M.Sc. Wildlife Science

CHOICE BASED CREDIT SYSTEM (CBCS)

2015-16

Course outline & Syllabus

July 2015

Rajasthan is a land of stupendous dimensions-colorful exotic, traditional and modern. Rajasthan is fortunate to have richness of natural beauty, flora and fauna accompanied with places of religious, historical and archeological importance. The rich cultural and historical heritage of the state attracts people from other states of India and as well as from all over the world. So far tourism in Rajasthan has been attracting domestic and foreign tourists towards its National Park and Wild Life Sanctuaries in large numbers but looking to the enchanting beauty and splendor of the picturesque forest wealth present in the hills of Aravallis and Vindhyas there is still lot of scope of opening avenues of wildlife tourism related to nature and forests. The forests of Rajasthan have tremendous potential in the tourism sector. The development of "Green Tourism or Eco-tourism" will not only enhance the tourist arrivals in the state but also earn sizable foreign exchange together with employment generation largely in an around forest areas benefiting rural and tribal population of the state.

The state houses tigers, black bucks, chinkara, the sporadic desert fox, the greatly threatened caracal, the great Indian bustard, gavial, monitor lizard, wild boars, and porcupine. Exotic traveling birds like the common crane, ducks, coots, pelicans and the rare Siberian cranes, imperial sand grouse, falcons, buzzards herd to this land throughout the bitter chilly winter months. Large characteristic zones strongly demonstrating each of the ecologies have been reserved as vast singular wildlife extents. Rajasthan proudly lays claim to two National Parks, over a dozen Sanctuaries and two Closed Areas. Most of these wide expanses are open to tourists and guests ceaselessly around the year but remain closed temporarily through the rainy season.

Kota is very rich in flora and fauna and Mukundara Hills Tiger Reserve is one of the prominent outcomes of the rich biodiversity notified by Govt. of India. The growing need of scientific studies with public awareness in Wildlife Science has triggered University of Kota to initiate the PG degree course as self-financing scheme at Kota (Rajasthan) in the year 2010.

The Wildlife program is a very rigorous program designed to provide the education and experience for being of wildlife professionals. The course is entirely taught by Guest faculty and Extension lectures of specialized experts are conducted to ensure the exposure of the students to the latest research and monitoring skills, techniques and software in their respective field. Students from all over India are undergoing the course. At present, department has students from Ladakh, Srinagar, Sikkim, Nepal, Nagaland, Orissa, West-Bengal, Bihar, Haryana, Karnataka,

Gujarat and parts of Rajasthan. This year there is one student from USA. The intricately structured course ensures the right amalgamation of theory and practical training. It instills in the young minds the spirit of scientific enquiry and acute sensitivity to environmental issues, Conservation and also serves as a model for developing higher education elsewhere in the country.

Objectives:

Wildlife Science focuses on the biology and management of wild animals, including their ecology and conservation. As a wildlife scientist one will study native and exotic birds, mammals, reptiles and amphibians in natural or created environments, their biodiversity and human-wildlife interactions. This major gives the ability to implement and evaluate wildlife management programs for captive and free-ranging wildlife. One will develop a strong scientific knowledge of wildlife anatomy and physiology, breeding, reproduction, nutrition, health, husbandry, ecology, welfare and behavior. With excellent wildlife trapping, identification and handling skills, one can make a major contribution to the wildlife, game and vertebrate pest management industries in the country. With their study they can provide healthy habitat to the animals in artificial environment.

Wildlife Science course enables to develop:

- in depth knowledge of wildlife conservation, and a critical understanding of concepts such as sustainability and sustainable development
- an understanding of the construction and analysis of data sets, and how they are used (and sometimes misused) for different purposes
- practical skills in mapping biodiversity and running spatial analysis to understand and illustrate conservation issues (GIS)
- an understanding of ecological networks and ecosystem services, and how they are identified, mapped and protected
- an understanding of environmental changes and the consequences
- approaches to habitat recreation
- understanding of socio-political and ethical dimensions of conservation problems
- Confidence in use of universally available resources and open-access software
- Transferable skills necessary for employment, including initiative, personal responsibility, leadership.

Course Structure

The M.Sc. course in wildlife science is a two year full time curriculum offered in the form of Choice-based Credit System organized in four semesters of 24 credits each. Each semester is structured into theory papers, field practicals and lab practical papers which will be evaluated during the semester. The first three semesters have three theory papers with five credit each and field and laboratory practical of 09 credits. Each theory paper is sub-divided into modules which will be administered by Module Coordinators. The assignment and practical exercises will also be administered separately by coordinators. In the third semester two of the three theory papers offered will be in the form of specialized papers in select thematic areas. The students need to choose one of the thematic areas offered. The number of students for a particular thematic area should not be less than three. Third semester will also have one specialized module on research design and for developing pre-proposal for dissertation. The fourth semester is a six month dissertation programme (four months field/lab work and two months for data analysis and writing).

There is an equal emphasis on providing theoretical understanding and developing practical skills. Classroom lectures, assignments, group discussions and extended field visits are therefore given equal importance. Each month will have about 20 working days, and each day will have three lecture hours in the forenoon.

An important activity during the course is critical review of published research. The students are expected to read and discuss original research papers as background to lectures and seminars. In order to inculcate the attitude and imbibe knowledge required to become a competent field biologist, critical review and seminar based discussions of research papers will form a major part of the course. In the assignments and presentations the student is expected to provide an overview, synthesis of work done in the past and critical evaluation based on the information that has been gathered.

Mode of teachingeach credit will be having 16 lectures, 3 lectures each day in forenoon hours. Sixty percent of the credit will be taught as regular class-room teaching and 40% will be interactive learning. The interactive learning will include seminars, group discussions, assignments, power-point and poster presentations etc. This is to ensure that the course is more interactive and discussion based and that the involvement of both students and teachers is equal.

Field Tours

In all there will be six field tours namely the Orientation tour, Techniques tour, National Park tour, Wetland field tour, Conservation Practice and Management tour. These tours are compulsory and part of the curriculum and will be conducted during the first three semesters. The students will be required to prepare tour journals and these will be evaluated during the respective semester.

Assignments and Seminars

Substantial time is made available for assignments and seminars, especially in afternoon hours, besides additional time during particular semester. These assignments will be based on the theory papers in the respective semesters. Each module within the semester will have at least one assignment. Seminars based on assignment topics will be organized during the respective semester and are compulsory.

Dissertation

Wildlife Science is essentially a field-based subject, and therefore due emphasis is given to this. The entire duration of the fourth semester is allotted for an independent field and or lab based dissertation project. As part of the preparations for the dissertation project students are required to submit a Pre-Proposal of 1000 words by the end of August of the third semester (Format of pre-proposal will be circulated at the start of the semester). The pre- proposals will be evaluated by a Dissertation Committee. Student Dissertation Committee will comprise three faculty members – one supervisor and two co-supervisors. Upon acceptance of their pre-proposal, a detailed proposal needs to be submitted in the first week of IVth Semester starting 15th December. The students will present and defend their final proposal in the third week of December and initiate work after that. The dissertation will be submitted in the prescribed format. Each dissertation will have two sections – one will be literature review of the subject and other in the form of research paper of actual field work, both of these must be written following the format of journal (Bioscience).

Attendance

Admitted students have to attend all the lectures, practical and field tours. A minimum of 75% attendance in each semester is required in order to be allowed to appear in the University examination.

Examinations

Evaluation of the theory papers will be both external and internal in the ratio of 70:30 respectively. The theory paper examination for 70 marks will be conducted by University of Kota at the end of each semester. The internal examination for 30 marks will be conducted by the respective paper coordinator. There will be two internal assessment tests each of 15% weight-age, for theory papers in each semester. Each internal assessment test shall be of one hour duration for each paper and shall be taken according to academic calendar notified by the University. For practical papers there will be only one external assessment (100% of maximum marks). There will be no internal examination in the practical paper. The fourth semester examination will be evaluation of the dissertation by external examiners including dissertation presentation and viva-voce including 24 credits.

Students are required to apply in the prescribed application form for appearing in the theory examination and need to pay the necessary examination fees on the date to be notified by the University. The candidate shall be declared as pass in a semester examination, if he/she secures at least 40% marks in each theory paper separately in external and internal examination and 50% marks in each practical paper at least 50% marks in project/dissertation with 50% aggregate marks in that semester. The semester wise distribution of the courses and papers are given below:

Semester-Wise Distribution of Marks
*** 70 Theory (University Exam) + 30 Theory (Internal Evaluation)**

Semester	Details	Marks
1	3 Papers (100 marks each*)	300
	Field practical	100
	Lab/Computer Practical	100
	Total Marks	**500**
2	3 Papers (100 marks each*)	300
	Field Practical	100
	Lab/Computer Practical	100
	Total Marks	**500**
3	3 Papers (100 marks each*)	300
	Field Practical	100
	Lab/Computer Practical	100
	Total Marks	**500**
4	Dissertation	400
	Presentation and Viva-Voce	100
	Total Marks	**500**
	GRAND TOTAL	**2000**

In order to qualify for the M.Sc. degree, a student should:

(a) Secure minimum 40% in each theory paper separately in external and internal examination and50% practical examinations, with 50% aggregate marks.

(b) Secure minimum 50% in his/her dissertation and viva-voce examinations.

Classification of successful candidates after last semester examination

Description of Marks Obtained	Division/Result
• 80% and above marks in a paper	Distinction in that paper
• A candidate who has secured aggregate 60% and above marks	First Division
• A candidate who has secured aggregate 50% and above but less than 60% marks	Second Division

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.40% (50% 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.

A total of nine theory papers (3 hours duration each) are prescribed in (3 in each semester). Field and Lab/Computer practical Examination (5 hrs. duration each) shall be conducted in each semester.

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.

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.

A candidate may be promoted to III semester if he/she secures at least 40% marks in at least seven out of ten papers (6 theory papers + 4 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 50%. Such candidate shall be required to appear in theory papers in which he/she has secured less than 40% 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.

A candidate may be promoted to second year if he/she has secured at least 40% marks in each theory paper but has failed to secure 50% 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 50% along with III and IV (Project) semester, whenever examination of these courses are held.

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.

Eligibility

B.Sc. in Forestry Science

OR

B.Sc. with Chemistry and any one of the following subjects:

Anthropology /Bio-Chemistry /Bio-Physics /Bio-Technology /Botany / Chemistry/Computer Science/Nursing/ Veterinary science /Genetics /Mathematics /Micro-Biology/Pharmacy/ Physics/ Statistics/Zoology/Botany or equivalents.

OR

MBBS / BDS / B.Tech or equivalents, from any University recognized by UGC with 50%marks. (SC/ST/OBC/SOBC is 40%)

Semester-I
(Tentative Syllabus 2015-16)

WLS –101: Biogeography, Ecology and Vegetation Science (05 Credits)

Min Pass Marks-25 Duration- 3 hrs MM - 70 marks

Unit - I

Module-1: Biogeography (01 Credit)

Classical biogeography concepts: Continental drift, dispersal, bio-geographical realms and provinces, ecology of dispersal and faunal exchange, barriers, concept of Island Biogeography, mode of dispersal, corridors their importance; threats and solution. Applied biogeography, biogeographical process, endemism, refugia. The differences between plant and animal geography. The origin of Indian fauna and flora and routes of faunal exchange and migration. Biogeographic classification of India.

Unit - II

Module 2: Introduction to Biological Diversity and Evolution (1 Credit)

Concept of Biodiversity, level of biodiversity: alpha, beta, gamma diversity, Keystone species, umbrella species, flagship species, indicator species, Indigenous and introduced / exotic species. History of evolutionary thought; natural selection and speciation; evolutionarily significant units. Species concepts; biological, phylogenetic, evolutionary and ecological species concepts. Macroevolution, co-evolution and mutualism.

Unit- III

Module 3: Fundamentals in Ecology (1 Credit)

Basic concepts and structure of ecosystems: abiotic and biotic components; climatic and edaphic regimes energy flow and nutrient cycles, the establishment of trophic equilibrium; trophic levels: autotrophs, heterotrophs, saprotrophs; food chains, food webs, biogeochemical cycles; nutrients and minerals; producers, consumers and decomposers. Ecological niche and succession, Eutrophication and biological magnification.

Pollution: Types, Global warming, green house effects, ozone layer depletion, acid rain, impact and control measures, environmental monitoring; concept of sustainable development, control and prevention of air, water and noise pollution.

Unit – IV

Module 4: General Plant Systematics and forest type (1 Credit)

Introduction to plant systematic. Basics of Bentham and Hooker's classification Plant succession: concepts and processes. Techniques of vegetation survey and quantification. Champion & Seth's classification of Indian Forest. Major Forest types of Rajasthan. Major natural habitats of Rajasthan – deserts, grasslands and forests.

Unit- V

Module 5: Forest Soils and Watershed Management (1 Credit)

Forests Soil: Classification, factors affecting soil formation; physical, chemical and biological properties. Causes for erosion; types–wind and water erosion; conservation and management of eroded soils/areas, wind breaks, shelter belts; sand dunes; reclamation of saline and alkaline soils, water logged and other waste lands. Role of micro-organisms in ameliorating soils; N and C cycles, VAM Concepts of watershed; role of mini-forests and forest trees in overall resource management, forest hydrology, watershed development in respect of torrent control, river channel stabilization, avalanche and landslide controls, rehabilitation of degraded areas.

WLS –102: Biology of Indian Wildlife and Bio-statistics (05 Credits)

Min Pass Marks-25 Duration- 3 hrs MM – 70 marks

Unit – I

Module 6: Mammalogy (1 Credit)

Mammalian characteristics and origin of mammals. Classification of mammal with detailed treatment of different orders represented in Indian sub-continent. Zoogeography of Indian mammals. Morphological and physiological adaptations in mammals. Hibernation, Torpor, Aestivation, locomotion and water regulation. Body size variation in mammals and its influence on life history, metabolic rate, weight constraints. Digestive system of herbivores and carnivores. Mammalian skin and its derivatives.

Unit – II

Module 7: Ornithology (1 Credit)

Avian classification and distribution with special reference to Indian birds morphological adaptations in bills and claws. Development of feathers, flight adaptations, plumage and moult, camouflage, mimicry, diurnal and nocturnal adaptations; Activities of birds: roosting, calls and songs; methods of analyzing and recording calls and songs.

Impact of migrants on resident species of birds. Economic importance of birds, Threats faced by the avian community, causes of decline of common birds and their control measures. Concept of IBA, SBA and EBAs.

Unit – III

Module 8: Herpetology, Batracology and Ichthyology (1 Credit)

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

Batracology: Taxonomy of amphibians, their role in nature, threats to their existence and conservation measures.

Ichthyology: Fresh, brackish and marine water fishes and their adaptation. Threatened fishes of India. Exotic fishes, Major and Minor carps.

Unit – IV

Module 9: Non-Chordates (1 Credit)

Major taxonomic groups, economic importance, social insects: Honey bee, Termites, Ants. Preliminary knowledge about Earthworms, Butterflies, Moths, Dragonflies, Scorpions, millipedes, etc. Role of non-chordates in nature, threats and conservation of non-chordates.

Unit – V

Module 10: Descriptive Bio-statistics (1 Credit)

Introduction to Bio-statistics and its application in wildlife studies. Definition of some statistical terms (Data, variable, sampling universe, sampling unit, sample size, accuracy and precision). Types of variables and scales of measurements (nominal, ordinal, interval / ration scales). Data summarization, frequency tables and curves. Data presentation, Histogram, bar diagram, pie charts, line diagram and scatter plot, skewness and kurtosis.

WLS -103: Remote Sensing and GIS (Credits 05)

Min Pass Marks-25 Duration- 3 hrs MM – 70 marks

Unit I

Module 11: Landscape Monitoring (1 Credit)

Fundamentals of Landscape ecology; Basics of Cartography, Principles of Remote Sensing, Sensors, Image interpretation and Digital Image Processing, Global Positioning System, Geographical information Systems: Data Entry and Preparation, Concept of Database and Metadata, Spatial Modelling and Data Visualization.

Unit II

Module 12: Basics of Remote Sensing (1 Credit)

Basics of remote sensing, active and passive remote sensing. Concept of electromagnetic spectrum (EMR). Interaction of EMR and earth's surface. Atmospheric windows. Types of platforms and scanning systems. Base and thematic maps, elements of a good map. Sources of thematic maps.

Unit III

Module 13: Application of Remote sensing (01 Credit)

Image Interpretation: Elements of image interpretation. Sensors and image characteristics of LANDSAT, SPOT, NOAA and IRS series of satellites. Spatial, spectral and temporal resolutions. Digital image processing techniques-FCC, filtering, base rationing, IHS and PCA images. Supervised and unsupervised classification.

Unit IV

Module 14: GIS Techniques (01 Credit)

GIS & GPS applications: Fundamentals of GIS. Functions of GIS, Data format, spatial & non-spatial data-vector and Raster data. Working principle, advantage, limitations and applications of GPS. Exposure to image processing and GIS software (Erdas Imagine and Arc Info). Concept of map projection, geo-coding and image registration.

Unit V

Module 15: Application of QGIS (01 Credit)

Introduction to QGIS; Basic structure and Interface; Opening / Viewing with Raster/ Vector Data, Layer Overlay / Project Saving, Open source GIS data and software availability. Geo-referencing Raster data (with GT sheets); Clip-merge operations on Raster Data; Creating point, line, polygon data in shape (shp) format; working with tables (Query / Field calculator); Local campus visit to collect GPS data by handheld GPS; Download / use GPS data, working with GPS

data, use of Google Earth as GIS tool; Vector analysis and processing; Raster terrain modeling, interpolation; Layer symbology; creation of GIS maps.

Practical (SEMESTER I)

WLS-104: Laboratory and Computer Practical-I (04 Credits)

Min Pass Marks-36 Duration- 5 hrs MM - 100 marks

Module 16: 04 Credits

1. Introduction of GPS, Map making
2. Linking GPS to map (topo-sheet) and vice-versa
3. Map reading and learning the procedure to procure SI maps
4. Study of French Institute's maps
5. Data Input - Digitization of Maps and Projection. Remote Sensing; Geo-rectification and Radiometric Correction. Image Classification Technique for Mapping of Earth Resources. Landscape Ecology - Logical and Quantitative Models for Species and Habitat. Map making.
6. QGIS (Open source GIS).
7. Epidermal derivative; Comparative studies of dentition and skull of different species.
8. Horn / Antler identification, study of pugmark and other indirect evidences of carnivores and herbivores.
9. Adaptation of skin, skull, feet, eggs and nests of characteristic species of birds.
10. Examination and drawing of museum materials and morpho-metric study of reptiles, amphibians and fish.
11. Two review papers by each student after going through minimum ten (10) research papers for each review paper on two different subjects and presentations.

WLS-105: Field Practical-I (05 Credits)

Pass Marks-36 Duration- 5 hrs MM - 100 marks

Module 17: Field practical (05 Credits)

1. Analysis of species diversity in field.
2. Analysis of vegetation types in a specific PA.
3. Analysis of habitat characteristics in a specific PA.
4. Quantification of vegetation sampling methods.
5. Estimation of species dominance, frequency and IVI using quadrate / plot methods.
6. Identification of poisonous and Non-poisonous snakes.
7. Bird watching and identification of resident and migratory birds (minimum 100 species) with their salient characteristics – a report (50% marks will be allotted to attendance of

the student in the field for bird watching and rest 50% for the report preparation and submission).

8. Seminar.

Field Tour

Orientation Tour	1 week
Techniques Tour-I	1 week

Semester II
(Tentative Syllabus 2015-2016)

WLS-206: Population Ecology and Advanced Bio-statistics (05 Credit)

Min Pass Marks-25 Duration- 3 hrs MM – 70 marks

Unit – I

Module 11: Habitat Ecology (1 Credit)

Habitat diversity: edge, ecotones, interspersion and juxtaposition. Physical and anthropogenic factors influencing terrestrial habitats. Habitat degradation and fragmentation. Animal sign as indicator of habitat use, use of map overlay approach in habitat evaluation. Monitoring changes in habitat parameters, use and availability of habitat resources.

Unit – II

Module 12: Fundamentals of Population Ecology (1 Credit)

Monitoring population and other demographic parameters, Predator-Prey Dynamics, Population Genetics, Estimation of Survival, Recruitment and other transition states using Mark-Recapture models, Modeling Occupancy. Bayesian models in Abundance Estimation (Spatial and Non Spatial).

Unit - III

Module 13: Human-Wildlife Conflict (1 Credit)

Park-people interface conflict and objectives of human dimensions in management; Eco-development-what, why, where, and whether; Community participation; Conservation-Development linkages; Livelihood analysis; Stakeholders in conservation; Conflict management; PA-People Mutual Influence Zone Analysis and village prioritization for pilot eco-development projects; Project planning, monitoring and evaluation.

Unit – IV

Module 14: Advanced Bio-statistics (1 Credit)

Introduction to statistical distributions. Normal distribution and its salient features. Parametric vs. non parametric statistical techniques. Introduction to hypothesis testing. Null and alternative hypothesis. Level of significance. Type I and Type II errors. One tailed and two tailed tests. Parametric and non parametric test of significance, Data transformation.

Unit - V

Module 15: Applied Bio-statistics (1 Credit)

Student t-test, Z-test, Mann-Whitney U test, Wilcoxon test for matched pairs. Analysis of variance, one way ANOVA, Kruskall Wallis one way ANOVA, Friedman two way ANOVA. Correlation and Regression. Spearman Rank Correlation Coefficient. Coefficient of determination. Significance of r, Chi-square test, Goodness of Fit Test.

WLS-207: Animal Behavior and Community Ecology (5 Credits)

Min Pass Marks-25 Duration- 3 hrs MM - 70 marks

Unit I

Module 23: Introduction to Animal Behavior (1 Credit)

Definition and importance of studying animal behavior. Physiological, Neural and hormonal mechanisms of behavior. Darwanian fitness and inclusive fitness concepts, fitness in natural environment and evolution of adaptive strategies. Movement and migration; types of migration, factors governing migration, advantages and disadvantages of migration, dispersal and orientation. Biological clock, avian navigation; flyover and pathways. Techniques in Animal Behavior Studies: sampling methods; random/haphazard sample, ad-libitum sampling, focal animal sampling, all occurrences, sequence sampling, one zero sampling, scan sampling.

Unit II

Module 24: Social Behavior in Animal Community (1 Credit)

Types of social organizations solitary, monogamy, harem forming, territorial male, multimale/multifemale theories. Benefit of living in social group, kinship Determinants of social behavior: Mating strategies and breeding biology, intolerance, group mobility, ecological factors, affection bonds, fecundity and longevity, gregariousness. Experience and learning behavior, Habituation, conditioned reflex, trial and error learning, latent learning, imprinting, limits to learning, learning and adaptation. Intelligence and communication by sight, smell, posture and vocalization.

Unit III

Module 25: Behavioral Ecology (1 Credit)

An interconnected approach understanding proximate and ultimate mechanisms, causal and functional explanations in animal behavior. Group living: costs, benefits and optimal group size. Selfishness and altruism. Competition for resources: ideal free distributions and resource defence. Sexual selection; parental care and mating systems. Cooperation and helping in mammals, birds and fishes. Behavioral patterns in captivity and animal welfare issues.

Unit IV

Module 26: Community Ecology (1 Credit)

Definition and nature of communities; scale and approaches. Community structure, organization and its stability (guilds, resource partitioning, niche, competitive exclusion).Factors governing species diversity. Concept and measurement of niche. Trophic interactions; top-down and bottom-up processes. Null models and their application in ecology. Energy and productivity, and its implication for species diversity.

Unit V

Module 27: Animal Physiology and Nutritional Ecology (1 Credit)

Feeding ecology of herbivores, carnivores, insectivores and omnivores – food selection, quantity, quality (nutritional value), seasonal variations, relations to food to animal condition. Predator-prey interactions. Importance of minerals to animal health, growth and reproduction. Ecology of seed dispersal and seed predation (depredation). Ecology of pollination by animals.

WLS-208: Wildlife Health and Wildlife Forensics (5 Credits)

Min Pass Marks-25 Duration- 3 hrs MM - 70 marks

Unit I

Module 28: Wildlife Health (1 Credit)

Introduction to disease and epizootiology, Determinants of disease and disease transmission, Disease and population dynamics. Importance of wildlife health studies in population management, evaluation of animal health and condition through direct observations of free living animals, physical examination of animals and collection of baseline data on health parameters. Quarantine and Quarantine Act.

Unit II

Module 29: Common disease in Indian Wildlife (1 Credit)

Review of major viral, bacterial, protozoan, fungal and parasitic diseases of Indian wild mammals, birds, amphibians and reptiles. Non-infectious diseases- nutritional diseases, poisoning, stress, shock, capture myopathy, physical trauma. Emerging and re-emerging diseases. Zoonoses. Assessment of condition, health and nutritional status in free-ranging populations. Disease control operations, Investigation of disease outbreaks including biological sampling and laboratory analysis, Planning and management of wildlife health programmes.

Unit III

Module 30: Capture & Handling of Wild Animals (1 Credit)

Capture and handling of animals - purpose, restraint techniques, different capture methods and animal barriers. Drug immobilization - drug delivery equipment and accessories. Immobilization drugs - action, dosage, response and side effects, safety measures, complications. Central Zoo Authority (CZA) protocol of Handling and transport of wild animals, designing sledge, crate and holding enclosures.

Unit IV

Module 31: Wildlife Health Management (1 Credit)

Wildlife-livestock interface and conservation. Biodiversity loss, climate change and its impact on wildlife health. Introduced/Invasive species issues and ecosystem health monitoring. Introduction to the problems of locally over-abundant wild animal population causing damage, control versus conservation, animal damage control techniques; biological, chemical and mechanical. Management of waterholes in wildlife disease control.

Unit V

Module 32: Wildlife Forensics (1 Credit)

Introduction to Bio-molecules-DNA, RNA and Proteins; Central Dogma of Molecular Biology Replication, Transcription and Translation; Molecular markers; PCR, DNA Sequencing. Wildlife Forensics- Overview, various forensic protocols for species identification with special emphasis on identification of species from different parts of reptiles, birds, mammals and plants. Wildlife forensics based on DNA analysis and morphometry; Principles of crime scene investigation and collection of physical and biological evidences (samples) from crime scene; Wildlife crime case studies. Key agencies contributing in wildlife crime enforcement.

Practical (SEMESTER II)

WLS-209: Laboratory and Computer Practical-II (04 Credits)

Min Pass Marks-36 Duration- 5 hrs MM - 100 marks

Module 33 (4 Credits)

1. Mark, Presence, Models in R Program
2. Understanding of probability distributions and population curves.
3. Lab practical will be organized for estimation of food quality with respect to nutritional significance in herbivores.
4. Major viral, bacterial, protozoan, fungal and parasitic diseases of Indian wild mammals, birds, amphibians and reptiles.
5. Use of different techniques in identification of different parts and products of flora and fauna reported in the wildlife trade.
6. Exercise on crime scene investigation using proper CZA protocols, collection of different evidences from a staged crime site.
7. DNA analysis and morphometry.
8. Two review papers writing after going through minimum 10 research papers on specific topics of animal behavior and community ecology and presentations of the review papers.

WLS-210: Field Practical-II (05 Credits)

Min Pass Marks-36 Duration- 5 hrs MM - 100 marks

Module 34: (05 Credits)

1. Comparison of several techniques for quantitative habitat survey and mapping. Evaluating habitat availability and utilization. Field visits for habitat evaluation, visit to wetland areas and demonstration of habitat quantification techniques.
2. Field data collection for estimating population abundance of mammals and birds using line transect and point counts respectively.
3. Methods of behavioral observation; Instantaneous scan, focal animal, all-occurrence and one-zero sampling, collection and analysis of behavioral data on few commonly seen species.
4. Social organization of mammals.
5. Preparation of Ethograms: time-activity budgets and social interaction matrices. Calculations of energy and productivity, demonstration of radio-telemetry methods to study activity patterns.
6. Demonstration of the use tags, collars, radio tracking equipment; biological sampling, preservation and transport of samples
7. Seminar based discussion and paper analysis and criticism.
8. Visit to any PA and record of all field observations (behavior and group structure) of selected species of mammals and birds.
9. Visit to local Zoo and record disease, health management practices of various animals.

Field Tour

Orientation Tour 1 week

Techniques Tour 1 week

Semester III
(Tentative Syllabus 2015-2016)

WLS-311: Applied Wildlife Science (5 credits)

Min Pass Marks-25 Duration- 3 hrs MM - 70 marks

UNIT-I

Module 35: Wildlife Management (1 Credit)

Management of special habitats; riparian zones, grasslands etc. Analysis of wildlife management problems in plantations and exploited forests. Management plan for Protected Areas: Forest working plans and wildlife management plans. 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.

Species reintroduction programs in the world. Important conservation projects undertaken in India: Project Tiger, Project Elephant, Rhino-reintroduction and Tiger-reintroduction Program.

UNIT-II

Module 36: Conservation Breeding and Wildlife Utilization (1 Credit)

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. Understanding biological requirements of species; design of facilities: food, hygiene, disease control, breeding. Propagation of threatened plants. Case studies on Conservation Breeding Programme of endangered wild animals.

Wildlife Utilization: Non-consumptive and consumptive utilization, their economic benefit. Game ranching and controlled off-take from wild population, rationale, management design, harvesting by management or hunting license in special cases. Wildlife based Tourism - objectives, planning and economics.

UNIT-III

Module 37: Environmental Impact Assessment (1 Credit)

Introduction to Environmental Impact Assessment (EIA) and other emerging decision support tools, scope and purpose of EIA. Salient features of important environmental legislation, statutory obligations, national environmental clearance procedures and factors affecting the

success of EIA as a decision support tool. Procedural steps in generic EIA and adaptations for promoting biodiversity inclusive impact assessment.

UNIT-IV

Module 38: Human dimensions in Wildlife Management (1 Credit)

Park-people interface conflict and objectives of human dimensions in management; Eco-development-what, why, where, and whether; Community participation; Conservation Development linkages; Livelihood analysis; Stakeholders in conservation; Conflict and management; PA-People Mutual Influence Zone Analysis and village prioritization for pilot eco-development projects; Project planning, monitoring and evaluation.

UNIT-V

Module 39: Silviculture (1 Credit)

General Silvicultural Principles: Ecological and physiological factors influencing vegetation, natural and artificial regeneration of forests; methods of propagation, locality factors; nursery techniques (layout, preparation of beds, seed sowing, tending, water budgeting, hardening, grading, etc), plantation techniques (planting in pits, direct seed sowing, cutting planting, etc).

Major Silvicultural systems (clear felling, coppice with standard system, selection system, etc). Management of silviculture systems in temperate, subtropical, humid tropical, dry tropical and coastal tropical forests with special reference to plantations, choice of species, establishment and management of standards, intensive mechanized methods, aerial seeding, thinning.

WLS-312: Conservation Practices (05 Credits)

Min Pass Marks-25 Duration- 3 hrs MM - 70 marks

Unit I

Module 40: Natural Resources: Water and Energy (01 Credit)

Introduction to natural resources; Clean and renewable energy mechanism, types of renewable energy sources; Advantages and methods of sustainable usage of renewable energy sources; Detail of applications and functioning of Solar energy, wind energy, atomic energy. Use of bio-gas and hydro-power to reduce dependency on conventional non-renewable energy demands. Traditional and innovative water harvesting practices. Case studies of successful implementation of renewable energy in rural India.

Unit II

Module 41: Natural Resources: Forest (01 Credit)

Forest as material and service provider: Environmentally sound forest harvesting practices; logging and extraction techniques and principles, transportation systems, storage and sale; Non-Timber Forest Products (NTFPs) - definition and scope; gums, resins, oleoresins, fibres, oil seeds nuts, rubber, canes, bamboos, medicinal plants, charcoal, lac and shellac, katha and Bidi leaves.

Present status of composite wood industry in India and future expansion plans. Pulp-paper and rayon; present position of supply of raw material to industry, wood substitution, utilization of plantation wood; problems and possibilities.

Unit III

Module 42: Various Dimensions of Ethnology & Restoration Ecology (01 Credit)

Ethno botany: medicinal value of plants, NTFPs and uses of non timber plants in protected areas. Traditional values of tribals and local people of protected area. Role of Ethno-botany in Indian Systems of Medicine; Ayurveda and Unani –Introduction, nomenclature, habitat, distribution and botanical features of medicinal and aromatic plants. Factors affecting action and toxicity of drug plants and their chemical constituents.

Introduction to Restoration Ecology. Setting goals for Ecological restorations. Analysis of landscapes from degraded to highly valued. Preventive measures and management of soil erosion. Regulatory requirements in ecological restorations. Monitoring and adaptive management in ecological restorations

Unit IV

Module 43: Forest Protection and Legislation (01 Credit)

Injuries to forest – abiotic and biotic, destructive agencies, insect-pests and disease, effects of air pollution on forests and forest die back. Susceptibility of forests to damage, nature of damage, cause, prevention, protective measures and benefits due to chemical and biological control. Role of afforestation and forest regeneration in absorption of CO_2, concept of carbon sequestration.

Indian Forest Policy, 1988 of People's involvement, Joint Forest Management, Involvement of women; Forestry policies and issues related to land use, timber and non-timber products, sustainable forest management; industrialization policies; institutional and structural changes. Forest laws, necessity; general principles, Indian Forest Act 1927; Forest Conservation Act, 1980; Wildlife Protection Act 1972 and their amendments; Application of Indian Penal Code to Forestry.

Unit V

Module 44: Wildlife Techniques (Wildlife conservation and Macro histological) (01 Credit)

Introduction Wildlife telemetry: Transmitters (Antenna, Power source) Transmitter attachments (General protocol, collars etc.), Radio tagging, Receivers, Relocating wildlife, Study Designing; Consideration, Sample Consideration, Habitat Utilization study review by species groups; Amphibians, Reptiles, Small mammals, Large Carnivores. Review of radio-telemetry studies in India.

Macro Histological: Introduction, hair types, classification of hair characteristics, Techniques to study hair structures. Protocols and setting up of infrastructure for identifying species from hair. Photomicrograph and description of hair characteristics of different classes of wild and domestic mammals. Review of studies on macro-histology in India.

WLS-313 Advance Social Science Research(05 Credits)

Min Pass Marks-25 Duration- 3 hrs MM - 70 marks

Unit I

Module 45: Introduction to Social Science (1 Credit)

Nature of Social Reality and different approaches: Positivism, Phenomenology, Ethno-methodology and symbolic Interactionism, Interpretative understanding.

Unit – II

Module 46: Methods of Social Science Research (1 Credit)

Logic of enquiry in Social Science Research, Inductive and Deductive, Theory-building, Objectivity/Value neutrality, Hypothesis.

Unit – III

Module 47: Application of Social Science Research (1 Credit)

Quantitative methods and Survey Research, Survey Techniques and its limitations, Operationalization and Research Design, Questionnaire Construction, Interview Schedule, Reliability and Validity.

Unit – IV

Module 48: Sampling Designs of Social Science Research (1 Credit)

Qualitative Research Techniques: Sampling Design, Participant Observation, Interview guide, Case Study Method, Content Analysis. Validity and Reliability in Qualitative research.

Unit –V

Module 49: Implementations of Social Science Research (1 Credit)

Review of case studies in Social Science Research in India. Review of Eco-development policies of different State Forest Department in India. Central policy of village relocation and rehabilitation.

WLS-314: Laboratory Practical-III (04 Credits)

Min Pass Marks-36 Duration- 5 hrs MM - 100 marks

Module 50: (04 Credits)

1. Study of different water harvesting practices in Rajasthan and other parts of India.
2. Two review paper writing after going through minimum ten research papers on specific topics of population estimation and Radio-telemetry and presentations.
3. 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).
4. Scat analysis and Identifying species from hair. Photomicrographs and descriptions of hair characteristics of different classes of wild and domestic mammals.
5. Role of NGOs in conservation programs.
6. Forest as material and service provider- utilization and uses.

WLS-315: Field Practical-III (05 Credits)

Min Pass Marks-36 Duration- 5 hrs MM - 100 marks

Module 51: (05 Credits)

1. Documentation of ethno-botanical practices in the peripheral villages of any PA in Rajasthan.
2. Study on tiger reintroduction program of Mukundara Tiger Reserve with reference to Sariska and Panna Tiger Reserves.
3. Review of latest ongoing projects in India.
4. Visit and report on five eco-development societies of any PA of Rajasthan.
5. Population Estimation data collection and use of software DISTANCE, MARK and PRESENCE.
6. Collection of pellet and scats for analysis of food-habits of ungulates and carnivores.
7. Socio-economic Questionnaire Survey in minimum five villages around any PA of Rajasthan.
8. Discussions: the role of zoos, aquariums and botanical gardens in conservation. Introduction/reintroduction and translocation.

Field Tours

Conservation Practices Tour	2 weeks
Management Practices Tour	1 week

FIELD EXERCISES

The following field courses and tours will be undertaken in association with the course unit programme prescribed above.

Semester-I

1. Orientation Tour 1 week

Orientation to field biology and natural history. Observations and collection of study material, wildlife sign and evidences.

2. Techniques Tour (Ecology, Study Techniques, Wildlife & Vegetation Studies). 1 week

Exercise on wildlife population parameters and census methods for various species. Vegetation study. Study on animal ecology.

Semester-II

3. National Park Tour 1 week

Visit a well known National Park (Corbett, Panna, Kanha, Sariska, Ranthambore, Bharatpur)

4. Specialized Techniques Tour -1 1 week

Visit important wetlands in the country, the appraisal of the habitat, waterfowl census, and documentation of threats to wetlands.

Semester-III

5. Conservation Practice and Management Tour 3 weeks

Field tour designed to examine wildlife conservation issues in a variety of ecological situations in a bio-geographic zone of India and designed to understand wildlife management practices, eco-development applications and field exercises in Protected Areas.

Total - 07 weeks

Semester IV

WLS-416: Field Research and Dissertation (24-Credits)

Project report/dissertation which will be based on field work on any topic related to wildlife biology/ ecology/ environment / habitat study etc.

1. Dissertation Internal (10-Credits) 200 marks
2. Dissertation External (10-Credits) 200 marks
3. Presentation and Viva-voce (04-Credits) 100 marks