems of Herpatofauna. Snake bites, Venom, Anti-venom, First Aid and Management of snake bite cases.

Unit- IV-Ichthyology

Fresh, brackish and marine water fishes and their adaptation. Threats to fish biodiversity: Threatened fishes of India. Conservation status of fish fauna in India. Methods for fish ecological studies. Exotic fishes, Major carps, Role of fishes in conservation of fishes, gharials, crocodiles, chelonians, otter, etc. Limnology of freshwater.

Unit – V-Forest Entomology

Introduction to Entomology: economic importance, ecological roles, adaptations, Insects as indicators for biodiversity monitoring. Insect fauna in prominent Indian PAs. Entomology of Teak forest. Role of insect conservation of wild animals: sloth bear, pangolin, birds, hedgehog and reptiles.

Practicals

Zoogeography of mammals of Indian sub-continent; Distribution of (i) Primates: Rhesus macaque (ii) Carnivores: Tiger, panther, hyena, sloth bear (iii) Ungulates: Sambar, chital, wild boar.

Study and identification of fish and insects commonly used in any study area.

Horn/ Antler identification. Pugmark analysis. Fake skin identification. Visit to Zoo, Darrah sanctuary, Abheda, Umedganj Pakshi vihar, Udpuria, Vulture roost site and Dump station.

Paper – WLS – 03-Population Ecology and Statistical Methods

Min Pass Marks-36 Duration- 3 hrs MM - 100 marks

Unit – I- Policy and Legislation

Conservation projects in India: International conservation bodies; IUCN UNDP, FAO, WWF, Conservation of wetlands.

Conservation laws, National wildlife conservation policy and action plan, National forest policy, wildlife (protection) act 1972, International conventions.

Unit – II-Concepts of Conservation

Concept of conservation with special reference to wildlife management and the management of forests in India. Conservation and sustainable development. Conservation versus preservation, Importance of wildlife.

Unit – III-Population Ecology

r & k selection, allometry, aging and sexing, Carrying, capacity, population estimation methods: relative, absolute measures and age/sex composites.

Preparation of sampling designs for population estimation. Analysis of census data. (Studies of various populations and use of census techniques will be carried out as part of field exercises)

Unit – IV-Quantitative Methods- I

Test of significance: Null hypothesis, student t-test, chi-square test.

Unit – V-Quantitative Methods-II

Hypothesis testing, analysis of variance. Regression and correlation. Use of statistical softwares (SPSS).

Practicals

Preparation of a wildlife case to prosecute in the court of Law.
Sampling/ Survey methods
Evaluation of Management Plans of Ramgarh/ Shergarh and Darrah Sanctuary.
Evaluation of Working Plan of Kota/ Baran/ Jhalawar/ Bundi Division.
Preparation of Micro-plan

Paper – WLS – 04-Illegal Trade of Wildlife

Min Pass Marks-36 Duration- 3 hrs MM - 100 marks

Unit – I-Illegal Trade of Important Indian Fauna

About TRAFFIC and Wildlife trade, Key agencies contributing to wildlife crime enforcement. Some methods of poaching in India, Illegal wildlife trade of some important species and products.

Unit – II-Illegal Trade of Important Indian Flora

Important Medicinal Plants of Arid and Semi-arid zone. CITES listed species
Medicinal Plant Conservation Areas (MPCA) in Rajasthan.

Unit – III-Forensic aspects and legal aspects

Prevention of wildlife Offences: Identifying early warning signs, post mortem, weapons of crime, intelligence gathering, maintaining a criminal profile directory, conducting interrogation, securing electronic evidence, some modes of concealment of illegal wildlife products.

Unit – IV-Wildlife Toxicology-I

Exposure of wildlife to toxicants in natural habitats and manmade habitats. Metals and their exposure. Toxicity testing of wildlife exposure to toxicants. Effect of Radiations on wildlife.

Unit – V-Wildlife Toxicology-II

Various toxicological testing methods. Biological indicators of pollution exposures. Biomagnification of pesticides and heavy metals, consequences of biomagnifications.

Practicals

Wildlife forensic: Collection of samples, Sample collection kit and chain of custody. Visit to post-mortem sites. Identification of fake skin/wildlife materials. Identification of weapons.

Practicals

Min Pass Marks-54	Duration- 5 hrs	MM - 150 marks
WLS-05	**Laboratory and Computer Practical-I**	MM - 75
WLS-06	**Field Practical-I**	MM- 75

Field Tour

Orientation Tour	2 weeks
Techniques Tour-I	4 weeks

Semester-II (2013-14)

M.Sc. Semester II - Wildlife Science

Paper Code	Nomenclature of the Paper	Max.Marks	Min. Marks
WLS-07	Habitat Ecology	100 (70+30)	36(25+11)
WLS-08	Wildlife Ecology and Conservation Biology	100(70+30)	36(25+11)
WLS-09	Wildlife Health	100 (70+30)	36(25+11)
WLS-10	Environment Impact Assessment (EIA)	100 (70+30)	36(25+11)
WLS-11	Laboratory and Computer Practical-II	75	27
WLS-12	Field Practical-II	75	27

Paper-WLS-07-Habitat Ecology

Min Pass Marks-36 Duration- 3 hrs MM - 100 marks

Unit I

Introduction to habitat ecology: Ecology of major habitats: Deserts, grasslands, Wetlands & forests.

Physical and anthropogenic factors influencing terrestrial habitats: Drought, flood, grazing, felling, fire. Habitat degradation and fragmentation.

Practical: Field visits for habitat evolution, visit to wetland areas. Wetland habitat (Ghana National Park/ Jhil Mil Tal wetland)

Unit II

Measuring wildlife habitats: Utilization of habitat by wild animals. Cover classification and mapping, Inventory of unique habitats like deserts. Use of photographic records for habitat monitoring.

Unit III

Animals' signs as indicators of use patterns: Animal signs: dig, scratch marks, pugmarks, kills, dragging sign, beat path, slips, rolling, browse and graze marks. Use and availability of habitat resources. Development of predictive models.

Unit IV

Application of Remote sensing in wildlife management: Principals and practical applications of remote sensing techniques, including aerial photography and satellite imagery. Use of photographs as maps and in map preparation. Interpretation of photography and imagery.

Unit V

GIS Techniques: *Geographical information systems:* Applications in wildlife. Use and imagery for quantitative analysis. Stereoscopy. Preparation of maps and field orientation. Introduction to computerized techniques.

Practical: Comparison of several techniques for quantitative habitat survey and mapping. Evaluating habitat availability and utilization. Visit to GIS Laboratory.

Paper-WLS-08-Wildlife Ecology & Conservation Biology

Min Pass Marks-36 Duration- 3 hrs MM - 100 marks

Unit I-Behavioral Ecology

Behavioral ecology and evolution: Optimal foraging theory and other models. Prey predator relationships and evolutionary arms races. Competition for resources: ideal free distributions and resource defense. Group living: costs, benefits and optimal group size theory, fights, contests and assessment.

Cooperation and helping : Mammals, birds fishes. Ecology and evolution of signals and communication pathways. Behavioral patterns in captivity.

Unit II-Community Ecology

Definitions and nature of communities; Community structure organization and stability (guilds, resource partitioning, niche, competitive exclusion).

Unit III-Conservation Biology

Conservation of biodiversity : Patterns and processes intra specific diversity, species richness, richness of higher taxa, ecosystem and biome diversity, patterns of losses; loss of biodiversity, causes and factors of mass extinctions and critical hot spots conservation of rage species, long lived species. Tiger reintroduction in Sariska, role of Ex-situ conservation, role of zoos and aquariums, introduction, rehabilitation of wild animals and translocation. PA network (National parks, Sanctuary, reserves, Community reserve, Biosphere reserves.)

Unit IV-Wildlife Genetics

Loss of genetic variation, genetically effective population size, demographic bottleneck and inbreeding depression. Management and conservation of genetic variation in natural population, conservation breeding, gene bank.

Unit V-Landscape Planning

Landscape as an environmental asset, techniques of landscape assessment at different levels, use of landscape design for environmental improvement. Eco-friendly Buildings. Landscape designing in zoos, zoo forestry.

Practicals

Methods of behavioral observation; Instantaneous scan, focal animal, all occurrence and one-zero sampling, collection and analysis of behavioral data of some common availability species, preparation of ethograms, time-activity budgets and social interaction matrices; demonstration of radio-telemetry methods of study activity patterns (if feasible)
Seminar based discussion and paper analysis and criticism. Calculations of energy and productivity. Analysis of species diversity.

Seminar and project/case study. Preparation of report on landscape planning of Kota zoo, preparation of report on eco-tourism zone of Darrah Sanctuary/ Shergarh Wildlife Sanctuary/ Ramgarh Vishdhary WLS.

Paper-WLS-09-Wildlife Health

Min Pass Marks-36 Duration- 3 hrs MM - 100 marks

Unit I-Wildlife Health

Review of major diseases of Indian wild mammals, birds, amphibians and reptiles. Epidemiology of disease. Disease transmission, between domestic and wild populations. Malnutrition, starvations, dehydration as disease syndromes. Control of disease, planning and management of wildlife health programmes.

Unit II-Common disease in Indian Wildlife

Parasitic Infections of Fish, Parasites of Reptiles Recommended Treatments for Diseases of waterfowl and Game Birds, FPL in big cats, Rabies in Sloth Bear, TB in Spotted Deer, Hanuman Langur, Lymphoid leucosis – Peafowl, Haemangioma & Paragonimus infection – Tiger, Ascending Duodenal Invagination–Leopard, Sarcocystois - Barasingha, Gasthrothylax - Swamp Deer, Pasteurellosis infection – Elephant.

Unit III-Diseases: Source and Management

Role of Wildlife in Parasitic Diseases of Man and animal, Wildlife Health Management in India, Insects and Disease Relationship in Man and Wildlife, Wildlife diseases of Vertebrates of Rajasthan. Importance of Wildlife Diseases and their control.

Unit IV-Capture & Handling of Wild Animals-I

Capture and handling of animals : Restraints, Capture and Animals Barriers : Purpose, live traps, snares, pits, nets, canon (rocket) nets, net gun, mist nets, corrals, stockade, spotlighting. Animal barriers : Reasons for use; trenches, walls, stockades, mechanical fences, electric, repellents.

Drug immobilization : Jabstick, blowpipe, pistol, rifle, crossbow, dart design; radio darts. Drug action, dosages, responses, side effects, effects, safety measures, complications, blind folding.

Unit V-Capture & Handling of Wild Animals-II

Handling and transport design of sledge, crate and holding enclosures. *Individuals identification and location :* Purposes, identification by natural marking, individual damage, passive marking collars, tags, branding, rings etc. Dynamic marking-beta light, radio tracking- harnesses, collars; tele- metering of physiological parameters etc.

Practicals : Demonstration of equipment traps, net, dart gun etc. Mist netting and trapping on campus. Participation in capture operations as appropriate. Examination of various types of barrier in the field. Field identification by natural markings. Equipment and its use tags, collars, radio tracking equipment. Bird ringing.

Identifying common parasites- protozoan, helminthes, insects, ticks and vectors.

Paper-WLS-10-Environment Impact Assessment (EIA)

Min Pass Marks-36 Duration- 3 hrs MM - 100 marks

Unit I - Procedures of EIA in Developed & Developing Countries

Introduction to Environmental Impact Assessment (EIA), Environmental Impact Analysis, Social Impact Assessment (SIA, Strategies Environmental Assessment (SEA), Environment Impact statement (EIS), Environmental Audits, definition of other useful terms in EIA Scope and purpose of EIA. Current status of EIA in India. EIA Procedures, introduction to administrative and technical requirements, procedural steps in EIA-scoping, screening. Baseline study formats, determination of impact significance criteria.

Unit II- Environmental Design

Design as a determinant of Environmental quality. Evolution of Environmental design, theories and practices of design. Criteria of Urban Environmental design issues-pedestrian-vehicular conflict. Environment, Housing areas, dereliction, environmental upgradation programmes. Urban climatology, effects of thermal pollution, factors causing heat sink effects, direct radiation, climatic effects on Urban areas, control techniques.
Environmental Mitigation planning, Principal and practices, mitigatory approaches and feasibility analysis. Environmental Auditing and Monitoring Concepts, objectives and usefulness. Environmental Economics. Introduction to some recent approaches in environmental economics for determination of monetary values of environmental goods and services.

Unit III-Environmental Impact Assessment

Role of EIA in the Planning and decision making process. Methods of EIA; advantages and limitations. Assessment of impacts on resources (Including air, water, flora and fauna). Assessment of impacts on Land use. Public Participation in EIA;definition and concepts, objectives, techniques, advantages and limitation, PRA techniques. Impacts of Development Projects on Flora. Impacts of Development Projects on Fauna.

Unit IV
Environmental Legislation, Evolution and Practices

Environmental Legislations and Regulations: Salient features of important environmental legislation, statutory obligations, environmental clearance procedures and GOI requirements. EP Act 1986. Air (Prevention and Control of pollution) Act. Water (Prevention and control of pollution) Act. Mines and Mineral Act. Factories Act. Pesticides Act. Indian Forest Act. Wildlife Act. Ancient Monuments and Archaeological Sites and Remains Act. Hazardous Waste Management and Handling Rules / Biomedical Rules / Solid Waste. Management Rules. Environment Tribunal Act. Climate change Protocols and Conventions. MOEF Guidelines and Notifications. Appellate Authority Act.

Unit V
Environmental Monitoring Assessment

Air Pollution- emission sources, vehicular emissions, techniques of monitoring of emissions, emission standards, and ambient air quality. Concepts of relevant meteorological parameters, and interpolation of data, wind system measurement, turbulence; mixing height, plume use, dispersion and dispersion models. Water Pollution – sources, water quality tests, minimum standards of disposal (for different uses),

performance criteria. Noise Pollution- sources, techniques of measurement, noise level standards. Land Pollution -sources, soil erodibility tests, minimum standards of disposal (minimum standards for different uses), performance criteria.

Practical

Environmental Impact Assessment Report: Guidelines for developing formats for preparing and reviewing EIA reports and Environmental Management Plans, Case Studies.

Familiarisation with relevant instruments/equipments and procedures (High Volume Sampler, Handy Sampler, Noise Meter, Spectrophotometer etc), TSPM, RSPM, SO2, NOX, Stack Monitoring, Noise Level Measurements etc.

Water Quality Parameters

Familiarisation with relevant instruments/equipments and procedures (Flame Photometer, Water Testing Kit, Digital pH meter, BOD Incubator, Dissolved Oxygen Meter)

Alkalinity, Amonical Nitrogen, BOD, COD, DO, Coliform, Fluoride, Nitrate-Nitrogen, pH, SAR, etc.

Soil Quality Parameters

Familiarisation with relevant instruments/equipments and procedures (Soil Testing Kit)

pH, EC, Soil Moisture, Phosphate, Potassium, Sodium, etc.

Weather Parameters

Familiarisation with relevant instruments/equipments and procedures (Electronic Weather Station)

Temperature, Relative Humidity, Rainfall, Wind Direction and Speed, etc.

Practical

Min Pass Marks-54 Duration- 5 hrs MM - 150 marks

WLS-11	Laboratory and Computer Practical-II	MM: 75
WLS-12	Field Practical-II	MM: 75

Field Tours

Techniques Tour-II	2 weeks
Specialized Techniques Tour/ Workshop on Photography	2 weeks

Field Tour

Orientation Tour	2 weeks
Techniques Tour-I	4 weeks

Semester-III

M.Sc. Semester III - Wildlife science

Paper Code	Nomenclature of the Paper	Max.Marks	Min. Marks
WLS-13	Physiology, Adaptations and Management	100 (70+30)	36(25+11)
WLS-14	Applied wildlife biology	100(70+30)	36(25+11)
WLS-15	Human Ecology	100(70+30)	36(25+11)
WLS-16	Biodiversity conservation	100(70+30)	36(25+11)
WLS-17	Laboratory and Computer Practical-III	75	27
WLS-18	Field Practical-III	75	27

Field Tours

Conservation Practices Tour	2 weeks
Management Practices Tour	2 weeks

Paper-WLS-13-Physiology, Adaptations and Management

Min Pass Marks-36 Duration- 3 hrs MM - 100 marks

Unit I-Nutritional and reproductive physiology

Feeding ecology of herbivores-carnivores, insectivores and omnivores food selection, quantity, quality (nutritional value), seasonal variations. Predator-prey interactions. Avoidance of competition for food and shelter.

Reproductive ecology, dispersion, patterns of growth and development. Eco-physiology-water and temperature physiology and its ecological implications. Effects of day length and temperature on reproduction, and migration. Importance of minerals in animal health, growth and reproduction.

Practicals: A study of habitat specificity in birds or small mammals on campus. Field methods of studying diet. Examination and recording of stomach contents of browser, grazer carnivore, insectivore and omnivore. Scat analysis of major herbivores and carnivores of your field visit. Experiments with captive reptiles, mammals in various situations of ambient temperature/isolation. Use of chemical capture equipment. (Note: this will be done in detail on field tour)

Unit II-Adaptations in animals and plants

Origin of adaptive and non adaptive characters, Kind of Adaptation in animals; Structural adaptation: Cursorial adaptations, fossorial adaptations, arboreal adaptations, digging mechanism, Volant adaptations, Cave adaptations, Aquatic adaptations, Desert adaptations, Deep sea adaptations ethological adaptation, parasitic adaptation,; Physiological adaptation; Protective adaptation: mimicry and protective coloration. Adaptations in Plants: Hydrophytes, Xerophytes, Mesophytes.

Practicals: Comparative study of Structural adaptation and Physiological adaptation of some birds and animals. Comparative study of plant adaptation in Hydrophytes, Xerophytes and Mesophytes.

Unit III-Wildlife Management

Principles and practices of wildlife management. Management of special habitats; riparian zones. Grasslands etc. Analysis of wildlife management, problems in plantations and exploited forests; Indian scenario. Species conservation projects; tiger, lion, rhino, crocodile etc.

Management plan for Protected Areas: Need for wildlife management planning. Principles of planning, objectives, resource surveys, analysis of surrounding region, management zones, theme plans, communications, staff and visitor amenities, monitoring. Financing protected areas.

Practical: Review of forest working plan and maps. Study of nearby forests and grasslands under various management regimes. Classroom based discussion and literature review. Field discussion of management practices in the tour. (Management practices will also be studied on field courses) exercise for preparing management plan

Unit IV-Economics of forest products

Forest Economics–fundamental principles, cost-benefit analyses; estimation of demand and supply; analysis of trends in the national and international market and changes in production and consumption patterns; assessment and projection of market structures; role of private sector and co-operatives; role of corporate financing. Socio-economic analyses of forest productivity and attitudes; valuation of forest goods and service. Forest products marketing, forest capital theory.

Inter-regional and international trade in forest products. Impact of economics and physical variables upon forest appraisal and management decisions. Externalities and property rights.

Practical: Exercises on estimation of demand and supply functions; biodiversity valuation, valuation of non-marketed forest products. Exercises on financial and economic appraisal of forestry projects. Exercises on marketing of forest products and international trade competitiveness. Computer applications for using programming techniques in evaluating forest management alternatives.

Unit V-Thematic planning

Some areas of thematic planning:-High Altitude Ecology:- Ecology of high altitude habitats (alpine, subalpine and upper temperate), species diversity & abundance, vegetation structure and composition, quantification of habitats and animal use, conservation issues and management practices. Mount abu: a special habitat in Rajasthan.

Wetland Ecology: - Ecology of inland wetlands, mangroves and coral reefs. Wetland soil and biogeochemistry. Wetland vegetation and plant production, seed bank and succession.

Landscape Ecology; Fundamentals of Landscape Ecology (genesis, definition and central concepts); Ecological and Spatial Scales; Landscape Pattern and Process; Fragmentation and Habitat Heterogeneity.

Global Warming and Climate Change; Introduction to globl warming and climate change - the earth's natural greenhouse effect. Sources of green house gases. The role of CO2 and Methane. The Carbon cycle. Global and regional drivers of accelerating CO2 emissions. Climate change and changes in global weather patterns. Climate change Impacts on ecosystems such as wetlands, glaciers, Arctic and Antarctic ecosystems and flora and fauna. Climate change vulnerability, response and adaptations.

Field Exercise: Measuring wetland variables including water quality and biomass production. Wetland fauna with special reference to monitoring of aquatic vertebrates. Wetland water quality and sediment properties.

Paper-WLS-14-Applied Wildlife Biology

Min Pass Marks-36 Duration- 3 hrs MM - 100 marks

Unit I-Man-animal interactions

Anthrozoology: Relation between human and animals. Man animal conflicts: causes and remedial measures to curb the conflicts. Human wildlife conflict: crop damage, livestock depredation, injuries to people, loss of human life, damage to property, injuries to wildlife, animal death and destruction of habitat.

Unit II-Man-vegetation interaction

People Plant Interaction; Ethnobotany: medicinal value of plants, NTFPs and uses of non timber plants in protected areas. Traditional values of tribals and local people of protected area. Pharmacognosy. Wildlife friendly plant. Designing wildlife garden: Nectar Bar. Attracting wildlife with native plants: Native plant landscaping for wildlife. Garden for wildlife: Making wildlife habitat at home. Forest plants and their wildlife uses.

Environmental impacts of plants: Replenishing O_2 supply, preventing soil erosion, Cooling buildings and neighborhoods, Filtering dust, Buffering noise.

Unit III-Radio-Telemetry Techniques

Introduction of Wildlife telemetry: transmitters (antenna, power source), transmitter attachments (general protocol, collars etc), receivers, relocating wildlife, study designing; general considerations, sample consideration, habitat utilization study review by species groups; amphibian, reptiles, small mammals, large carnivores.

Unit IV-Techniques to study Hair Structure (Some mammals) And DNA-Mapping

Introduction, Hair Types, Classification of Hair Characteristics, Techniques to Study Hair Structure, Photomicrographs and Descriptions of Hair Characteristics of Argali (*Ovis ammon*), Blackbuck (*Antilope cervicapra*), , Chinkara (*Gazella bennettii*), Four-horned antelope (*Tetracerus quadricornis*), Nilgai (*Boselaphus tragocamelus*) , Chital (*Axis axis*), Sambar (*Cervus unicolor*),
Caracal (*Caracal caracal*), Jungle cat (*Felis chaus*), Leopard (*Panthera pardus*), Tiger (*Panthera tigris*) , Indian Fox (*Vulpes bengalensis*), Jackal (*Canis aureus*), Wolf (*Canis lupus*), Striped hyaena (*Hyaena hyaena*), Sloth bear (*Melursus ursinus*), Small Indian civet (*Viverricula indica*), Common mongoose (*Herpestes edwardsii*), Rufous tailed hare (*Lepus nigricollis ruficaudatus*), Common langur (*Semnopithecus entellus*), Protocols and setting up of infrastructure for identifying species from hair. Use of DNA-mapping in Wildlife. Protocols of Tiger and panther.

Unit V-Sono-Taxonomy.

Modern methods of identification of species: without disturbing the individuals with particular reference to wild life. High resolution images of key features for identification, DNA bar coding. Sono taxonomy-sound based identification of species with particular reference to wild life, principles of bio-acoustics and vocalization, types of calls, sound spectrum and analysis, Karauli, Sound based monitoring of species. Advantage of sound based identification and monitoring of species.

Practicals

Techniques to Study Hair Structure: Slide preparation of hair from scats. Photomicrographs of some wild animals. DNA-mapping protocols of Tiger and Panther. Modern methods of identification of species by sono-taxanomy. Wildlife telemetry: transmitters (antenna, power source), transmitter attachments (general protocol, collars etc), receivers, relocating wildlife. Case study of Man-Animal conflict and Ethnobotany.

Paper-WLS-15-Human Ecology

Min Pass Marks-36 Duration- 3 hrs MM - 100 marks

Unit I-Man & Environment Interaction

The concept of environment, components of man & environment interaction; Physical environment, The social and cultural environment, Psychological Environment, Social Issues and the Environment: from unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, Watershed Management, Water conservation, Rain water harvesting. Acid rain, ozone layer depletion, nuclear accidents and nuclear holocaust. Case studies.

Unit II -Ecosystem People

Role of ecosystem people in protecting wilderness Vishnois of Rajasthan, etymology, socioeconomic profile of ecosystem people, wildlife environmental preservation, tribal outreach program, conservation efforts and support of the tribes or the local inhabitant in protected area.

Environmental ethics: issues and possible solutions: Resource consumption patterns and the need for their equitable utilization. Urban – rural equity issues. The need for Gender Equity and preserving resources for future generations, the rights of animals. The ethical basis of environment education and awareness. The conservation ethic and traditional value systems of India (Case study: Chipko movement).

Unit III-Biopiracy and bioprospecting

Introduction, Patents, Indigenous and Traditional Knowledge. Biopiracy: Implication of Biopiracy for Biological and Cultural Diversity. The Appropriative Aspects of Biopiracy, Patent Regimes and Biopiracy. Bioprospecting or biodiversity prospecting, bioprospector, uses of bioprospecting, limitations of bioprospecting.

Unit IV -Biotechnology in wildlife conservation

Animal cell culture, culture media, transfections of animal cell lines, expression of cloned protein in animal cells, vaccines, transgenic animals, bioreactors, genetic engineering, gene library, tissue culture, plant regenerations, Embryo transfer, PCR, captive breeding and in-situ, ex-situ conservations. Latest techniques used in Biotechnology for ecological and wildlife preservation. Biotechnology use for studying endangered wildlife and plants and the diseases and factors that threaten their survival.

Unit V-Captive breeding and ex-situ gene pool conservation

Captive breeding and Propagation: Founder population, rehabilitation, education, utilization, gene banks, Ex-situ and in-situ linkages, conservation breeding Management Plans, Role of scientific institution and NGOs in Conservation Breeding Programme. Propagation of threatened plants. Case studies on Conservation Breeding Programme of endangered wild animals. Role of ex-situ gene pool conservation in wildlife.

Practicals: Review of forest working plan and maps. Study of nearby forests and grasslands under various management regimes. (Management practices will also be studied on field courses)

Paper-WLS-16-Biodiversity conservation

Min Pass Marks-36 Duration- 3 hrs MM - 100 marks

Unit I-Biodiversity Conservation in India

Aims of biodiversity conservation, Necessity of conservation, economic value, balance of nature , genetic resources, aesthetic enjoyment, education, the nature of the loss, management and the conservation of wildlife, endangered species, action to save endangered species, research and documentation , habitat preservation and development of wildlife refuses, providing critical resources, legal action for the preservation of the species, breeding and captivity, wildlife conservation, importance of conservation, classification of scarce wildlife, methods of wildlife conservation, history of wildlife conservation, wildlife conservation in India, sanctuaries, various protected wild animals of India.

Unit II-Global Biodiversity Assessment

Introduction, Characterization of biodiversity. Magnitude and distribution of biodiversity, Generation, maintenance and loss of biodiversity, Biodiversity and ecosystem function basic principles. Biodiversity and ecosystem function biome analyses. Inventorying and monitoring of biodiversityHuman influences on biodiversity. Economic values of biodiversity and Measures for conservation of biodiversity and sustainable use of its components.

Unit III-Indian Biodiversity Act 2002

Regulation of access to biological diversity , national biodiversity authority , function and powers of the national biodiversity authority , approval by the national biodiversity authority , state biodiversity board, finance ,accounts and audit of national biodiversity authority and state biodiversity board. Duties of the central and the State Government, Biodiversity management committees, Local biodiversities funds and bodies.

Unit IV-Economics of Biodiversity

Social Development initiatives in India: Review of rural and tribal development programmers, and the impact of resource use practices and development programmers on local people and natural resources of the regions; Reasons for failure/success and lessons learnt; Alternative approaches to development, integrated development, small is beautiful, eco-development.

Working with local communities: Community diversity, beliefs and value systems, and how this relates to resources use and management; community participation-dimensions and typology; Gender concern, importance of gender based role, needs and priorities in relation to resource use and management; Community survey methods.

Unit V-Ecodevelopment and biodiversity

Park-people interface, conflict and objectives of human dimensions management; Basic of Eco-development-what, why, where and whether, Stakeholder identification and analysis, problems, and potentials in working with different stakeholders, stakeholders mapping; PA-People Mutual Influence Zone Analysis (MIZA) and demarcation of the influence Zone: Village prioritization for taking up pilot eco-development projects planning-participatory problem analysis (problem tree), objective setting, identifying external factors or assumptions that have impact on the initiative (if-then), log-frame approach, selecting and developing strategy; Monitoring and evolution.

Displacement and Resettlement of local communities with respect to creation of protected Areas: legal Situation, PA manager's role and responsibility in resettlement: Characteristics of an ideal resettlement scheme- what can go wrong and how to forestall these problems.

Practicals: Field based discussions about human aspects of conservation two day during orientation tour); Analysis of pressure and resource dependency of local communities upon PAs; and community survey methods including participatory learning methods.

Elective topics are designed to introduce the student to independent bibliographic search, information collection and interpretation and the formulation of scientific hypotheses and conclusion. This is achieved by a tutorial/directed reading approach on the topic. Examples would include 'Discuss the role of nutritional and day length factors in determining breeding season in Indian ungulates or Develop a population model for a tiger and single herbivore community in an simulated protected areas'. The students will submit a detailed review paper on the topic and make a seminar presentation.

Practical

Min Pass Marks-54 Duration- 5 hrs MM - 150 marks

WLS-17	Laboratory and Computer Practical-III	MM: 75
WLS-18	Field Practical-III	MM: 75

Field Tours

Conservation Practices Tour	2 weeks
Management Practices Tour	2 weeks

M.Sc. Semester IV - Wildlife science

1. Project report/dissertation which will be based on field work on any topic related to wildlife biology/ ecology/environment/habitat study etc. **400** Marks
   (200 Internal+ 200 External assessment)
2. Presentation/seminar (External) **75** Marks
3. Viva-voce examination based on project work done/Dissertation (Ext.) **75** Marks