

M.Sc. Wildlife Science

CHOICE BASED CREDIT SYSTEM (CBCS)
2020-21



Course outline & Syllabus

University of Kota, Kota M.B.S. Marg near Kabir circle, 324005



Rajasthan is a land of stupendous dimensions, which are colourful, 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 as well as from all over the world. So far tourism in Rajasthan has been attracting domestic and foreign tourists towards its National Parks 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 Vindhya 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 benefitting 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, gavialis, monitor lizard, wild boars, porcupine etc. 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.

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 fields. Students from all over India are undergoing the course. The students from all the states of India and one NRI student from California US have pursued the course.

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, and to evaluate wildlife management programs for captive and free-ranging wildlife.

Wildlife Science course enables to develop:

- ~ 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 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.
- ~ 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 softwares.
- ~ Transferable skills necessary for employment.



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 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 5 modules. The assignment and practical exercises will also be administered separately by coordinators. (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 and two practical hours.

An important activity during the course is critical review of published research. 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. Sixty percent of the credit will be taught as regular class-room teaching and 40% will be interactive learning, which will include seminars, group discussions, assignments, power-point and poster presentations etc.

Field Tours

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

Assignments and Seminars

Substantial time is made available for assignments and seminars, besides additional time during particular semester. These assignments and seminars will be based on the theory papers in the respective semesters.

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). 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.

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% weightage, 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 and internal 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

***University Exam Theory papers 70 marks +Internal Evaluation Theory papers 30marks**

Semester	Details	Marks
1	3 Papers (100 marks each*) Field practical Lab/Computer Practical	300 100 100
Total Marks		500
2	3 Papers (100 marks each*) Field Practical Lab/Computer Practical	300 100 100
Total Marks		500
3	3 Papers (100 marks each*) Field Practical Lab/Computer Practical	300 100 100
Total Marks		500
4	Dissertation 200+200=400marks Presentation and Viva-Voce	400 100
Total Marks		500
GRANDTOTAL		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 and 50% 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
<ul style="list-style-type: none"> ● 80% and above marks in a paper ● A candidate who has secured aggregate 60% and above but less than 80% marks

A candidate who has secured aggregate 50% and above but less than 60% marks

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.

(For SC/ST/OBC/SOBC is 40%)

Semester-I

(Tentative Syllabus 2020-21)

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

MinPassMarks-28

Duration-3hrs

MM - 70marks

Unit - I

Module-1: Biogeography (01 Credit)

Biogeography: Continental drift, bio-geographical realms (8 - Afrotropical, Antarctic, Australian, Indomalayan, Nearctic, Neotropical, Oceanian, Palearctic) and 14 Biomes,.Applied biogeography, biogeographical process, endemism, refugia.The differences between plant and animal geography.Biogeographic classification of India.

Dispersal- Ecology of dispersal, barriers, Dispersal of flora and fauna on oceanic islands, corridors and their importance; threats and solution.The origin of Indian fauna and flora and routes of faunal exchange and migration.

Unit - II

Module 2: Introduction to Biological Diversity and Evolution (01 Credit)

Types 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 Species concepts and speciation;; phylogenetic, evolutionary and ecological species concepts. Macroevolution, co-evolution and mutualism.evolutionarily significant units(ESU) subspecies or variety .

Unit- III

Module 3: Fundamentals in Ecology (01 Credit)

Basic concepts and structure of ecosystems: abiotic and biotic components; climatic and edaphic regimes, energy flow 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 biomagnification.

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

Unit – IV

Module 4: General Plant Systematics and forest type (01 Credit)

Introduction to plant systematics, Basics of Bentham and Hooker's classification, Plant succession primary and secondary. Hydrosere, xerosere, lithosere: concepts and processes. Techniques of vegetation survey and quantification (write the names of the techniques). Champion & Seth's classification of Indian Forest. Major Forest types of Rajasthan (Tropical thorn forest, Tropical Dry Deciduous Forest, Bamboo Forest. Central India Sub-tropical hill forests. Mixed miscellaneous forest.) Major natural habitats of Rajasthan – deserts, grasslands and forests.

Unit- V

Module 5: Forest Soils and Watershed Management (01 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 (improving) soils; (Function of vesicular arbuscular mycorrhiza fungus (VAM) in absorption of nutrients from soil) 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 (05 Credits)

Min Pass Marks-28

Duration-3hrs

MM – 70 marks

Unit – I

Module 6: Non-Chordates (01 Credit)

Major phyla of non chordates – protozoa to Echinodermata, Echinodermata, distinguishing characters; social organization and economic importance of – Honey bee, Termites, Ants and silkworm. Preliminary knowledge about Butterflies, Moths, Dragonflies, Scorpions, Spiders, pearl culture and vermiculture.

Unit – II

Module 7: Ichthyology (01 Credit)

Classification and evolution of major groups of fishes in India. Ichthyogeography and diversity of freshwater fishes. Ecology and adaptation of fishes in different ecosystems. Economic importance of sport fishes (Masheer, Trout and common carp). Difference between elasmobranchs osteichthyes, Skate, Rays; Threats and conservation perspectives of fish biodiversity. Threatened fishes. Methods to study ecology of fish habitat diversity, abundance, growth (write names of method).

Unit – III

Module 8: Batracology & Herpetology (01 Credit)

Batracology: Taxonomy of amphibians; characteristics, examples, their role in nature, threats to their existence and conservation measures. Difference between; frog, toad, newt, salamander siren, apoda.

Herpetology: Taxonomy of reptilian characteristics, examples; different between Lizard, gecko, Agama, Chameleon, Skink, Gila, Krait, Viper, turtle, tortoise, terrapins; crocodile gharial, alligator) Trampling, Zoo-phobia, Thermoregulation, Aestivation and Hibernation. Role of temperature in sex determination. Identification of venomous and non venomous snakes. Snake bites, types of Venom, Anti-venom, First Aid and Management of snake bite cases.

Unit – IV

Module 9: Ornithology (01 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, diurnal and nocturnal adaptations; Activities of birds: roosting, calls and songs; methods (write names of methods) of analyzing and recording calls and songs.

Difference between birds based on habit and habitat.

Bird Migration and navigation, Impact of migrants on resident species of birds. Threats faced by the avian community, causes of decline of common birds and their control measures. Concept of IBA (Important bird areas), SBA (Sovereign base areas) and EBAs (Endemic bird areas) and bird census techniques.

Unit – V

Module 10: Mammalogy (01 Credit)

Mammalian characteristics and origin of mammals. Classification of mammal still orders represented in Indian sub-continent. Zoogeography of Indian mammals. Morphological and physiological adaptations in mammals. Difference between Antelope, deer; puma, jaguar, cheetah, tiger, Leopard, lion: Otter, Beaver, Weasel, Skunk, Raccoon, Mongoose; Hedge hog, Echidna; Rabbit and Hare; Armadillo, Pangolin; Primates- Tarsiers, Lemurs, New World Monkey, Old World Monkey, Greater Apes; Manatee Dugong, Seals, Waalrus. Digestive system of herbivores and carnivores. Mammalian skin and its derivatives.

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

MinPassMarks-28

Duration-3hrs

MM – 70 marks

Unit I

Module 11: Landscape Ecology (01 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: Remote Sensing and GIS (01 Credit)

Basics of remote sensing, active and passive remote sensing. Concept of electromagnetic spectrum. Types of platforms and scanning systems. Fundamentals of GIS: Functions of GIS, Working principle, advantage, limitations and applications of GPS.

Unit III

Module 13: Descriptive Bio-statistics (01 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 / ratio scales). Data summarization, frequency tables and curves. Data presentation: Histogram, bar diagram, pie charts, line diagram and scatter plot, Skewness and Kurtosis.

Unit IV

Module 14: Advanced Bio-statistics (01 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 tests of significance. Data transformation.

Unit V

Module 15: Applied Bio-statistics (01 Credit)

Student t-test, Z-test, Mann-Whitney U test, Wilcoxon test for matched pairs. Analysis of variance, one way ANOVA, Kruskal 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.

Practical (SEMESTER I)

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

MinPassMarks-50

Duration-5hrs

MM - 100marks

Module 16: Laboratory and Computer Practical (04 Credits)

1. Data entry, data summarization, data management and Chart and graph making inExcel.
2. Introduction of GPS, Mapmaking.
3. Linking GPS to map (Topo-sheet) andvice-versa.
4. Map reading and learning the procedure to procure SImap.
5. Study of French institute'smap.
6. 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 & Habitat. Map making in QGIS and use of googleearth.
7. Epidermal derivative; Comparative studies of dentition and skull of differentspecies.
8. Horn / antler identification.
Study of pugmark and other indirect evidences of carnivores and herbivores.
9. Research Paper presentation of any topic from thesyllabus.

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

PassMarks-50

Duration-5hrs

MM - 100marks

Module 17: Field practical (05 Credits)

1. Analysis of species diversity infield.
2. Analysis of vegetation types in a specificPA.
3. Analysis of habitat characteristics in a specificPA.
4. Quantification of flora using vegetation sampling methods (Estimation of species dominance, frequency, density using quadrate / plotmethods).
5. Identification of poisonous and non-poisonoussnakes.
6. Bird watching and identification of resident and migratory birds (minimum 100 species) with their salient characteristics and use of different bird censustechniques.
7. Seminar onassignment.

Field Tour

Orientation Tour 1 week

Techniques Tour-I 1 week

Semester II (Tentative Syllabus 2020-21)

WLS-206: Habitat Ecology, Population Ecology and Conservation Biology (05 Credits)

MinPassMarks-28

Duration-3hrs

MM – 70 marks

Unit – I

Module 18: Habitat Ecology (01 Credit)

Introduction to Habitat Ecology - Historical, ecological & evolutionary perspectives of Habitat Ecology, basic concepts. Ecology of major habitats: terrestrial (Deserts, Grasslands, Forests), Wetlands. Habitat diversity: edge, ecotones, interspersed and juxtaposition. Physical and anthropogenic factors influencing terrestrial habitats. Habitat degradation, fragmentation and Successional changes.

Unit – II

Module 19 :Applied Habitat Ecology (01 credit)

Inventory, evaluation and monitoring of habitat (land species, water, estuarine water) Availability, quality, palatability of graze and browse. Inventory of unique habitats (name them) and their distribution, 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 - III

Module 20: Population Ecology (01 Credit)

Monitoring population and other demographic parameters: r & K selection, allometry, aging and sexing, life tables. Population dynamics: exponential, logistic and other forms of growth of population, density dependent and independent growth, population simulation, Predator-Prey Dynamics, Population Genetics, & carrying capacity.

Unit – IV

Module 21: Advanced Population Ecology (01 Credit)

Sampling designs for population estimation, population estimation methods: Distance based Sampling Methods, Mark-Recapture for Closed Population, Indices, Modelling Occupancy. Bayesian models in Abundance Estimation (Spatial and Non Spatial).

Unit - V

Module 22 :Conservation Biology (01 Credit)

Introduction to conservation biology, values of biodiversity and conservation ethics, losses and threats to biodiversity. Biological consequences of habitat fragmentation, covering barriers and isolation, crowding effect, local and regional extinctions, edge effects, changes in species composition and community; ecosystem level conservation. Control of invasive species. Significance of ecological restoration in conservation. Different types of protected areas National Parks, Wildlife Sanctuaries, Biosphere reserve.

WLS-207: Animal Behavior and Community Ecology (05 Credits)

MinPassMarks-28

Duration-3hrs

MM - 70marks

Unit I

Module 23: Introduction to Animal Behavior (01Credit)

Definition and importance of studying animal behavior. Patterns of behavior- aggression territory, communication, feeding, mating, parenting. Physiological, Neural and hormonal mechanisms of behavior. Darwinian fitness and inclusive fitness concepts. Types of migration, factors governing migration, clock, advantages and disadvantages of migration, flyover and pathways. Techniques in Animal Behavior studies: sampling methods; ad-libitum focal animal all occurrences, sequence, one zero & scan sampling.

Unit II

Module 24: Social Behavior in Animal Community (01 Credit)

Types of social organizations solitary, monogamy, harem forming, territorial male, multimale/multifemale. Benefit of living in social group, Sociobiology – types of fitness (reproductive success, fitness, Darwinian fitness, inclusive fitness, kin selection, Hamilton, rule) Mating strategies, ecological factors, affection bonds, fecundity, Experience and learning behavior,

Habituation, conditioned reflex, trial and error learning, latent learning and imprinting, Reasoning, Intelligence and tool use.

Unit III

Module 25: Behavioral Ecology (01 Credit)

Understanding proximate and ultimate mechanisms, Group living: costs, benefits and optimal group size. Selfishness and altruism. Competition for resources: Sexual selection; parental care . Cooperation and helping in mammals, birds and fishes. Advantage and disadvantage of keeping animals in captivity. Behavioral change in captivity. Introduction to PETA (People for the Ethical treatment of animal).

Unit IV

Module 26: Community Ecology (01 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 (01 Credit)

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

WLS-208: Wildlife Health and Wildlife Forensics (05 Credits)

MinPassMarks-28

Duration-3hrs

MM - 70marks

Unit I

Module 28: Wildlife Health (01 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 diseases in Indian Wildlife (01 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 (01 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 (01 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: Conservation, Genetics and Wildlife Forensics (01 Credit)

Introduction to Bio-molecules-DNA, RNA and Proteins; Central Dogma of Molecular Biology- Replication, Transcription and Translation; Mendelian Genetics- Mendel's Laws; Genetic Code- Characteristics and feature of genetic code; Genotyping; Allelic variation; Interpretation of genetic data; Application of genetics for wildlife conservation; Loss of genetic diversity, Resolving taxonomic uncertainties.

Wildlife Forensics- Overview, various forensic protocols for species identification, Molecular markers used in wildlife forensics; Wildlife forensics based on DNA analysis and morphometry; Wildlife crime case studies. Key agencies contributing in wildlife crime enforcement .

Practical (SEMESTER II)

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

MinPassMarks-50

Duration-5hrs

MM - 100marks

Module 33 (04 Credits)

1. Population Estimation data collection and use of software DISTANCE, MARK and PRESENCE and RProgram.
2. Understanding of probability distributions curves.
3. Demonstration of equipment used in capturing and handling of wild animals.
4. Major viral, bacterial, protozoan, fungal and parasitic diseases of Indian wild mammals, birds, amphibian and reptiles.
5. Pugmark Identification & characterization of common large mammals.
6. Use of different techniques in identification of different parts and products of flora and fauna reported in the wildlife trade.
7. Species identification through morphometry of hair and scat identification.
8. Presentation of any published research papers on subject relevant paper followed by discussion.
9. Record of treatment of an ill/ injured wild animal.

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

MinPassMarks-50

Duration-5hrs

MM - 100marks

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 using line transect, occupancy survey and point counts.
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 organisation of mammals: Observation and submission of report.
5. Preparation of Ethograms: time-activity budgets and social interaction matrices.
6. Knowledge of tags, collars, radio-tracking equipments.
7. Biological Sampling, preservation and transport of samples.
8. Presentation on any specific topic from habitat and population ecology.
9. Visit to local Zoo and record disease, health management practices of various animals.

10. An approach to rescue of wildanimals.

Field Tour

Orientation Tour 1 week

TechniquesTour 1 week

Semester III

(Tentative Syllabus 2020-21)

WLS-311: Applied Wildlife Science (05 credits)

MinPassMarks-28

Duration-3hrs

MM - 70marks

UNIT-I

Module 35: Wildlife Management (01 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.

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 (01 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 Programmes. 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 in India.

Wildlife Utilization: Non-consumptive and consumptive utilization, their economic benefits. 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 (01 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(01 Credit)

Park-people interface, conflict and objectives of human dimension in management; Ecodevelopment – What, why, and where; Community participation; conservation development linkage; livelihood analysis; Stakeholders in conservation; Conflict and management; PA-people mutual influence zone analysis and village prioritization for pilot ecodevelopment projects; Project planning, Monitoring and evaluation.

UNIT-V

Module 39: Silviculture (01 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)

MinPassMarks-28

Duration-3hrs

MM - 70marks

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 tendu 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 CO₂, 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 to Wildlife telemetry: Transmitters (Antenna, Power source) Transmitter attachments (General protocol, collars etc.), Radio tagging, Receivers, Relocating wildlife, Study Designing; Consideration, Sample Consideration, Study review of Habitat Utilization 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 Social Science in Conservation and Research Methodology (05 Credits)

MinPassMarks-28

Duration-3hrs

MM - 70marks

Unit I

Module 45: Introduction to Social Science (01 Credit)

Conservation and Sociology: role of social science in conservation Ecological Economics and its potential role in conservation, Conservation ethics as a Conservation Social Science. Central and state policy of village relocation and rehabilitation.

Unit – II

Module 46: Application of Social Science Research(01 Credit)

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

Unit – III

Module 47: Introduction to Research (01 Credit)

Research Definition ; Importance and Meaning of research , Characteristics of research, Types of Research, Steps in research; Identification, Selection and formulation of research problem , Research design, Research questions, Formulation of Hypothesis and Review of Literature.

Unit – IV

Module 48: Sampling Designs of Research (01 Credit)

Sampling techniques: Sampling theory, types of sampling , Steps in sampling, Sampling and Non sampling error , Sample size , Advantages and limitations of sampling. Collection of Data: Primary Data; Meaning , Data Collection methods. Secondary data ; Meaning, Relevance, limitations and cautions.

Unit –V

Module 49: Proposal and Report writing (01 Credit)

Styles and formats of writing proposals for ecological / wildlife conservation projects, Research Report : Types of reports , contents, styles of reporting, Steps in drafting reports, Editing the final draft , Evaluating the final draft. Citation, reference and bibliography.

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

MinPassMarks-50

Duration-5hrs

MM - 100marks

Module 50: (04 Credits)

1. Study of different water harvesting practices in Rajasthan and other parts of India.
2. Presentation of Research Paper representation on specific topics of population estimation and Radio-telemetry.
3. Review of forest working plan and maps. Study of nearby forest and grassland 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)

MinPassMarks-50

Duration-5hrs

MM - 100marks

Module 51: (05 Credits)

1. Documentation of ethno-botanical flora in any PA in Rajasthan.
2. Study on tiger reintroduction program of Mukundara Tiger Reserve with reference to Sariska/Panna Tiger Reserves.

3. Review of ongoing Wildlife projects in India.
4. Visit and report submission on eco-development society activity in Rajasthan.
5. Collection of pellet and scats for analysis of food-habits of ungulates and carnivores.
6. Socio-economic Questionnaire Survey in minimum five villages around any PA of Rajasthan.

Field Tours

Conservation Practices Tour	1 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 week & Vegetation Studies).

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 Rajasthan. Appraisal of the habitat, waterfowl census, and documentation of threats to wetlands.

Semester-III

5. Conservation Practice and Management Tour

1+1 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 - 06
weeks(2
weeks/semester)**

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.

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