MSc in WILDLIFE AND BIODIVERSITY CONSERVATION

(Effective from 2021-2022)

Semester Pattern Examination
Choice Based Credit System (CBCS)

MAHARAJA SRIRAM CHANDRA BHANJADEO
UNIVERSITY (ERSTWHILE NORTH ORISSA UNIVERSITY)
SRIRAM CHANDRA VIHAR, TAKATPUR
BARIPADA-757003

P. G. Department of Wildlife & Biodiversity Conservation

Maharaja Sriram Chandra Bhanjadeo University (Erstwhile North Orissa University), Takatpur, Baripada-757003

M.Sc. WLBC Course structure under CBCS

The entire PG syllabus of Wildlife & Biodiversity Conservation is spread over in four semesters consisting of 100 credits. The Department offers one open elective in Semester-II for the students other than department of Wildlife & Biodiversity Conservation of the University.

Semester	Course Code	Course Title	Credit	Examination hour	Mark		Total
					Mid Term	End Term	
I	WLBC 401	Wildlife, Taxonomy & Biogeography	5	3	20	80	100
	WLBC 403	Ecology	5	3	20	80	100
	WLBC 405	Biology of Wildlife –I & Biostatistics	5	3	20	80	100
	WLBC 407	Wildlife Forensics and Computer Basics	5	3	20	80	100
	WLBC 409	Field and Laboratory Practical and Field Tour Report	5			100	100
			25		**80**	**420**	**500**
II	WLBC 402	Maintenance and Mapping of Biodiversity	5	3	20	80	100
	WLBC 404	Biodiversity Conservation	5	3	20	80	100
	WLBC 406	Legal Aspects in Wildlife Management	5	3	20	80	100
	WLBC 408	Wildlife Conservation and Management	5	3	20	80	100
	WLBC 410	Field and Laboratory Practical and Field Tour Report	5	3		100	100
	WLBC 412	**Natural Resource Management**	5	3	20	80	100
			30		**100**	**500**	**600**
III	WLBC 501	Traditional Ecological Knowledge (TEK) and Resource Management	5	3	20	80	100
	WLBC 503	Animal Behavior	5	3	20	80	100
	WLBC 505	Biology of Wildlife-II	5	3	20	80	100
	WLBC 507	Techniques in field studies & Wildlife Monitoring	5	3	20	80	100

	WLBC 509	Field and Laboratory Practical and Field Tour Report	5			100	100
			25		**80**	**420**	**500**
IV	WLBC 502	Environmental Impact Assessment	5	3	20	80	100
	WLBC 504	Climate Change and Sustainable development	5	3	20	80	100
	WLBC 506	Field and Laboratory Practical	5			100	100
	WLBC 508	Dissertation Project	5			100	100
			20		**40**	**160**	**400**
	Grand Total		**100**				**2000**

Course Outcomes

The goal of the course is to teach a critical and conceptual knowledge of biodiversity and wildlife in the context of natural landscape exploration, ecosystem dynamics, ecosystem functioning, and ecosystem service provision. The course design also addresses the indiscriminate use of natural resources, particularly floral and faunal resources, as well as the diminishing of wild animal natural habitats. It is feasible to manage the depletion of valuable resources at this time by increasing the knowledge base of the students about the importance of diverse kinds of plant and animal populations, as well as the rules and regulations available to conserve them in their natural habitat. More specifically this course focuses on the fundamental principles, concepts and abilities associated with plant and animal conservation and management. Implementing habitat management strategies, identifying animal conflicts, and taking part in personal and community leadership development activities and planning are all part of this. Science and management views will be discussed in the context of historical, current, and future initiatives aimed at preserving biological diversity. The course work will also be guided by work on scientific papers and field experience.

Course Specific Outcomes

M. Sc. Degree in Wildlife and Biodiversity Conservation of this University has the following specific outcome:

1. Prepare students to have a good understanding of cellular and organism-level plant and animal structures, taxonomy and metabolic processes.
2. Equip students to identify plant vegetative and floral structures and be able to identify native and non-native herbaceous and woody plants.
3. Enhance understanding of students on the general principles of ecology as how it related to terrestrial and aquatic plant and animal conservation and management.
4. Enhance the ability of students to identify species, characteristics, habitat requirements and life cycles of birds, fish and mammalian wildlife species.
5. Impart field based training to students how it will be applicable to solve problems related to wildlife conservation and management.
6. Students will be equipped with knowledge on wildlife conservation and management relates to the economy and environment, both currently and in the future.
7. Students will be able to critically evaluate current events and public information related to wildlife conservation and management as being scientifically based or opinion based and contributes to the knowledge base of information.
8. Encourage the students to carry out the research works in frontier areas of Wildlife and Biodiversity Conservation.

Programme Outcome

The designed course covers papers on varied aspects like wildlife sciences, remote sensing and Geographic information system, ecology, animal behaviour, phylogeny, systematics, molecular biology, microbiology, wildlife biotechnology, biodiversity assessment studies. The paper covers topics related to both basic and applied fields of life sciences. Students can choose to proceed in the field of research and academia. The students after successfully graduating from this course can get an opportunity to work in environmental consultancy projects, molecular techniques oriented corporate sectors which are industrial interfaces of the subject. In government services the students can join in Indian forest services or state forest services. The MSc curriculum of Wildlife and Biodiversity Conservation provides a holistic approach of project comprising of molecular laboratory techniques, wildlife forensics and field based studies.

This programme is unique and is one of its kind offered by this university only in the entire state of Odisha.

SEMESTER - I
WLBC-401 (Credit: 05) WILDLIFE, TAXONOMY & BIOGEOGRAPHY

OBJECTIVE: To identify plants and animals, their morphology, characteristics and scientific names with international nomenclature. To understand the concept of Biogeography that will help in understanding the worldwide species distribution patterns.

CONTENT

UNIT 1

Definition and basic concepts of wildlife, Scope of wildlife, importance of wildlife, Values of wildlife: Positive values (recreational, aesthetic, educational, scientific, ecological, utilitarian, commercial, cultural and game value) and negative values (accidents, life stock and crop damage, disease reservoirs); measurement and attitude survey of wildlife values.

UNIT II

Stages and importance of taxonomy, Newer trends in Taxonomy (Morphological approach, Embryological approach, Ecological approach, Behavioural approach, Cytological approach, Biochemical approach & Molecular approach). Concept of Species, and their criticism, sub-species, Nomenclature and types, Basic idea about the International Code of Botanical (ICBN) & Zoological Nomenclature (ICZN).

UNIT III

Classification of bacteria, alga, fungi, plants (major classes), Zoological Classification, Kinds of Classification (Phenetic, Natural, Phylogenetic, Evolutionary, Omnispective), Future of classification, Components of classification, Classification of Protozoans, Invertebrates & Vertebrates.

UNIT IV

Biogeography:- Concept of biogeography, Zoogeographical Realms of the World (Palaearctic region, Neoarctic region, Ethiopian region, Oriental region, Australian region, and Neotropical region,). Biomes of the World, Natural history of major flora & fauna of India, Biogeographic classification of India, Differences between plant and animal geography, Major plant communities of the world; vegetation of India (Moist tropical, dry tropical forests, montane subtropical, montane temperate, alpine forests).

COURSE OUTCOME: On completion of this paper, students will able to know how to identify animals and plants and give them scientific names by applying and interpreting international nomenclatural rules and placing them in the proper order and family. In addition, this paper gives students a grasp of the ecological and historical underpinnings for comprehending species distribution and abundance, as well as changes in distribution and abundance across time. Students would be able to understand the fundamental principles of biogeography as a discipline, apply field methodologies and data analysis techniques used in biogeography, and critically understand human impacts on species distributions and modern conservation strategies.

References:

- Molecular Markers, Natural History & Evolution (Chapman & Hall, New York). By J. C. Avise.
- Principles of Animal Taxonomy (Oxford IBH Publ. Comp.). by G. G. Simpson.
- Theory and practices of Animal Taxonomy. By V.C.Kapoor. Oxford and IBH Publishing Co.
- Threatened animals of India (ZSI Publ., Calcutta). By B. K. Tikader.
- Elements of Taxonomy. By E. Myer
- The book of Indian animals (Oxford Univ. Press). By S. H. Prater
- Amphibians of India and Sri Lanka: Checklist & Bibliography (Odyssey Publ.) by S. K. Dutta.
- Biogeography of India (Junk Publ.). by M. S. Mani.
- Biogeography of reptiles of south Asia (Elsevier, USA). By I. Das.
- Essentials of Biogeography, by H.S.Mathur, Pointer Publ. Jaipur.
- Environmental Biology, PS Verma, VK Agarwal; SChand Publication.
- Fundamental of Ecology; SK Agarwal. Ashis Publication House, New Delhi.

SEMESTER-I
WLBC-403 (Credit: 05) ECOLOGY

OBJECTIVE: To identify the differences in the structure and function of different types of ecosystems. To Identify the structure and dynamics of population and their characteristics along with their adaptation to various habitats and their inter-relationships.

CONTENT

UNIT I

Definition, Principle, scope and history of ecology, Basic concepts and structure of ecosystem, Ecosystem Productivity, Types of productivity, methods of measurement of productivity, concept of trophic level, food chain, food web and ecological pyramids, Energy flow model. Niche concept, niche separation and its significance, Ecotone.

UNIT II

Population Ecology: Population characteristics, Age & sex distribution, structure and growth pattern, survivorship curve, life history strategies and environmental resistance. Interaction between populations; Types of interactions, predator-prey interactions, r & k selection, carrying capacity, Interspecific relations(Neutralism, Mutualism, Symbiosis , Commensalism, Antagonism, Parasitism, Predation, Competition)

UNIT III

Habitat ecology: Fresh water ecology (classification, types of communities, lentic, lotic), Marine ecology (Environmental conditions, types of communities);Estuarine ecology(Types of communities); Terrestrial ecology (Environmental conditions, types of communities); Desert ecology, Concept of plant animal communities, ecological succession

UNIT IV

Adaptations to temperature extremes (Hibernation, Aestivation, Thermal migrants), Effect of temperature on animal distribution (Gloger's rule, Jordan's rule, Allen's rule, Bergman's rule), Adaptations (cursorial, fussorial, arboreal, scansoreal, volant, cave, desert, aquatic). Plant adaptations to water, temperature, salinity & predation. Association between plant & animal for adaptation, super specialized animal species (ant eater)

COURSE OUTCOME: On completion of this paper, students will familiar with variety of ways that the living organisms interact with the physical environment and to develop an understanding of the differences in the structure and function of different types of ecosystems. In light of the current environmental situation, the paper also teaches students how to interpret and analyse data collected through surveys and data collecting in order to be more effective in scientific research and tackle environmental problems. **The paper's contents also provide students with the skills and knowledge they need to contribute effectively to their chosen career in the field of ecology and environmental conservation.**

References:

- Ecology and Environment: P.D. Sharma, Rastogi Publications.
- Ecology (Amerind). By Odum • Fundamentals of ecology (W. B. Saunders). by Odum
- Ecology (W. H. Freeman & Co., NewYork).by R. E. Ricklefs & G. Miller.
- Environmental Science (W. B. Saunders) by Turk & Turk
- Ecology, individuals, populations and communities (Blackwell Science Oxford). By M. Begon, J. L. Harper & C. R. Townsend.
- Ecological concepts (Blackwell Sci. Publ., Oxford). By J. M. Cherrett.
- Population biology (Van Nostrand Co., New York).
- Fundamentals of ecological modelling (Elsvier, New York).
- Statistical ecology (John Wiley & Sons, New York). By J. A. Ludwig & J. F.Reynolds.
- Evolutionary ecology (Harper & Row, New York). By E. R. Pianka.

SEMESTER-I
WLBC-405 (Credit: 05) BIOLOGY OF WILDLIFE – I & BIOSTATISTICS

OBJECTIVE: To familiarise with the biology of animals, as well as their management based on scientific principles. The biostatistics section of the course will sharpen the ideas regarding collection of scientific data, enumeration with standard errors with statistical tools.

CONTENT

UNIT I

Insects:- Introduction, Classification, External Morphology, Wings & flight, Thermal Relations, Social life in Insects(Behaviour, Evolution, Characteristics, Orders),Insect Control, Parasitism, Economic importance of Insects (Injurious, Productive & Helpful insects).

UNIT II

Fishes:- Classification, Ecology of Fish (Fresh water, Brackish, Marine water), Breeding, development and Parental care in Fishes. Indian fisheries (Kinds of fisheries, Principal capture fisheries of India), Fresh water pond culture, Integrated fish farming, Fish migration, Economic Importance. Adaptive radiation of Bony fishes, Food and feeding habits of fishes, Gastro somatic Index (GaSI), Fish diseases (Bacterial, Viral, Fungal, by Protozoan, by Worms, by Crustaceans, Environmental diseases and Nutritional diseases)

UNIT III

Amphibians and Reptiles:- Introduction, Classification, Reproductive modes in amphibia (Caecillians, Salamander, Frog)and reptiles (Crocodilians, Lizards, Turtles, Snakes), parental care in amphibian and reptile (nest or egg attendance, nest and egg guarding, egg brooding, egg, larval or hatchling transport, feeding of young, guarding or attending young's), Reproductive Ecology (ecology of nesting, seasonality in reproduction), Thermoregulation. Feeding ecology of amphibians and reptiles.

UNIT IV

Biostatistics: Definition and scope of biostatistics in wild life studies. Concept of population and sample. Census vs sampling techniques. Frequency distribution. Measures of central tendency (Mean, Median, Mode). Measures of dispersion: Range, Mean Deviation, Standard Deviation, Variance and Coefficient of variation. Graphical representation of data (Hstogram, line diagram, bar diagram, pie chart, Skewness and Kurtosis. Correlation, Regression, Chi-square test, t-test, F-test and analysis of variance.

COURSE OUTCOME: On successful completion of this paper, students will familiarise with the biology of animals, as well as their management and wise use based on scientific principles. In addition, the students will learn about statistical approaches for summarising and evaluating biological data. Students will be able to improve their abilities in data tabulation, treatment, analysis, interpretation, and graphical representation of data after completing the paper. Examine the implications of inferential statistics in biology and develop their skills in hypothesis testing and interpretation.

References:

- The book of Indian animals (Oxford Univ. Press). By S. H. Prater.
- Wildlife wealth of India ,by T.C.Majupuria. Tecpress Service.
- Biology of amphibians. By W. E. Duellman & L. Trueb.
- Biology of Reptilia (C. Gans ed., 15 vols.).
- An Introduction to Reptiles & Amphibia 2nd edition by HS Bhamrah & Kavita Juneja
- Birds Migration ,by T.Alerstan .Cambridge Univ.Press. Introduction to mathematics for life scientists, By - Batschelet, E. , Springer – Verlag, Berlin.
- Sampling design and statistical methods for environmental biologists, By - Green, R.H. John Wiley & Sons, New York.
- Biostastics, By - Mishra and Mishra.
- Biostatistics Analysis By- J.H. Zar; Prentice Hall.
- Statistics., By Gupta, Sultan and Chanal.

SEMESTER-I
WLBC-407 (Credit: 05) WILDLIFE FORENSICS AND COMPUTER BASICS

OBJECTIVE: To learn the current trends in wildlife poaching and illegal trading of wild animals and their parts, as well as the basics of DNA Sequencing, Morphometric, Co-dominant and dominant markers for identification of animals and fingerprinting techniques that can be utilised to address these concerns.

CONTENT

UNIT I

Introduction to Bio-molecules (Structure, type, properties and functions of DNA, RNA, Protein, Carbohydrate) DNA as a genetic material, Genetic code, denaturation of Nucleic acid and proteins, Concept of Central Dogma, Replication, Transcription and Translation in prokaryotes and Eukaryotes, RNA Splicing

UNIT II

Chromosome structure, Euchromatin, Heterochromatin, Nuclear organization of chromatin, Types of DNA damage and repair, Cytoskeleton system; role and structure of microtubules, microfilaments and intermediate filaments

UNIT III

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. Mechanism and application of PCR, DNA Sequencing, Morphometric, Codominent and dominant markers for identification of plants and animals, Principles of crime scene investigation and collection of physical and biological evidences (samples) from crime scene; Wildlife crime case studies.

UNIT IV

Introduction to compute hardware: History of development of computers, mainframe, mini-, micro- and super computer systems, Generation and classification of computers, Input/ output devices, CPU, Memory, Storage devices. Representation of data: Bits, Bytes, Characters, Number systems (Binary, Octal, Hexadecimal systems), ASCII and EBCDIC representations, Introduction to computer software: Application and system software, operating system, machine language, assembly language, high level language, assembler, interpreter, compilers, application of internet.

COURSE OUTCOME: On successful completion of this paper, students will have an understanding of the numerous type of wildlife crime evidence using various instrumental approaches as well as the usage of basic computer knowledge. They would have obtained a solid technical understanding of the use of various microscopes and photography required in this procedure to strengthen the evidence gathering and examination of wildlife crime. The students will obtain knowledge about electronic and molecular evidence in wildlife forensics but also about the legal principles that relate to cybercrime and electronic wildlife trade might aid in the battle against wildlife crime. ***Skill development in various forensic sciences needed for investigation on illegal animal hunting, poaching etc. Employability in Forest Services, wild life institutes & NGO Sectors***

References:

- Lehninger Principles of Biochemistry : David Nelson and Michael Cox
- The Cell: A Molecular Approach : Geoffrey M. Cooper
- Cell & Molecular Biology : E.D.P. De Robertis, E.M.F. De Robertis
- An Introduction to Genetic Engineering : Desmond S. T. Nicholl
- Forensic DNA Typing : John Butler
- Molecular Markers, Natural History, and Evolution : John Avise
- Cell and Molecular Biology: Concepts and Experiments : Gerald Karp
- MS-Office 2000, By-Mario Reid, Karl Schwartz, Diana Rain and Marni Ayers Brady, BPB Publication, New Delhi.

- Computer Fundamentala: P. K. Sinha and Preeti SinhaGerstman, B. Burt. *Basic biostatistics*. Jones & Bartlett Learning, LLC, 2014.

SEMESTER I

WLBC-409: PRACTICAL (Credit: 05)

(Laboratory practical: 70; Field report: 20; Collection: 10)

Laboratory and field practical: (70 marks)

1. Study and identification of museum specimen (Pisces, amphibians, reptiles)

2. Study of dry skeleton (dis-articulated bones of amphibians and reptiles).

3. Determination of linear changes in vegetation by using line and Belt transect methods.

4. Determination of frequency, density abundance, dominance, dominance Index, similarity index & diversity index by using quadrate frame.

5. Water analysis for dissolved oxygen and carbon-di-oxide.

6. Student's t-test for comparing the means of two samples

7. Analysis of variance for comparing means of three or more samples:

• For comparing separate treatments (One-way ANOVA)

• Calculating the Least Significant Difference between means

8. Chi-squared test for categories of data.

9. Correlation coefficient and regression analysis for line fitting:

• linear regression • logarithmic and sigmoid curves

10. Preparation of solutions for molecular biology experiments

11. Extraction of total genomic DNA from Plant sources

12. Removal of RNA from genomic DNA using RNAase treatment

13. Agarose gel electrophoresis of genomic DNA

14. Amplification of DNA by PCR

15. Separation of amplified product (amplicon) using Electrophoresis

16. Building phylogenetic Trees (using different software)

17. Isolation of plasmid DNA and detection by electrophoresis

18. Restriction digestion and gel electrophoresis of plasmid DNA

19. Systematic collection: (10 marks) Collection method, Insect collection & mounting; Preservation and Storage of Invertebrates, Vertebrates and inter-tidal animals and Plants; Curation & Storage of specimen, Collection and identification of bird feathers. Identification of amphibian /reptiles/ birds/ mammals in the locality and preparation of their checklists. Identification, Collection and Submission of amphibian /reptiles/ birds/ mammals in the locality and preparation of their checklists.

20. Field report based on Orientation tour (20 marks)

SEMESTER II

WLBC-402(Credit: 05) MAPPING AND MAINTENANCE OF BIODIVERSITY

OBJECTIVE: To learn about the various techniques used for mapping through GIS & Remote sensing tools. To obtain basic concepts and idea RDNA technology, conservation strategies and challenges for maintaining biodiversity.

CONTENT

UNIT I

Biodiversity mapping Introduction, magnitude of biodiversity, issues of scale, extreme of high and low diversity, gradients in biodiversity, biodiversity assessment and inventory, taxonomic diversity index, Growing Space Index (GSI), disturbance index, measurement of niche width and niche overlapping and Ramkrishnan Index of Stand Quality (RISQ).

UNIT II

Maintenance of biodiversity Introduction, objectives of the convention, responses to the convention, general measures for conservation and sustainable use, identification and monitoring of biodiversity rich areas, sustainable use of components of biological diversity, incentive measures, sustainable use and public participation, India's biodiversity and its conservation, International efforts for conserving biodiversity.

UNIT III

Recombinant DNA technology Restriction Endonucleases, Restriction mapping, Cloning vector, Method of gene cloning (gene construction & Recombinant DNA preparation, Screening of DNA library, transformation and selection), DNA probes, cDNA synthesis, Oligonucleotide synthesis, Methods of gene transfer (Agrobacterium mediated & direct gene transfer), selection of transgenic, selectable marker and reporter gene

UNIT IV

Sustainable Biodiversity Conservation Ecological issues linked to sustainable development in biodiversity rich areas, sustainable utilisation of biological resources, bio-prospecting, People biodiversity register (PBR), intellectual property rights - TRIPS, role of Indigenous Knowledge System (IKS), rights of farmers, breeders and indigenous people, territorial demarcation of traditional societies, genetic resource ownership, genetic engineering and genetically modified organisms (GMOs) and their applications, bio-piracy, the policy options available for enabling environmental diversity, and the needs, challenges and alternatives for the future.

COURSE OUTCOME: On successful completion of this paper, students will have a thorough knowledge of modern scientific methods, strategies, and instruments that are required for biodiversity assessment and monitoring to meet conservation goals. More specifically students will be able to choose appropriate methods for assessing biological resources using biodiversity indices in various ecosystems and formulate conservation strategies to address habitat loss and population reduction, such as tropical forest restoration, protected area management, and community conservation approaches.

Skill development in different tools and techniques required for biodiversity studies, mapping, conservation and its management. Employability scope in different Govt. and NGOs

References

- Biodiversity (Academic Press). By E. O. Wilson.
- The biology of biodiversity (Springer). By M. Kato.
- Wilson. E.O. Biodiversity (Academic Press).
- Kato, K. The biology of biodiversity (Springer).
- Wilson, E.O (1992). The Diversity of life. The Belknop Press of Havard Univ. Cambridge.
- Plant Botechnology : B. D. Singh
- Molecular Biotechnology : Glick
- Molecular Biotechnology : S. B. Primrose
- Odum E.P. (1971). Fundamentals of Ecology, Sounders.
- Dash,M.C. ()2001). Fundamental sof Ecology. Tata Mc Graw Hill.

- Magurraan ,A. (1983). Ecological diversity, University press Cambridge

SEMESTER II
WLBC-404 (Credit: 05) BIODIVERSITY CONSERVATION

OBJECTIVE: To evaluate how human settlement and resource-use patterns have led to habitat loss, Species fragmentation, species endangerment and ongoing threats to both terrestrial and aquatic biodiversity.

CONTENT

UNIT I:

Biodiversity fundamentals: Biodiversity concepts(Species diversity, Genetic diversity and Ecosystem biodiversity), , biodiversity hot spots, biodiversity of the Western Ghats of India, biodiversity of the Eastern Ghats of India, biodiversity of the Northeast, biodiversity of the Himalayan region, ethical and aesthetical values, methodology for valuation of biodiversity, uses of plants (food, fodder & foraging, timber, medicinal plants, ornamental plants, uses of animals.

UNIT II:

Biodiversity assessment and status: Sources of information, Fossil record, molecular evidences, Brief history of biodiversity (Principal features from the beginning to present day), Biological diversity and dominance, concept of ecological indices and relationship between diversity indices, dominance and system stability (Shannon diversity index, Simpson's index, Lincolin index); Application of diversity indices for biological monitoring.

UNIT III:

Biodiversity function and conservation: Strategies of biodiversity in ecosystem functional attributes; Understanding biodiversity complexity (Keystone species, Redundancy, Mutualism);Biodiversity and ecosystem function in traditional and modern agricultural system; Biodiversity and Biotechnology(Biotechnology and its role in assessment of biodiversity and bio-resources). DNA Fingerprinting: Applications of molecular markers (ISSR, DAMD, SSR) for biodiversity studies

UNIT IV:

Biodiversity management and threats: Introduction, Biodiversity legislation and convention, International Biodiversity laws, Convention on Biological diversity, Ramsar convention, Types of ex situ & in situ conservation, Role of protected areas, Trans-boundary issues, role of zoos, Biodiversity parks, gene banks, tissue culture, aquariums and botanic gardens, factors causing loss of diversity, habitat loss and fragmentation, introduction of alien and invasive species, disturbance and pollution, harvesting and over exploitation, demographic bottlenecks, threats to marine biodiversity.

COURSE OUTCOME: On successful completion of this paper, students will be able to know how geography and physical environment act as determinants of biodiversity and endemism in flora and fauna. Communicate principles and practices of biodiversity conservation with a particular focus on habitat fragmentation and management of threatened species and populations.

References:

- Biodiversity (Academic Press). By E. O. Wilson.
- The Diversity of Life(The College,W.W.Northem & Co) by E.O. Wilson.
- Elephants in Similipal: History,status, issues, techniques and biological notes on elephants, by S.S.Srivastava and L.A.K.Singh.
- Diversity by Maguran.; The biology of biodiversity (Springer). By M. Kato.
- Wilson, E.O (1992). The Diversity of life. The Belknop Press of Havard Univ. Cambridge.
- Odum E.P. (1971). Fundamentals of Ecology, Sounders.
- Magurraan ,A. (1983). Ecological diversity, University press Cambridge
- Magurraan ,A. (2003). Measuring Biological Diversity. Blackwell Publishing Co. London.
- Lduig, John A. and Reynolds, J.F. (1988). Statistical ecology, John Wiley & Sons
- Spellberg, J.F. (1991). Monitoring Ecological Change, Cambridge University Press, New York.

- An advanced text book on Biodiversity, KV Krishnamurty, Oxford and IBH publishing Co. Pvt. Ltd, New Delhi, 2004.

SEMESTER II

WLBC-406 (Credit: 05) LEGAL ASPECTS IN WILDLIFE MANAGEMENT

OBJECTIVE: To comprehend the intricacy of the national and international legal provisions, as well as identify the present organisations entrusted with enacting and implementing both national and international wildlife laws.

CONTENT

UNIT I

Conservation, preservation, protection, Extinct species, Extinct threshold, Causes of extinction/depletion (Hunting, destruction of habitat, cleanliness, migratory routes, exotic species, low fecundity, Industrial/environmental pollution, Economic considerations), Rare, Threatened and Endangered species, causes for endangering the species (Habitat disturbances, predator and pest control, Medical research, pollution).

UNIT II

Biological basis of Wildlife Management: Density (Absolute, subsistence, Optimum, security, Tolerance) ,Saturation point, Migration, Dispersion (Emigration, Immigration), Natality, Fertility and Fecundity, Gregariousness and Flocking, Shootable Surplus, Mortality and Decimating factors (Wildlife diseases, adverse climate, accidents, poisoning, human interference, Illegal hunting, stress, starvation, movement). Wildlife Tourism and its impact on wildlife.

UNIT III

International and National Organizations in Wildlife Conservation : Government Organizations- CITES, Global Tiger Forum (GTF); Non-Government Organizations – Worldwide Fund for Nature (WWF), Bombay Natural History Society (BNHS), Wildlife Preservation Society of India (WPSI), Indian Board for Wildlife (IBWL), International Union for Conservation of Nature and Natural Resources (IUCN), Conservation Breeding Specialist Group (CBSG), Species Survival Commission (SSC), Population and Habitat Viability Assessment (PHVA), Conservation Assessment and Management Plan (CAMP).

UNIT IV

Need of Wildlife Management / Conservation, Planning of Wildlife Management (Wildlife Census, Measurement of Productivity, Diagnosis of control measures, treatment); Problems in Wildlife Conservation and management, Management of National Parks and Sanctuaries, Management measures (Wildlife habitats, Protection, Biotic interference, Forestry operation, use of fire, effects of Silvicultural practices on the status of Wildlife),National Park-Future plan and strategy.

COURSE OUTCOME: On successful completion of this paper, students will be able to develop critical thinking skills that will enable them to recognise the cultural, legal and ethical factors that complicate solutions to current conservation difficulties. Thus, students will be able to analyze the property and constitutional foundations of state wildlife laws, structures of state wildlife regulation and rights to control the wildlife resources. **Employability and skill development contents after course completion in NGOs and Govt. forest department.**

References:

- IUCN Red List of Threatened animals (compiled by World Conservation Monitoring Centre).
- Wildlife Protection Act 1972. Natraj Publ.Co. Dehradun.
- Convention on Biological Diversity. UNDP.
- Textbook of Wildlife Management , S.K.Singh, International Book Distributing Co. Lucknow.

SEMESTER II

WLBC-408 (Credit: 05) WILDLIFE CONSERVATION & MANAGEMENT

OBJECTIVE: To gain a solid understanding on the techniques and methods for conducting conservation research, in the field of ecology, population genetics and remote sensing

CONTENT

UNIT I

Ecological basis of wildlife management, concept of carrying capacity, home range and territory, Management of rangelands (Types of rangeland, Characteristics, Rangeland carrying capacity, Forests and wildlife corridors, rangeland conditions). Conservation Schemes: Project Tiger (Initiation, Finance, Objective, Management, Status, Threats), Gir Lion Sanctuary Project (Threats, Management, Work plan and achievements), Crocodile Breeding Project (Causes of depletion, Work Plan, achievement), Project Elephant, Conservation of Sea Turtle in India.

UNIT II

Introduction to Remote Sensing, Electromagnetic Spectrum, Radiation Laws (Plank's Law, Stefan Boltzman Law, Wien's Dispacement Law), Image Interpretation elements and Interpretation elements, Remote Sensing Observation Platforms, Types of Remote Sensors. Fundamental of Geographical Information System, Components of GIS

UNIT III

Population genetics and conservation Mendelian Genetics - Mendel's Laws; Application of genetics for wildlife conservation; Genotyping; characterizing genetic difference between populations, importance of genetic diversity, Loss of genetic diversity, Resolving taxonomic uncertainties; Mutations, Foundational population genetic concepts, population genetic information needed to manage threatened species, Genetic drift, Gene flow and the structuring of populations, Interpretation of genetic data; Phylogenetic concepts and processes, Quantitative genetics and complex traits, Mitochondrial DNA analysis; Microsatellite markers

UNIT IV

Environmental Impact Assessment (EIA): Aim, Types, Organizations Responsible, Contents, Prediction of changes and impacts (on air, water, soil, noise, biological, cultural and socio-economic environment), Factors. EIA in India, Components of EIA (Purpose, Screening and IEE, Scoping, Preparation of Terms of reference, EIA report, Assessment of methodologies, Review, Impact, Evaluation, Overall assessment).

COURSE OUTCOME: On successful completion of this paper, students will be able to analyse and appraise wildlife threats and will have a basic understanding of wildlife in India, which can be used to pursue a career in a wildlife conservation group or further research and the complexity that arises when multiple stakeholders are considered, and the application of the scientific method in formulating an evidence-based management approach to contentious wildlife conservation issues, as well as how the scientific method can be leveraged to build a compelling conservation management plan.

Skill development in remote sensing, wild life conservation and management skills. Employability in Forest Services, wild life institutes & NGO Sectors

References:

- Introduction to Wildlife Management, by P.R.Krausman, Prentice Hall Pearson Educ. Inc. New Jersey. • Genetics: A Conceptual Approach by Benjamin A. Pierce
- Wildlife Management ,by R.H.Giles Jr.The wildlife scri.
- Wildlife Ecology and Management, by W.L.Robinson & E.G.Bolen. Mc.Millan Publ. Comp. New York.
- Managing Protected Areas in Tropics, by J.K.Mackinnon, Natraj Publ. Dehradun.
- Environmental Impact Assessment and Management ,Ed. B.B.Hosetti and A.Kumar, Daya Publishing House, Delhi.
- Introduction to Remote Sensing: - J. B. Cambell – Rawat Publication.
- Remote Sensing – Principle and application – Sabiens, E.P- W.N. Freeman and co, New York.

- Principle of remote sensing – Cunner P.J. – Long man Scientific and Technical.
- Geographical Information System, Theory and Practices: - Rao & Shrieff – Rawat Publication.

Semester II
WLBC-410: PRACTICAL (Credit:05)
(Laboratory and Field practical: 60; Tour report: 20, Seminar-20)

Laboratory and field practical: (60 marks)

1. Description of community structure by using the quadrates.

2. Estimation of total biomass and herbage yield by harvest method.

3. Description of zonation in a pond and stratification in a forest

4. Experiments related to soil

i. Garden soil experiment to make texture.
ii. Capillary water.
iii. Field capacity.
iv. Witing coefficient.
v. PH of the soil.
vi. Chemistry of the soil (NO_3 ,PO_4 & SO_4)

5. Identification and inventory of important crop plants and economic plants.

6. Preparation of peoples Biodiversity Register

7. Extraction and purification of total genomic DNA from plant leaf samples or Animal tissue/Blood

8. Agarose gel electrophoresis of genomic DNA extracted from plants or/ humans

9. Amplification of extracted DNA using microsatellite markers

10. Separation of amplified product (amplicon) using agarose gel Electrophoresis

11. Elucidation of human / plant diversity indexes and prepation of phylogenetic tree

12. Faecal sample collection and analysis. (i) Collection of Fecal Samples [Faecal sample of Rabbit, Tiger, Mouse deer, Sambar, Barking deer, Porcupine, Spotted deer, Mugger and Leopard], (ii) Storage and Shipment of Fecal Samples (iii) Maintaining test components (iv) Performing the microscopic exam

13. Bioacoustics (call analysis).

14. Field report based on Technique tour (20 marks) Field reports based on Technique tour (related to forest ecosystem, invertebrates, nature, wildlife, photography, bird watching): Wildlife products used by local community; report on utilization of minor forest produces; field ornithology; Analysis of inter-relationship among plants and animals (parasitism, mutualism, commensals, symbiosis); Census Techniques for wild animals.

15. Seminar Presentation :(20 Marks) On any topic related to Wildlife, Environment, etc.

Semester II
OE-WLBC-412 Natural Resource Management (Credit: 05)

OBJECTIVE: To learn about the basic concept on natural resources, renewable and nonrenewable resources. To gain basic knowledge on the problems associated with pollution and their effective remediation.

CONTENT

UNIT I

Natural resources: Introduction, Natural resources, Biota-Microbes, plants and animals and Abiota-Air (Oxygen, Carbon dioxide and other useful gases), Water (Seas, oceans, freshwater, sources, ponds and rivers), Soil (Rocks, ores and minerals).

UNIT II

Energy: Introduction, growing energy needs, use of energy, sources of energy: Coal, Petroleum and Natural gases, Nuclear energy, hydroelectric energy, solar energy, Wind energy, Biomass, Geothermal energy, Tidal power.

UNIT III

Growing energy demands and problems associated with over exploitation of natural resources; Pollutants, Pollution-Air, Water, Soil, Noise, Waste generation, Solid, liquid, gases, e-waste.

UNIT IV

Concepts of Ecological footprints, Sustainability and Sustainable Development, sustainable use of resources, UNESCO goals Environmental Management and Planning.

COURSE OUTCOMES: On completion of this paper, students will be able to understand ecological principles underpinning the management of resources, populations, communities, and ecosystems. They will also be familiar with the use of data collection and analysis tools such as field methods, GIS modelling and statistics to develop resource management plans, as well as learn about biological, chemical, physical, and social science principles to apply them in environmental resource management issues. **After course completion students can get employed in various NGOs and Govt. affiliated bodies.**

References:

- Conroy, Michael J., and James T. Peterson. *Decision making in natural resource management: a structured, adaptive approach*. John Wiley & Sons, 2013.
- Kaplan, Daniel Moshe, and Christopher Gerard White. *Integrating landscape ecology into natural resource management*. No. 1. Cambridge University Press, 2002
- Anderson, David A. *Environmental economics and natural resource management*. Routledge, 2010.
- Rydin, Yvonne. *Networks and institutions in natural resource management*. Edward Elgar Publishing, 2006.
- Van Dyne, George, ed. *The ecosystem concept in natural resource management*. Elsevier, 2012.

SEMESTER III

WLBC-501 (Credit:05) TRADITIONAL ECOLOGICAL KNOWLEDGE (TEK) AND RESOURCE MANAGEMENT

OBJECTIVE: To understand and gain knowledge on traditional ecology, what are the importance of traditional ecological knowledge and biodiversity conservation**.**

CONTENT

UNIT I

Introduction to TEK and community based TEK: Basic concept (What is TEK, Benefits) accruing from TEK, Historical context, difference between LEK &TEK, Traditional manipulation, Ecological and social implication of TEK,Factors affecting the acquisition of TEK.

UNIT II

TEK & Sustainable Development: Introduction, population dynamics and sustainable development, Application of TEK in ecosystem rehabilitation/management, Integrative Vs Sectoral perspectives of sustainable development , Indigenous knowledge , religious and land use practices, Traditional knowledge for economic sustainability.

UNIT III

Strategies for Commercialization of Biodiversity: Economic stake in biodiversity conservation commercial possibilities of crop plants, medicinal plants underutilized crops, value chain approach and marketing case studies

UNIT IV

Biodiversity and TEK : Introduction, TEK in Biodiversity conservation planning role of TEK in Biodiversity conservation, Integration of TEK &EBK in biodiversity conservation planning, evolutionary biology knowledge (EBK) at the population level ,community value and practices relating to proper use of resources, Socio-cultural relation of ethnic communities conservation techniques of biodiversity by ethnic people, Health case medicine and nutrition.

COURSE OUTCOME: Upon successful completion of this paper, students should be able to differentiate the nature, sources, and characteristics of traditional ecological knowledge. They identify and describe specified plants and animals and the ecological relationship among them from an indigenous perspective to interpret key differences between scientific and indigenous styles of knowing about the environment.

References:

- SK Jain (1981). Glimpses of Indian Ethnobotany, New Delhi.
- B. Mukeru (1953). The Indian Pharmaceutical Codex, New Delhi.
- JR Harlan (1992). Crops and Man (2nd Edition). American Society of Agronomy. Inc. Madison, Wisconsim, USA.
- AK Srivastava(2004). Nature Conservation. APH Publishing Corporation, New Delhi
- OH Frankel and ES Michaele (1987). Conservation and Evolution Cambridge Univ. Press.
- AK Ghosh (2012). Indigenous knowledge on Ethnobotany. Daya Publishing House, New Delhi.Wathern, Peter, ed. *Environmental impact assessment*.

SEMESTER III
WLBC-503 (Credit: 05) ANIMAL BEHAVIOR

OBJECTIVE: To understand the basic concept of animal behaviour, their relationship during reproductive phase and parental care. Gain idea regarding genome, gene mapping and the behaviour between Inter and Intra-species population.

CONTENT

UNIT I

Ethology, Concept of ethology, pattern of behavior: Innate behavior (tropism, taxes, reflexes, instincts); learned behavior (learning and reasoning) , fixed action pattern, stimulus filtering.

UNIT II

Communication in animals and their methods, Communication signal, adaptive signal, olfactory communication, acoustics communication, tactile communication, Adaptiveness of Communication, Communication in Caecillians, Salamanders, Frogs, Turtles, Crocodilians, Lizards, Snakes.

UNIT III

Social behavior (Different levels, advantages), Family and group behavior, Dominance behavior, Territorial behavior, Aggressive behavior, Reproductive behavior. Neural control of behavior, Hormonal control of behavior.

UNIT IV

Unit-IV Concept of Gene, Genome, Genome map, Genetics and behavior, genes and behavior, genetic differences, behavior differences and IQ difference, brooding behavior (Time, place, forms of nest, nest hiding, brooding in birds) biological clocks (Circadian rhythm, Lunar periodicities, Seasonal periodicities, Effect of photoperiod on animals), learning and memory.

COURSE OUTCOME: By the completion of this paper, students will be expected to gain a comprehensive understanding of the behaviour of animals. They will comprehend the proximate controls of behaviour such as the role of hormones, the animal's genotype and the animal's environment in the development of behaviour. Additionally, students will have a thorough understanding of the adaptive value of behaviour, with an emphasis on animal communication, social behaviour, territoriality, sexual selection and mating systems.

References:

- An introduction to behavioral ecology. By J.R.Krebs & N.B.Davis. Blackwell, Oxford, UK
- Animal Behavior-An evolutionary approach By J. Alcock.(Sinauer Assoc.)
- Principles of Animal communication. By J. W. Bradbury & S. L. Vehrencamp.
- Ethology. The Biology of Behavior (Holt, Riehart & Winston, New York). By Eibl- Eibesfeldt.
- Biology of Animal Behavior. (Mosby College), by Grier.
- Introduction to Ethology (Plenum Press). By Immelmann.
- The Foundation of Ethology (Springer-Verlag). By Lorenz.
- An Introduction to Animal Behavior (Addison-Wesley). By Manning.
- Animal Behavior: Psychology, Ethology & Evolution.(Pitman).by Mc. Farland.
- Animal Behavior in Laboratory & Field (Freeman). By Price & Stoker.
- Elements of Ethology (Chapman & Hall). By Wood-Gush.
- Animal Behavior, by Reena Mathur. Rastogi Publ. Co.
- An Introduction to Animal Behavior, by S.N.Prasad & V.Kashyap. Kitab Mahal, Allahabad.
- Social Behavior of Mammals, by T.Poole. Blackie & Sons Ltd. Britain

SEMESTER III

WLBC-505(Credit : 05) BIOLOGY OF WILDLIFE –II

OBJECTIVE: To gain systematic understanding of the biological principles supporting wild animal conservation and management, as well as the epidemiology, diagnosis, and control of wildlife disease, in order to comprehend the function of food in preventing health problems in wild animals

CONTENT

UNIT I

Birds and Mammals: Introduction, Classification of birds and mammals, Origin & Ancestry of birds and mammals; Adaptive radiation, Adaptive convergence and Adaptations (Aquatic & Flying) of mammals, Dentition in mammals; Types of beak, feet & Claws of birds, Modes & Mechanism of Flight, Flight Adaptations in birds, bird migration, Major Bird Sanctuaries of India.

UNIT II

Threatened mammals of Orissa, Economic importance, Mammalian migration. Characteristics of Carnivora and special attributes of Felids, Cats of India and their conservation, Trade in Pelts, Cat Conservation strategy and action plan.

UNIT III

Animal Nutrition: Composition of food (Carbohydrates, Proteins, Lipids, Vitamins, Minerals); Factors affecting digestibility; Feeding strategy of animals.

UNIT IV

Wildlife Health / Common disease in Indian Wildlife 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 reemerging 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. Molecular techniques in diagnosing of infectious diseases in wildlife.

COURSE OUTCOME: On successful completion of this course, students will be able to analyse chemical composition of food materials of wild animals and also to determine their nutritional needs in different physiological phases. In these context students will have specialised skills to identify and explain the determinants of health and causes of disease in wildlife populations, and how these are detected, described and measured. Further they will have gained knowledge to apply the principles of wildlife health management to make recommendations for disease outbreak and conservation interventions.

References:

- The book of Indian animals (Oxford Univ. Press). By S. H. Prater.
- Wildlife wealth of India ,by T.C.Majupuria. Tecpress Service .
- The fauna of India, Mammalia, vol. 3, Rodentia (Two parts) (Manager of Publications, New Delhi). by J. R. Ellerman.
- An Introduction to Birds 2nd revised ed. by HS Bhamrah & Kavita Juneja
- An Introduction to Mammals 2nd edition by HS Bhamrah & Kavita Juneja
- Pocket guide to the birds of Indian subcontinent (Oxford Univ. Press). By R.Grimmett, C. Inskipp & T. Inskipp.
- Birds of the Indian subcontinent (Christopher Helm, London). by Grimmett, C.Inskipp & T. Inskipp.
- The book of Indian birds, by S.Ali. Bomb. Nat. History Society.
- Handbook of birds of India and Pakistan (10 vols) by S.Ali & S.D. Ripley.
- Pictorial guide to the birds of Indian subcontinent. by S. Ali & S. D. Ripley. Bombay Natural History Society, Mumbai.
- Checklist of the birds of Orissa. By U. N. Dev.
- Wildlife in India, by V.B.Saharia. Natraj Publ.,Dehradun.

SEMESTER III

WLBC-507- (Credit: 05) TECHNIQUES IN FIELD STUDIES & WILDLIFE MONITORING

OBJECTIVE: To gain basic concept and principles of techniques used in wildlife such as DNA fingerprinting, PCR, gel electrophoresis, identification and quantification of proteins, wildlife of veterinary and their applications.

CONTENT

UNIT I

Molecular Techniques – Genomics Extraction of DNA from plant and animal samples, DNA amplification by PCR: Inverse, reverse transcription PCR, RAPD, RFLP & AFLP PCR, DNA Fingerprinting, Southern Blotting and its applications, Agarose gel electrophoresis, Orthogonal field alteration gel electrophoresis(OFAGE), Pulse field gel electrophoresis(PFGE)

UNIT II

Molecular Techniques – Proteomics Extraction & Evaluation of Proteins, Protein Fingerprinting (e.g. Venom proteins, Plant proteins) Western Blotting and its applications, Protein characterization (PAGE, Mass spectrometry, X-Ray crystallography)

UNIT III

Study of Evidences (Signs and Symptoms), Locomotory patterns in tetrapods, Types of movement (Ambulatory, Pendulous), Stride, Straddle, Measuring & monitoring biological diversity, mark-release-recapture technique, Bird Ringing. Methods of wildlife census with reference to birds, crocodiles, tigers, lion, elephant; Use of Transmitters, Radio tracking, Radio telemetry.

UNIT IV

Wildlife veterinary, Chemical restraints:- Purpose, advantages, disadvantages, Drugs (Classes, Properties and action, Pharmacological and biological considerations, Estimation of drug dosage and examples), Drug delivery (Oral, Hand-held syringes, Dart). Chemical restraints for Large and small herbivores and Wild Carnivores, Post capture medical care and treatment, Procurement of immobilization equipment and drugs.

COURSE OUTCOME: On successful completion of the paper, students will have the knowledge and skills to carries out inventories, demographic censuses, reproductive studies and monitoring of various floral and faunal groups. Specifically, they will be able to relate the use of sampling techniques to the problems of biodiversity conservation and wildlife management. Furthermore, the student's knowledge base will be useful in formulating a testable hypothesis and designing experiments to effectively test it, all based on a thorough understanding of the research literature, as well as interpreting data against original hypotheses and suggesting future research avenues.

***Skill enhancement on molecular techniques and tools used for modern day wild life research, forestry and employment opportunities in wild life institutes, Govt. and NGOs, academics*.**

References:

- Measuring and Monitoring Biological Diversity: Standard Methods for amphibians (Smithsonian Institution Press, Washington and London). Edited by W. R. Heyer, M. A. Donnelly, R. W. McDiarmid, L. A. C. Hayek & M. S. Foster.
- Wildlife diseases in India, by B.M.Arora. Periodical Expert Book Agency, New Delhi.
- Investigation and Management of diseases in wild animals, by G.A.Wobeser. Plenum Press, New York.
- Animal Marking, by B.Stonehouse. The MacMillon Press Ltd. London.
- Ecological census techniques, by W.J.Sutherland. Cambridge Univ. Press.
- Tracking Tigers ,by L.A.K.Singh. WWF-India.

SEMESTER III

WLBC-509– PRACTICALS (Credit: 05)

(Laboratory Practical: 70 marks; Field report: 20 Marks; Seminar: 10 Marks)

1. WBC and RBC study.
2. Blood Serum Protein analysis of animals;
3. Study of developmental stages of (Frog)
4. Study and identification of museum specimen (Birds, Mammals)
5. Study of dry skeleton (Dis-articulated bones of Birds, Mammals).
6. Taxidermy (Reptiles/Birds/Mammals).
7. Collection and morphometric characterization / identification of 20 plant specimens with extraction of genomic DNA from leaf samples for ethno-botanical importance in Odisha.
8. Purification and dilution of genomic DNA for PCR analysis
9. RAPD/ ISSR/DAMD PCR of 20 plant species for diversity analysis.
10. To calculate the amplified amplicons size using known DNA Rullers
11. Elucidation among Individual plant diversity / population diversity
12. Knowledge of making use of 20 plants – parts of the above 20 for various medicinal purposes. The mode of application, the efficiency and superstitions, if any, associated with them. The student may prepare a case study report, preferably, by direct contact with the Tribe or the community concerned who are known to possess with the knowledge of the same.
13. Visit to sacred grove or sacred forest or a particular ecosystem to prepare a field report on the ecosystem.
14. Collection and identification of ethnobotanical specimen – preparations of the following categories (4 each) – oils, medicines for asthma, skin diseases, diarrhea, family planning, and snake bite.
15. Preparation of artificial seeds
16. Estimation of protein content using plant or/ animal tissues using Lowry et al., (1951)
17. SDS-PAGE of given protein samples.
18. Culture of bacteria from water and soil samples
19. Sterilization and preparation of culture media
20. Techniques of pure culture
21. Determination of bacteria sensitivity to antibiotics and different medicinal plant extract
22. Different Medicinal plant extraction by Soxhlet apparatus & separation of mixcompounds by TLC
23. SEMINAR PRESENTATION The seminar topics can be suggested by the students themselves or by the teacher. Topics are to be finalized within three months of the beginning of the session, and presentations are to be made by October/ November.
24. Field Report on the Management tour:- To National Park, Biosphere Reserve Sanctuary, Protected Area and Captive Breeding Program .

SEMESTER IV

WLBC-502 (Credit: 05) ENVIRONMENTAL IMPACT ASSESSMENT AND CLIMATE CHANGE

OBJECTIVE: To understand and identifying potential environmental impacts of a proposed project activity. To devise an Environment Management Plan that can minimize the adverse impacts and enumerate various steps to be taken for improvement of the environment.

CONTENT

UNIT I

Basic concepts & objectives of EIA Purpose of EIA, objectives of EIA, Environmental components, projects and its environmental impacts, Environmental impact statement, Environmental base line study.

UNIT II

Components and Methods of EIA Process, screening, scoping and setting of EIA, Analysis, mitigation, matrices network and checklists of EIA, cost benefit analysis of EIA , Analysis of alternatives, Expert systems in EIA.

UNIT III

EIA regulatory frame work Documents needed for EIA. Necessary steps in securing an environmental compliance certificate (ECC), Importance of public participation in EIA , Enumeration of critical projects & environmentally critical areas covered by EIA.

UNIT IV

Tools and Evaluation techniques of EIA Mathematical modeling for impact prediction, Assessment of impacts (Air,Water, Soil, Noise biological and sociocultural environments). Impact Assessment, Documentation of EIA findings, term examination, activity report, investigatory activity report, scoping exercise report, Investigatory activity report, Final Examination environment and social impact Assessment report ,oral presentation.

COURSE OUTCOME: On successful completion of this paper, students will be able to understand the Environmental Impact Assessment (EIA) process and stages, as well as how it is applied to specific areas such as landscape and visual impact assessment, ecology, soils, and climate change, among others, after completing this paper. Furthermore, they will have gained an awareness of the function of Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) in development project decision making, as well as the ability to assess and appraise the EIA process and its outcomes in environmental management.

Employability in Govt. & NGO Sectors

References:

- Environmental Impact Assessment and Management ,Ed. B.B.Hosetti and A.Kumar, Daya Publishing House, Delhi.
- MoEF 1994. The Environmental Impact Assessment Notification (As amended on 4.5.94). MOEF , GoI, New Delhi
- BNN Lohani (1997). Environmental Impact Assessment for developing Countries In Asia; Case studies Vol-II. Asian Development bank, Manila
- A Rajvanshi (1995).). Environment Assessment of Linear developments in ; Manual for 11th Intensive course on Environmental Assessment and Management. Centre for Environmental Management and Planning.

SEMESTER IV

WLBC-504 (Credit: 05) CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT

OBJECTIVE: To understand the concept of global climate change, the factors affecting them and the consequences to global biodiversity. To gain basic concept of sustainable development which will empanel to Eradicate poverty in all its forms, everywhere. Eradicate hunger, achieve food safety and improved diet and promote sustainable agriculture. Ensure healthy lives and promote well-being for every one of all age.

CONTENT

UNIT I

Definition and Basic Concept Climate, Weather and climate, Climate of the world, Indian climates, Climatic zones, Factors responsible for change of climate, tools to study climate change.

UNIT II

Global Warming Basic concepts and issues of global warming, an overview of Biosphere, Ozone depletion, UV radiation, Greenhouse effect and acid rain, Global warming potential, Importance of global warming for changes in environment, effect of global warming on sea level rise, water table, Aquifers, crop yield, water balance and human health.

UNIT III

Impact on Environment Environmental changes deep to climate changes, Interaction with ecological factors like light, temperature, rainfall, humidity of air, atmospheric gases and wind, CO2 fertilization effect on plants, Biomass allocation and reproductive effort, range of distribution of organisms.

UNIT IV

Sustainable Development Sustainability, Causes of un-sustainability, Ecological footprint, Threats to sustainable development, International programmes on sustainable development (UNCED, CSD, WSSD), Sustainability indicators (Land, Biodiversity), Environmental Sustainability Index (ESI), National sustainable development strategies.

COURSE OUTCOME: Successful completion of this paper equips students with the necessary tools and methodologies for analysing climate change consequences and evaluating and implementing measures that reduce system vulnerability. Students will also gain knowledge of the ethical, scientific, and policy strengths and limitations of present and prospective mitigation and adaptation options, as well as an understanding of how to evaluate the social and economic externalities of climate change. Furthermore, the students will be able to clarify the differences between government and governance, as well as the numerous ideas and meanings associated with the goal of sustainable development, and critically examine policy-making processes in relation to sustainability challenges.

Skill enhancement on climate change methodologies and analysis capability in implementing the climate change adaptations and mitigating the problem. Employability in Govt. & NGO Sectors

References:

- IPCC (Intergovernmental panel on Climate Change). 1990. Climate change: The IPCC Assessment. Cambridge University Press, Cambridge.
- IPCC (Intergovernmental panel on Climate Change). 1995. Climate change: The science of climate change. Houghton, J.T., Meria Filho, L.G., Callender, B.A.,
- Harris, N., Kattenberg, A. and Maskell, K. (eds.) Contribution of working Group I to the Second Assessment of the Intergovernmental panel on climate change. Cambridge University Press, Cambridge, UK.
- IPCC (Intergovernmental panel in Climate change). 2001. Climate change: the scientific basis. Third Assessment Report. Cambridge University Press, Cambridge.
- McCarthy, J.J., Brewer, P.G. and Feldman, G. 1986/87. Global Ocean Flux. Oceanus 29:16-26. • Conservation and evolution; OH Frankel & E.S. Micheaele, Camb. University Press.

SEMESTER - IV

WLBC-506: PRACTICALS (Credit: 05) (Laboratory Practical: 70 marks; Seminar: 30)

Laboratory and field practical: (70 marks)

1. Water analysis; Comparative water quality analysis of lentic and lotic water bodies, Ground water quality analysis

2. Study of quantitative and qualitative analysis of aquatic vegetation

3. Productivity of water bodies.

4. Soil and Sediment analysis.

5. Biomass studies – based on number, energy, fresh and dry weight.

6. Multiple sequence alignment using gene/DNA sequence (Clustal W)

7. Pairwise Sequence alignment Tools (BLAST, PSI-BLAST)

8. Selected forest ecosystem analysis through project work.

Seminar Presentation: (30 Marks) on any topic related to Wildlife, Environment and Biodiversity, etc.

SEMESTER – IV

WLBC-508- (Credit :05) THESIS WORK (Field work & Dissertation writing)

**Dissertation work (Marks: 75)

*Writing of synopsis, Literature survey, Methodology. (25 marks)

*Presentation in the Seminar for discussion. (25 marks)

*Improvement of Research design, Data collection, data analysis, and interpretation. Preparation of thesis, Evaluation on the basis of the thesis. (25 marks).

**Viva-voce (25 marks): Development of the project (synopsis & literature survey), research design (methodology, work plan & data collection), data analysis & interpretation of results.(The dissertation work should be related to forest biodiversity, habitat, ecosystem, invertebrate or vertebrate biology, wildlife conservation, dependency on forests , socio-economic aspects etc.).

Note:

(1)The Seminar presentation is to be completed within 90 days of the subject allotment. Dissertation works are to be assigned to the students, who are expected to conduct the study independently and under the guidance of a teacher/guide .The findings are to be submitted in the form of a report getting duly authenticated by the teacher/guide concerned. The completed study will be compiled at the end of final year, when the student will submit the final thesis. The project work is to be completed within three months including dissertation writing. Viva-voce may be held any time within a month of thesis submission.

(2)For the project work the students has to follow the rules as mentioned below:-

1) The work should be the original work to be done by the students independently.

2) The project work is to be done under the direct guidance of the faculty member (s) of the department.

3) If the work is to be carried out under the guidance other than the faculty member, the work is to be done under the joint supervision taking the faculty member(s) of the department.

FIELD COURSES

The following field courses and tours will be undertaken during the session:-

FIRST SEMESTER

Orientation Tour (One week)

Orientation to the Field Biology and Natural History. Bird watching and identification, Collection of study materials, Wildlife signs and evidences. Excursion trip to nearby/any Natural areas would form the part of the orientation tour. Identification of flora and herbarium collection. The tour has to be completed during first four months of the session. The tour journal/report has to be submitted within fifteen days of completion of the tour for assessment.

SECOND SEMESTER

Field Technique Tour (10-12 DAYS)

Field visit to Similipal/ Bhitarkanika/ Gahirmatha/ Chilika or any Reserve forests / Sanctuary/National Park/ Zoological Park. Exercise on wildlife population and census methods for various species. Vegetation Studies. Studies on Animal ecology. To examine Wildlife Conservation and biology issues in any bio-geographic zone of India. Eco-development applications and field exercises. To be completed during January. The tour journal/report has to be submitted within fifteen days of completion of the tour for assessment.

THIRD SEMESTER

Management Tour (One Week)

Field visit to Nandankanan or any Reserve forests/ Biosphere Reserve/Sanctuary/National Park / Zoological Park. Understand the wildlife management and Captive breeding programme planning process, Eco-development applications and field exercises. To be completed during February. The tour journal/report has to be submitted within fifteen days of completion of the tour for assessment.

FOURTH SEMESTER

Project Work (Three months) [Including Thesis Writing]

Project work will be related to biodiversity, animal biology, flora, fauna, conservation, management problem, environmental issues, socio-economic aspects of any Reserve forests / Sanctuary/ National Park/ Zoological Park or any other topic related to the Wildlife and Conservation. Besides these above assignment students have to go the nearby places for the collection /identification of specimen and to study the water quality of the peripheral rivers / streams / ponds.