

**ASSAM DON BOSCO UNIVERSITY**  
**SCHOOL OF LIFE SCIENCES**  
**DEPARTMENT OF ZOOLOGY**  
**Modified Course Structure/Syllabus in SPRING 2019**

**ZGEE0006: ECOLOGY, ENVIRONMENTAL BIOLOGY AND ETHOLOGY**

**(4 Credits – 60 hours)**

**Objective:** *The purpose of this course is to familiarize students with essential aspects of environmental conservation and management through a comprehensive understanding of animal behaviour and the components of the ecosystem, biological cycles, habitat ecology, resource ecology, pollution and its management.*

**Module I (10 hours)**

- a) Types of ecosystems – Salient features of aquatic and terrestrial ecosystems and their biotic communities.
- b) Ecological energetics and energy flow; Measuring ecosystem productivity
- c) Population Ecology - Population density, Growth rate, Natality, mortality, survivorship curves and life tables, Biotic potential

**Module II (10 hours)**

- a) Community Ecology - Types of biotic communities, organization, carrying capacity, r and k-selection.
- b) Community Development – Types of community changes, ecological succession - its causes and examples, climax community.
- c) Positive and Negative interactions between two species, Competition theory, Niche, Habitat, Ecological Equivalents, Character displacement; Liebig law of minimum, Shelford's law of tolerance, Significance of limiting factors, Ecotone and Edge effect.

**Module III (10 hours)**

- a) Eutrophication in aquatic ecosystem, Remediation of eutrophication.
- b) Acidification in aquatic and terrestrial environment, Consequences and control strategies.
- c) Environmental monitoring, Environmental impact assessment and environmental management plan.
- d) Biogeochemical cycles – carbon, nitrogen, sulphur cycles, impact of human activity on nutrient cycles.

**Module IV (10 hours)**

- a) Biodegradation and Bioremediation: concept, environmental limitation for bioremediation, bioremediation of ecosystem (Air/water/soil)
- b) Wastes in Ecosystem and management: Agricultural wastes and Management, Biomedical wastes and Management, Domestic waste, effects and management for purification and recirculation.
- a) Environmental toxicology: Diversity and classification of environmental toxins, Air, Water and soil pollutants, Food additives and contaminants, Pesticides, Metals and Solvents, Radioactive pollution.

**Module V (10 hours)**

- a) Concepts of Ethology, Genes and behaviour; Evolution of behaviour, Development of behavior
- b) Definition of Social behaviour: Properties and advantages of social grouping, social group of monkeys; Sociobiology - Darwinian fitness, individual fitness, kin selection, group selection, cooperation, reciprocation, altruism , reciprocal altruism, Proximate and Ultimate causations;

aggression; Parental care in animals(amphibians)

#### **Module VI (10 hours)**

Communication in animals - vocal, tactile, visual and chemical; Learning: Introduction and definition, Types - Habituation, trial and error, conditioning, cognition and imprinting; Short and long term memory, neural mechanism of learning

#### **Suggested Readings**

1. Asthana, D.K. and Asthana, M. Environmental Problems and Solutions. S. Chand and Co., New Delhi.
2. Odum : Basic Ecology (Saunders)
3. Odum : Fundamentals of Ecology (Saunders)
4. Odum. E.P. Fundamentals of Ecology. Nataraj Publishers, Dehra Dun.
5. Raven, Berg, Johnson : Environment (Saunders College Publishing)
6. Sharma : Ecology and Environment (Rastogi Publication)
7. Smith, R.L. Elements of Ecology. Harpet and Row Publishers, New York.
8. Trivedi, P.R.and Gurdeepraj, K. Environmental Biology. Akashdeep Publishing House New Delhi
9. Turk and Turk : Environmental Science
10. Drickamer & Vessey: Animal Behaviour –Concepts, Processes and Methods, Wadsworth
11. Goodenough et al : Perspectives on Animal Behaviour, Wiley,
12. Grier : Biology of Animal Behaviour, Mosby,
13. Verma P.S. and Agarwal V.K,Environmental Biology (Principles of Ecology) by., S. Chand Publishing.
14. Gupta S.R. and Singh S.P., Ecology Environmental Science and Conservation, S. Chand Publishing
15. Manju Yadav, Ecology, Discovery Publishing House
16. Rana S. V. S., Essentials of Ecology and Environmental Science, S.V.S. Rana. Publisher, Prentice-Hall of India
17. Anderwartha, H.G. and Birch, L. C., The distribution and abundance of animals, University of Chicago Press, Chicago London.
18. Beeby, A., Applying Ecology Chapman and Hall Madras.
19. Begon, M., Harper J. L. and Townsend, C. R, Ecology – Individuals, populations and communities, Blackwell Science, Cambridge UK.
20. Brewer, R., The science of Ecology, Saunders College of Publishing, New York.
21. Chapman, J. L. and Resis, M. J., Ecology- Principles and applications, Cambridge University Press, Cambridge UK.
22. Kaeighs, S. C., Ecology with special references to animal and Man, Prentice Hall Inc.
23. Putmann, R. J. and Wratten, S. D., Principles of Ecology,
24. Crown Helm, London.Salanki, J., Jeffery E. and Hughes G. M., Biological Monitoring of the Environment (A manual of Methods) CAB International, Wallingford UK.
25. Singh M C: Environment Protection and the Law (Ashish Publishing House)

### **ZGAZ0016: APPLIED ZOOLOGY II**

#### **(4 Credits- 60 hours)**

**Objective:** The course is designed to provide knowledge on parasitology with special reference to emerging viral diseases, Pest management, Poultry rearing and Biodiversity

#### **Module I: Parasitology (20 hours)**

Parasitism and types of parasites, primary and secondary hosts, transmission of parasitic infection.

Host- parasitic interactions – parasitic effects benefiting the parasites, parasitic effects benefiting the host. Vibrio cholera and Clostridium titani- Life cycle, mode of transmission, infection and treatment.

Influenza, Dengue, Bird flu- Life cycle, mode of transmission, infection and treatment. Toxins and antitoxins, Identification characters, life cycle, pathogenecity and control of Taenia solium and Ancylostoma duodenale

## **Module II: Insect pest management, Public Health and Forensic Entomology (10 hours)**

Concept of Pest, concept of integrated pest management (IPM) Mosquito (Aedes, Culex, Anopheles), Housefly- Taxonomy, Biology, Behavior and their control. Life cycle of Calliphora and Scrophaga, determination of death and causes of death.

## **Module III: Poultry management (8 hours)**

Poultry Rearing / Farming: Housing and equipment; Nutritional Requirements; Poultry diseases  
Poultry products: Broilers, meat processing and meat products; Egg structure and quality, factors affecting size and egg processing; Poultry by products

## **Module IV Biodiversity (12 hours)**

Components of Biodiversity (Genetic, Organismal and Ecological), Value of Biodiversity, threats to biodiversity, biodiversity conservation, Mega biodiversity countries, hot spots and heritage sites, Threats to biodiversity. IUCN Red list categories. Habitat diversity of Indian wildlife, endemic and threatened species of northeast India. Ethnozoology with special reference to Northeast India  
Vermiculture: species of worms, condition for efficient vermiculture (domestic and commercial level), Economics of Vermiculture

## **Suggested Readings**

1. Venkitaraman: Economic Zoology, Sudarsana Publishers
2. Srivastava : A Text Book of Applied Entomology, Vol. II & II.I Kalyani Publishers
3. Shukla & Upadhyaya : Economic Zoology. Rastogi Publishers.
4. Ananthkrishnan, T. N.and K.G. Shivaramakrishnan.Ecological entomology: Insect life in odd environment. Scientific Pub.: India
5. David, B.VandT.N. Ananthkrishnan.General and Applied Entomology. Tata McGraw-Hill Publ. Co. Ltd.: New Delhi
6. Dent, D. R.Insect pest management.Westville Publishing House: Delhi
7. Eldridge B Medical entomology (Springer)
8. Fenemore P G and Prakash Applied Entomology (New Age Publishers: New Delhi)
9. Madigan, M. T., J. M. Martinko and J. Parker Brock Biology of Microorganisms (Ed. IX).Prentice Hall International Publication.
10. Kreier, J.P. and J.R. Baker.Parasitic Protozoa. Allen and Unwin Press.
11. Kathering ,M.G. A. James paul and V. Zaman. Churchill Livingstone.Medical and Veterinary Protozoology
12. Asa C. Chandler, (7th ed.), Introduction to Parasitology, With Special Reference to the Parasites of Man, New York: Wiley
13. Despommier, Gwadz, Hotez, Knirsch: Parasitic Diseases (5th Ed). Apple Trees Productions, LLC.
14. Stephen A. Berger, John Marr, Human Parasitic Diseases Sourcebook, Jones & Bartlett Learning
15. D Molyneux, Advances in Parasitology- Control of Human Parasitic Diseases, (1st Ed).Academic Press.
16. Jeremy Farrar & Peter Hotez& Thomas Junghanss&Gagandeep Kang & David Laloo& Nicholas J. White. Manson's Tropical Diseases, (23rd Ed).Elsevier publication.
17. Howes, H. Modern Poultry Management.Read Books
18. Jadhav & Siddiqui .Handbook of Poultry Production and Management.Jaypee Publications
19. Maiti, P.K. & P. Maiti. Biodiversity: Perception, Peril and Preservation. PHI Learning Private Limited
20. Bharucha, E.The Bio-Diversity of India Hardcover. Grantha Corporation
21. Krishnamurthy. An Advanced Textbook On Biodiversity : Principles and Practice. Oxford & IBH Publishing
22. Johns, J. Worm Farming - Creating Compost at Home With Vermiculture. Createspace Independent Pub
23. NPCS Board of Consultants & Engineers. The Complete Technology Book on Vermiculture and Vermicompost
24. ICAR. Handbook of Integrated Pest Management (IPM) Pub: ICAR, Govt. of India
25. Metcalf, R W.H.Luckmann. Introduction To Insect Pest Management. Wiley India Pvt Ltd

## ZGCP0021: CAPTURE FISHERY AND POST-HARVEST TECHNOLOGY

**(4 Credits-60 Hours)**

**Objective:** The students will learn about River systems and their fishery, Marine fishery, Fish yield and preservation, processing and marketing of fishes and their by products

### Module I (40 hours)

**Capture fishery:** Fish catch statistics of the world special reference to India; Riverine Fisheries River systems in India, their ecology and fisheries (Ganga & Brahmaputra); Reservoir Fisheries: Development, Exploitation and management of Reservoirs with special reference to India – Dams and their effect on fish migration; Beel fisheries of Assam: Fish resources, problems and management; Cold water fisheries: Hill stream fisheries of North East India; Mahseer fisheries: prospects and problems with special reference to NE India; Major Estuaries of India and their fisheries; Brackish water Fisheries: Chilka lake Hilsa fishery – causes of decline and efforts for revival; Craft and Gear used in Fisheries : Traditional and mechanized boats and nets used in catching fish; Marine fisheries of commercial importance; Coastal fisheries of India (Sardine & Mackerel fisheries); Population Dynamics : Fish populations and factors affecting the population structures ; Estimation of fish yield and control of over-fishing; Fishing crafts and gears used in Inland capture fisheries; Destructive fishing – its impact on fish diversity.

### Module II (20 hours)

**Post harvest technology and fish by-products:** Preservation and processing: Methods of preservation of both finfish and shellfish preservation (Refrigeration and freezing, Drying, Salting, Smoking, Canning, Pickling, pasting and spicing) and associated problems; Rigor mortis and post-mortem changes. Handling and packaging of fish for marketing; product stability and shelf -life

**Fish By-products:** Fish oils, Fish Proteins, Fish manure, Fish glue, Fish flour, Isinglass, Fish meal, Fish Silage, Fish guano, Bone meal; Production of fish sauce by lactic acid fermentation

### Suggested Readings

1. Bal, D.V. and VeerabhadraRao, K. Marine Fisheries. IBH Publications
2. Balakrishnan, N. N. and Thampy, D. M.A textbook of marine ecology.
3. Beaven C R Handbook of the freshwater fishes of India (Narendra Publishing House)
4. Biswas K P A Text Book of Fish, Fisheries and Technology, (Narendra Publishing House)
5. Brody , Fishery by-products technology., AVI, Westport
6. Chandy, M. Fishes, National Book Trust, India;
7. EIRI Board.Hand Book Of Fish Farming & Fishery Products
8. Gopakumar, K., Singh, B.N. and Chitranshi, V.R. Fifty Years of Fisheries Research in India, Fisheries Division Indian Council of Agricultural Research, New Delhi.
9. Gupta S.K., Gupta P.C .General & Applied Ichthyology.S Chand & Company
10. Jayaram K. C. The fresh water fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka.
11. Jhingran V. G. Fish and Fisheries of India.
12. Jobling M Environmental Biology of Fishes (Chapman and Hall)
13. Khanna S. S. and H. R. Singh. A textbook of Fish Biology and Fisheries, Narendra Publishing House,
14. Kreuzer, R., Fishery products., FAO, Fishing News Books Ltd., England
15. Krishnaveni, G., N. Veerabhadra Rao and K. Veeranjanyulu Recent Technologies in Fish and Fisheries.Rigi Publication
16. Lagler, K.F. Ichthyology. John Wiley Publication.
17. Nikolsky, G.V. Ecology of fishes. Academic Press.
18. Pandey.Fish and Fisheries.Rastogi Publications
19. Rao, K. L. India's water wealth.
20. Ravishankar Piska. Fisheries and Aquaculture. Lahari Publications, Hyderabad.
21. Ricker, W.E. 1984.Methods for assessment of fish production in freshwaters.Blackwell Publications.

22. Rounsfell, G.A. and Everhart, W.H. Fishery Science: it's Methods and Applications John Wiley & Sons,
23. Sachindra, N.M. & N.S. Mahendrakar. Fish Processing Byproducts: Quality Assessment And Application Studium press
24. Santhanam,R. Fisheries Science, Daya Publishing House, 1990.
25. Singh, B. A. Dey. Fish and Fisheries. Invincible Publishers
26. Srivastava, C.B.L. A Textbook of Fishery Science and Indian Fisheries, Kitab Mahal.
27. The Wealth of India, Raw Materials Vol. IV, Fish and Fisheries, CSIR, 1962

## ZGRE0023: WILDLIFE RESOURCE MANAGEMENT AND ECONOMICS

### (4 Credits-60 Hours)

**Objective:** *The course is designed to equip students with a foundation for Natural Resource Management and Conservation*

#### Module I (20 hours)

Species conservation: IUCN categories, criteria for allocation into different categories; Threatened animal species of India with special reference to NE India; Role of Iconic species designation in conservation; Concept and significance of conservation of Flagship (Target) species – Wildlife projects implemented in India; An overview of conservation problems and issues of fauna of Indian sub-continent.

#### Module II (15 hours)

Natural resource management and conservation: Introduction to forestry, principles of forest management, forest and wildlife as natural resources; Importance and performance of joint forest management (JFM) – Role of Non-government Organizations (NGO); Conservation movement in India, socio-economic and political realities; Concept of stakeholders; International conservation bodies: IUCN UNDP, FAO, WWF.

Environmental Laws, Environment Impact Assessment; Intellectual Property Right

#### Module III (5 hours)

Wildlife Laws:  
Wildlife Protection Act 1972  
Wildlife Trade: CITES

#### Module IV (20 hours)

Population ecology: Demographic and life history parameters, evolution of life history parameters: r & K selection, allometry, aging and sexing, life tables, age and stage structures models, methods of estimation of life history parameters; Sampling designs for population estimation, population estimation methods: Distance based Sampling Methods, Mark-Recapture for Closed Population, Indices, and Estimation of Demographic parameters.

#### Suggested Readings

1. Caughley G (1978). Analysis Of Vertebrate Populations. John Wiley, Chichester.
2. Hastings A (1997). Population Biology: Concepts And Models. Springer Verlag, New York.
3. Neal D (2004). Introduction to population biology. Cambridge University Press. UK
4. Ricklefs R (2010). The Economy of Nature (6 edition). W. H. Freeman
5. Tokeshi M (1998). Species Coexistence: Ecological and Evolutionary Perspectives.
6. W.J.Ecological Census Techniques Cambridge University Press
7. Patro, L. Biodiversity Conservation and Management
8. Misra, H.N. – Managing Natural Resources- Focus on Land and Water
9. Anderson, Sweeney and Williams- Wildlife and Natural Resource Management
10. Deal, K.H. Environmental Economics and Natural Resource Management
11. Kumar, R. Environmental Laws

12. Muthukrishna- Natural Resource Economics
13. Field, B.C. Economics of Environment
14. Began, M. & Mortimer, M.- Population Ecology
15. Rockwood- Introduction to population Ecology

## ZGPL6008: SPECIALIZATION LAB II

### INSECT ANATOMY AND LIFE HISTORY

#### (2 Credits)

1. Histological study of foregut, midgut and hindgut of insect.
2. Reproductive system of cockroach
3. Prothoracic gland of cockroach
4. Alimentary canal of house fly with crop
5. Bacterial chamber of termite
6. Salivary gland of Cockroach
7. Pharyngeal, labial and thoracic salivary gland of honey bee
8. Sting apparatus of honey bee
9. Identification of aquatic, terrestrial and boring insects with specific adaptive characteristics.
10. Visit to agricultural field/tea garden and forest for on spot study of pest and damage caused by them
11. Preparation of Phylogenetic tree of Insect species
12. Study of Life cycle of Mosquito, Housefly, Drosophila
13. Collection and identification of economically important insects and various stages of their life history.

## CYTOCHEMISTRY AND IMMUNOLOGICAL TECHNIQUES LAB

#### (2 Credits)

1. Tissue homogenization and fractionation by differential centrifugation for isolation of mitochondria, nuclei and cytosol
2. Separation of proteins and DNA by agarose electrophoresis
3. Separation of proteins and isoenzymes on SDS-PAGE and PAGE
4. Electroeluting of proteins, DNA/RNA from electrophoretic gels
5. Separation of amino acids by paper chromatography
6. Separation of phospholipids by TLC
7. Separation of hemoglobin by column chromatography
8. Detection of Carbohydrate (a) PAS method (b) Alcian blue method
9. Detection of Proteins (a) Mercury bromophenol blue method (b) Ninhydrin method
10. Detection of Lipids (a) Phosphomolybic acid method (b) Copper phthalocyanin n method
11. Detection of Nucleic acid (a) Feulgen method (b) Methylene green- Pyronin method.
12. Isolation of lymphocytes from sensitized animals from spleen, lymph nodes
13. Quantization of antibodies: (a) Precipitation techniques (b) Immunodiffusion method

### LIMNOLOGY AND FISHERY

#### (2 credits)

1. Analysis of water samples for various physico-chemical parameters – pH, free CO<sub>2</sub>, dissolved oxygen, alkalinity, chloride, hardness, nitrates, phosphates, BOD, COD
2. Estimation of primary productivity by light and dark method.
3. Composition and biomass of phytoplankton, Collection, enumeration and biomass of Zooplankton
4. Identification of important fish parasites (external and internal).
5. Identification of fishing gears and fish byproducts.
6. Fieldwork : Visit to freshwater bodies, study of physico-chemical and biological status and make a report

7. Visit to fish processing centers and make a report.

### **TECHNIQUES IN WILDLIFE STUDY**

#### **(2 Credits)**

1. Ecological census techniques: mark recapture; point and line transects, belt transect, plot-less & quadrat samplings. Pugmark census, camera trap census; pellet group count
2. Animal sign & marks analysis
3. Scat/ Dung analysis: (parasite identification)
4. Analysis of Abundance Data
5. Preparation of conservation statements applicable to the state of Assam-through review of literature.
6. Extraction of DNA from biological sample, PCR amplification
7. Habitat (habitat suitability index), measuring habitat fragmentation (index of habitat proximity)
8. Canopy (cover & closer), leaf litter and ground cover measurements
9. Acoustic analysis of birds /amphibians

### **ZGTM6010: TEACHING METHODOLOGY AND CLASS ROOM MANAGEMENT**

#### **(2 Credits)**

**Objective:** This course is designed to help the students to prepare for efficient teaching with skills of class room management.

**Total: 30 Hours**

#### **Module: I**

Introduction to Core teaching Skills.

Micro- teaching.

Introduction to Methods, Maxims, Devices and techniques of teaching.

Practice teaching on Core teaching Skills in Micro-teaching mode.

Approaches and methods of teaching Science - (a) Lecture, demonstration, explanation, Observation. (b) Ensuring Problem solving, laboratory, Project, Heuristic, Discussion for teaching science. (c) Learning by discovery, group work and team teaching. (d) Collaborative strategies, provision in heterogeneous class room.

#### **Module: II**

Planning and designing for effective instruction in science.

- a) Design of unit and lesson planning approaches to lesson planning, format of lesson plan
- b) Teaching aids and laboratory in science, their necessity and importance.
- c) Museum, field trips and excursion, their relevance to science.
- d) Preparation of simple aids of Science teaching.

#### **Module: III**

Evaluation of Learners Progress.

- a) Concept and importance of assessment & evaluation.
- b) Techniques of evaluation ( Theory & Practical)
- c) Construction of Unit test: Design and blue print, Item construction, Question wise analysis, Construction of Science question paper including marking scheme.

#### **Module: IV**

Information and Communication Technology (ICT) Integration in Science teaching.

- a) Introduction to ICT.
- b) Importance of ICT in Science teaching.
- c) Exploring various ICT tools for Science teaching.
- d) Open Education Resources (OER) and its uses in Science teaching.
- e) ICT Integration in Science teaching.
- f) Exploring FOSS in Science teaching.