NATIONAL UNIVERSITY

Syllabus

Department of Zoology

One Year Master's Course

Effective from the Session: 2013-2014

National University

Subject: Zoology

Syllabus for One-Year Master's Course

Effective from the Session: 2013-2014

Wildlife Biology Branch

Paper Code	Paper Title	Credits
313101	Advance Biology	4
313103	Wildlife Ecology	4
313105	Herpetology (Amphibia and Reptile)	4
313107	Ornithology	4
313109	Mammalology	4
313111	Wildlife Management	4
313113	Wildlife Economy and Conservation Biology	4
313114	Thesis/Theory	6
313116	Viva-Voce	2
Or		
313118	Practical	6
313120	Viva-Voce (Field record and practical Note Book) Practical Group = A, Thesis Group = B	2
	Total =	**36**

Detailed Syllabus

Paper Code	313101	-------	**Credits: 4**	**Class Hours: 120 hrs.**
Paper Title:	Advanced Biology			

[Common compulsory paper for Wildlife Biology, Fisheries &Entomology group]

A. Biodiversity and Resource Conservation:

Concepts of Biodiversity
Concept and classification of resources
Renewable and non- renewable resources and their management
Consequences of the loss of Natural Resources
Protection of Local, National and Global Environment
Conservation of Ecosystems
Conservation and Management Strategies including ex situ and in situ
Legislation: National & International Convention Case study of Biodiversity and Resource Management, Coral Reefs, Tropical Rain Forest, Mangrove Forest.

B. Human Ecology, Population Ecology & Genetic Ecology

Human Ecology:

History of Human race and its distribution
Human types and their physical features, distribution and mode of living in relation to social, cultural, religious and other activities Ecological impacts on Man's physical features, social and cultural life. Impacts of Human population on environment Development activities and their impacts on environment.
History of Agriculture revolution, industrial revolution and green revolution.
Impacts of scientific and technological development on Human ethics.

Population Ecology:

Definition
Population and population Change
Group properties of population: Density, natality, mortality, biotic potential, age distribution, dispersion.
Concept of Carrying Capacity
Population Growth Forms: J and S-shaped growth forms
Population Interactions: Coexistence, competition, Predation and plant- herbivore interaction.
Life Table: Definition, types, construction and analysis.

Genetic Ecology:

Importance of Genetic Ecology
Patterns of Genetic Variation
-External Influence
-Isolation of populations
-Ecotype and Clines.

Books Recommended:

1. E. J. Milner – Gulland and R. Mace. 1998. The Conservation and Use of Biological Resources. Blackwell Science.
2. A Dobson. 1996. Conservation and Biodiversity. Scientific American.
3. J. Turk, J. Witters, R. Witters and Turk. Ecosystems, Energy. Population. W.B. Saunders Company. Philadelphia, London.
4. B. Groombride and M. D. Jenkins. 1996. Assessing Biodiversity Status and Sustainability. WCWC.
5. K. J. Gaston and J. I. Spicer. 1998. Biodiversity: An Introduction Blackwell Science.
6. M. Jeffries. 1997. Biodiversity and Conservation. Routkedge
7. J. Trewek. 1999. Ecological Impact Assessment. Blackwell Science
8. M. Liddle. 1997. Recreation Ecology: The Ecological Impact of Outdoor Recreation and ecotourism. Chapman & Hall.
9. G.W. Suter. 1993. Ecological Risk Assessment Lewis, USA
10. Instant Basics, Dr. M.A. Basher, 2004, Positron publication, Bangla Bazar, Dhaka.
11. B‡KvjwR I cwi‡ek, `~lY, kvnAvjgbex Ges G. †K. Gg. dRjyjKwig †Pxa~ix 2003, ZvRjvB‡e^{a}ix, PÆMÖvg|

Paper Code	313103	-------	**Credits: 4**	**Class Hours: 120 hrs.**
Paper Title:	Wildlife Ecology			

Ecology:

Ecosystem – Ecological Networks, Energy flow through the ecological system,
Ecological succession and Ecotone.
Population ecology and management, population estimation, Community Ecology, Estuarine:
Habitat type (Aquatic, Terrestrial,Arboreal, Aerial etc.
Habitat defragmentation: causes and Effects.
Degradation of Biodiversity (Biodiversity Act 2013- Basic knowledge of offences, trial and penalties)
Predator prey interactions.
Biogeochemical cycles, Limiting factors.

Environmental Issues:

Environmental Safeguards policies and Regulations.
Environmental policy (1992) and Environmental Action plan (1992)
National Environmental Management plan (1995)
Environmental Acts and their applications, Bangladesh Environmental Conservation Act (1995) and Rules (1197)
Environmental Codes and Best Management practices
Impacts of Local and Regional economic activities on wildlife environment.
Global Environmental Issues: Global warming Climate change, Green House Effects, Acid Rain, Ozone layer depletion, CFC, etc.
Local Issues: Natural calamities,Embankments, Hydroelectric projects, Flood control (FAP) and their impacts on wildlife and their environment.
Environmental Screening: Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA), Environmental Management plan (EMP)

Paper Code	313105	-------	Credits: 4	Class Hours: 120 hrs.
Paper Title:	Herpetology (Amphibia and Reptile)			

Amphibia and Reptilia

Classification of Amphibians and Reptiles of Bangladesh.
Faunal diversity and Taxonomic issues at generic and specieslevel of Amphibian and Reptilian species of Bangladesh.
Status and Distributions of the Amphibians and Reptilians of the Oriental Region with special reference to Bangladesh.
Adaption in reference to morphological and physiological features: Adaptive radiation of Amphibians and Reptiles in aquatic,terrestrial, arboreal and aerial habitats.
Ecology, Habitat use Hibernation and Aestivation, adaptive radiation.
Food and Feeding Habits, territoriality, flights, dispersion and orientation of amphibians and reptiles.
Poisonous and Non – poisonous snakes , Epidemiology of snake bite, Fangs and snake bite signs symptoms and treatment , biting mechanism , snake venom , snake charmers and superstitions and physio-chemical properties of snake venom.
Economic important of amphibians and reptiles in relation to agriculture, forestry and fisheries.
Pest control, aesthetic, education and economic values.
Role of amphibians Calls, courtship behaviour, nesting egg laying, and parental care of Amphibians and Reptiles.
Intra species and Inter–species interaction.
Extinct, Endangered and Threatened Amphibians and Reptiles in Bangladesh and their causes of Decline (Red Data Book, CITES schedules,etc.).
Techniques Amphibians and Reptiles study and data analysis.
Intra and Inter- species interaction.
Social behaviour: Environmental influences upon behaviour.
Competition for resources and Communications.

Paper Code	313107	-------	Credits: 4	Class Hours: 120 hrs.
Paper Title:	**Ornithology**			

Classification, Faunal diversity and Taxonomic issues at generic and species, sub species level of the Birds.
Past and reference status and distributions of Birds species of the Oriental Region with special reference to Bangladesh.

(a) Avian adaptation to habitat diversity at micro and macro habitat levels. Macro- habitat (Biome)
(b) Micro – habitat of water fowls, wader / shore birds, other wetlands birds, forest birds of prey, game birds and cultivated land birds.

Adaption in relation to morphological and physiological features: Adaptation of birds in relation to mode of life, Flying and flying capacity.
Food and Feeding habits of beneficial and harmful birds: Insectivores, grainivores, frugivores, piscivores, nectar feeders and omnivorous birds.
Structural modification in relation to the food and feeding behaviour.
Habitats types, predation, feathers and flight, adaptations, flightless birds.

Breeding: Breeding seasons, courtship behaviour, nesting, egg laying, incubation hatching etc.
Intra and Inter-species interaction.
Social behaviour: Environmental influences upon behaviour.
Competition for resources and Communications.

Paper Code	313109	-------	**Credits: 4**	**Class Hours: 120 hrs.**
Paper Title:	**Mammalology**			

Classification and Faunal diversity and Taxonomic issues at generic and species level of the mammals.
Status and Distribution of Mammals of Bangladesh up to species level.
Adaption on relation to morphological and physiological features, Adaptive modification (Aquatic, terrestrial, arboreal and aerial habitats).
Food and Feeding Habits of mammals:Herbivores, carnivores, omnivores, predator and prey relationship.
Breeding behaviour and Biology: Breeding season's territory and home range, mating and gestation period and litter, lactation and parental care of major Taxonomic group of mammals.
Egg laying mammals and marsupial, arboreal and aquatic mammals.
Extinct, Endangered and Threatened mammals of Bangladesh and their cause of Decline.
Territoriality, flights, migration, dispersion and behaviour.
Habitat analysis and habitat restoration.
Intra and Inter- species interaction.
Social behaviour: Environmental influences upon behaviour.
Competition for resources and Communications.

Paper Code	313111	-------	**Credits: 4**	**Class Hours: 120 hrs.**
Paper Title:	**Wildlife Management**			

Management- principles and practices.
Planning and Monitoring process of wildlife management.
Salient features of wildlife preservation order, 1973, wildlife Management Laws and practices in Bangladesh.
Laws and conventions related to wildlife. Bangladesh wildlife Act, Forest Act 1927, Convention on Biological diversity (1992) Ramsar convention (1971).
Wildlife Trade: Convention on international Trade in Endangered Species of wild Fauna and Flora (CITES) (Traded animals,parts, products and derivatives), World trade market and CITES schedules.
Protected Areas of Bangladesh: History, Status, categories and Management, Co-management of protected areas IUCN threatened Categories, National Parks, Sanctuaries, Game reserves, Recreational parks, Wetlands, Forest.
Protected areas of Bangladesh, India and Pakistan.
Economic aspects of Wildlife Management: Tourism, Zoos and Safari parks, Museum, animal Farming and Captive Breeding, re-introduction of wildlife,wildlife, Cage/ Fencing, habitat, preparation and maintenance of wildlife for captive breeding.

Wildlife farming: Prospect and scope of wildlife farming in Bangladesh, general outline of wildlife farming, economic importance of wildlife farming, Frog farming, Turtle farming, crocodile farming in Bangladesh.
Human- Wildlife Conflict in Bangladesh and its mitigation:Cause, Impacts and potential solutions to human wildlife conflict (snake bite, crop damage by elephants and macaques, poultry damage by wild cats and jackals, human and cattle deaths by tiger etc.)
Role of wildlife in maintaining ecological balance.
Vertebrate pests and their management strategies.
Development activities and its impacts on Wildlife.
Introduction of exotic species and Impacts on indigenous species.
Deforestation monoculture forest and plantation and Animal Association.
Management of wildness areas Management of World Heritage Sites, Ramsar sites, UNESCO Biosphere Reserves, Trans-boundaryArrangements.
Introduction of filed equipment for wildlife study (Map. Compass, Binoculars, Rangefinder, Refractometer, Camera, GPS, Soil pH meteretc.).
Wildlife survey (planning, Sampling, direct and indirect methods).

Paper Code	313113	-------	**Credits: 4**	**Class Hours: 120 hrs.**
Paper Title:	**Wildlife Economy and Conservation Biology**			

Preliminary knowledge about wildlife of Bangladesh.
Scopes of conservation biology, valuing the wildlife biodiversity, threats to wildlife.
Conservation priorities, conservation strategies, establishing, designing and managing protected areas.
Ethics of conservation, priorities in conservation effort, conservation and rural development, role of culture and religion in conservation, National Conservation Strategy plan of Bangladesh.
Culture aspects of conservation, conservation of forest, wetlands and insular ecosystems.
Wildlife conservation and sustainable development, social forestry, fragmentation of population, plantation of indigenous species.
Invasive alien and exotic species.
Participatory approaches to wildlife conservation and conservation education.
Wildlife capture, transportation, care, wildlife handling.
Conservation of the threatened animals in –situ and Ex-situ conservation.
Epidemiology and Wildlife Zoonotic diseases in Bangladesh, parasites (Ecto and Endo), handling/ controlling and medication for wild animals.
Epidemiology of following Zoonotic diseases: Anthrax, Rabies, Nipah, Avian Influenza (H5N1, H7N9), parasitic infestation, Effects of overuse of antibiotics.
Integrated conservation and development approaches and techniques (Co-management counsel formation).
Wildlife education and awareness building strategies (Eco-tourism, Management of Zoo and Museum).
National and international organizations involved in wildlife conservation: WWF, IUCN, CITES, IPPL, SSC, CNPPA, WSB, etc.

Paper Code	313114	**-------**	**Credits: 6**	
Paper Title:	Thesis/Theory			

Paper Code	313116	**------**	**Credits: 2**	
Paper Title:	Viva-Voce			

Paper Code	313118	**-----**	**Credits: 6**	
Paper Title:	**Practical**			

Taxonomy: Classification and identification of Amphibia to Mammalia up to species level in museum and in the field.
Museum study: Morphological structures like toes, claws, webs, scales, fangs, feathers, scores counting, measurements, key characters etc.
Taxonomy of Museum Specimens: Amphibia, Reptiles, Birds and Mammals.
Food analysis of toads and frogs and available wild animals.
* Qualitative
* Quantitative and
* Volumetric.
Wildlife study techniques: Population census, transects and plot counting, age determination , collection, netting and trapping , killing , preservation and identification , tagging, marking, ringing, radio telemetry, time laps camera, hiding observatory.
Population study techniques:

a. Trapping and Marking of captured animals.
b. Census:
   (i) Transect lines (ii) Plot counting or sampling (iii) Dropping
   (iv) Pug marks (v) capture and Recapture (vi) Direct observation.

1. Collections,Killing andpreservation.
2. Application of biostatistician methods i.e. Standards.

Morphological Study: Dissection and incubation period, stages of embryological development, hatching and rearing.
Bio-statisticalstudy: Date collection and recording Standard Deviation, Mean, Average, carrying capacity.
Viva voce including all class records.
Book review, Library survey of Dhaka city, Newspaper cutting.
Preparation of reports.

M. Sc. Final Practical Examination, 2014 (Group –A)
Wildlife Biology Branch

Day	Question no.	Experiments and reports	Marks
1st	01	Identify the Specimens : (a-j)	10×3=30
	02	Comments on the Specimens : (a-e)	5×3=10
	03	Find out the percentage of the specimens supplied	10
	04	Write a report on the systematic of the specimens supplied (Books will be supplied)	10
2nd	05	Identify the hair supplied.	10
	06	Study the specimens supplied and point out their taxonomic characters at the generic and species level.	20
	07	Field study. Visit the area specified and a report on the birds/ other wildlife giving – (a) Date (b) Weather (c) Topography (d) Ecological Conditions (e) Identifications Spp. And (f) Population status.	15
3rd	08	Write an ecological account of the area specified	15
	09	Analysis the stomach / pallet contents supplied and prepare a report.	15
	10	Dissect and display the alimentary canal/ Reproductive system of the specimen supplied.	10+5=15
4th	**Viva voce**	Class records (Collection), Practical Note Book	10
		Special Report (to be submitted as directed)	10
		Viva voce	30

Books Recommended

- G. Cubitt and G. Mountfort, 1985. Wildlife – The Wildlife and Sanctuary of India and Nepal. William Collins Sons. Co. Ltd London.
- S.H. prater. 1971. The Book of India animals (2) BNHS Oxford Univ. Chicago press.
- J. C. Daniel. 1983. The Book of Indian Reptiles, Bombay Nat.Hist. Soc. Bombay
- R. Whitaker. 1978. Common Snakes of India , Macmillan Co. India
- R.H. Giles 1971. Wildlife management Techniques. The Wildlife Society, Washington, D.C.
- M.A.R. khan 2010. Wildlife of Bangladesh – A Checklist. Sahitya Prakash, Dhaka
- M.M.H. Khan 2008, protected Areas of Bangladesh – A guide to wildlife. Bangladesh Forest Dept. Dhaka
- M. Bolton (Editor), 1997. Conservation and the Use of Wildlife Resources. Chapman & Hall.
- R.M. DeGraff and R.I. Miller (Editors). 1996. Conservation of Faunal Diversity in Forested Landscapes. Chapman 7 Hall.

Paper Code	313120	**-----**	**Credits: 2**	
Paper Title:	Viva-Voce			

Fisheries Branch

Paper Code	Paper Title	Credits
313101	Advance Biology	4
313115	Fish Taxonomy, Fish Physiology and Ichthyology	4
313117	Fish Biology, Aquaculture nutrition and Population dynamics	4
313119	Fish Ecology, Fish limnology and Oceanography	4
313121	Aquaculture and Fisheries Technology & Harvesting	4
313123	Fish Processing &Handling, Fisheries resources & Management and Extension, Economics, Rural sociology, Marketing &Cooperation	4
313125	Fish Genetics and Fish Pathology & Parasitology	4
313122	Thesis/Theory	6
313124	Viva-Voce	2
	Or	
313126	Practical	6
313128	Viva-Voce (Field record and practical Note Book) Practical Group = A, Thesis Group = B	2
	Total =	**36**

Detailed Syllabus

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[Common compulsory paper for Wildlife Biology, Fisheries &Entomology group]

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Legislation: National & International Convention Case study of Biodiversity and Resource Management, Coral Reefs, Tropical Rain Forest, Mangrove Forest.

C. Human Ecology, Population Ecology & Genetic Ecology

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Human types and their physical features, distribution and mode of living in relation to social, cultural, religious and other activities Ecological impacts on Man's physical features, social and cultural life. Impacts of Human population on environment
Development activities and their impacts on environment.
History of Agriculture revolution, industrial revolution and green revolution.
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Population Growth Forms: J and S-shaped growth forms
Population Interactions: Coexistence, competition, Predation and plant- herbivore interaction.
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3. J. Turk, J. Witters, R. Witters and Turk. Ecosystems, Energy. Population. W.B. Saunders Company. Philadelphia, London.
4. B. Groombride and M. D. Jenkins. 1996. Assessing Biodiversity Status and Sustainability. WCWC.
5. K. J. Gaston and J. I. Spicer. 1998. Biodiversity: An Introduction Blackwell Science.
6. M. Jeffries. 1997. Biodiversity and Conservation. Routkedge
7. J. Trewek. 1999. Ecological Impact Assessment. Blackwell Science
8. M. Liddle. 1997. Recreation Ecology: The Ecological Impact of Outdoor Recreation and ecotourism. Chapman & Hall.
9. G.W. Suter. 1993. Ecological Risk Assessment Lewis, USA
10. Instant Basics, Dr. M.A. Basher, 2004, Positron publication, Bangla Bazar, Dhaka.
11. B‡KvjwR I cwi‡ek, `~lY, kvnAvjgbexGes G. †K. Gg. dRjyjKwig †Pxa~ix 2003, ZvRjvB‡e^{a}ix, PÆMÖvg|

Paper Code	313115	-------	Credits: 4	Class Hours: 120 hrs.
Paper Title:	Fish Taxonomy, Fish Physiology and Ichthyology			

Fish Taxonomy:
Principles & techniques of systematic study.
Collection, preservation, taxonomic procedures, **meristic of now meristic studies.**
Classification of Crustaceans & mollusks up to order
Classification of fishes uptofamily.

Fish Physiology:
Osmoregulation
Reproduction
Endocrine organs, their secretions & functions
Physiology of digestion, circulations & respiration (including accessory respiration)
Sensory organs.

Ichthyology:
Structural modification of fish for aquatic adaptation
Migration of fishes including shoal & school)
Seasonal Changes in fishes
Developmental adaptations, physiological & energetic adaptations.

Paper Code	313117	-------	Credits: 4	Class Hours: 120 hrs.
Paper Title:	Fish Biology, Aquaculture nutrition and Population dynamics			

Fish Biology:
Principles & techniques in biological studies of fish.
Biological study of food & feeding habit
Growth condition, factors &meristic relationship
Maturation & spawning habit
Fecundity
Life of *Labeo rohita, tenualosa ilisha, Clrias batrachus*
Anabastestudineus&Macrobrachium rosenbergii

Aquaculture nutrition:

Qualitative& quantitative requirements of proteins, fat & energy of fish.
Feed preparation -formulation, handling & storage
Feed strategies for carps & shrimp, environmental issues on fish feed used for aquatic systems.
Factors influencing feeding behaviour, feed types, feeding method
Net protein utilization
Growth rate & histological parameters of a healthy herbivore (*Labeo rohita*)& Carnivore (*Chana punctatus*)

Population dynamics:

Estimation of population size & measurement of abundance
Age & growth estimation of growth parameters
Estimation of survival & mortality rates
Stock assessment (with tools &analysis), Stock recruitment
Theory of fishing
Tagging & Marking-types & techniques
Production &analysis of exploited population
Problems of over and under fishing

Paper Code	313119	-------	**Credits: 4**	**Class Hours: 120 hrs.**
Paper Title:	**Fish Ecology, Fish limnology and Oceanography**			

Fish Ecology:
Aquatic ecosystem
Ecological classification marine, estuarine & fresh water
Ecological (special reference to Bangladesh)
Interrelationship between fish & their biotic – abiotic environment
Impacts of man's activities on ecosystem.

Fish limnology:
Introduction of physicochemical & biological limnology.
Hydrological cycles
Limnological problems in fish culture in lentic & lotic water
Eutrophication
Sediments & its physio–chemical characteristics.
Plankton -spatial and seasonal distribution
Benthos
Productivity of water bodies & food chains

Oceanography:
Introduction to oceanography
Origin & history of ocean basins, continental shells &slopes,
Zonation of sea
Topography, sediment formation of ocean bottom
Mixing process of oceans
Water actions inter water tides, currents,eddidiffusion
Upwelling & tsunami
The role of ocean in global warning.
Effect of climate change in world oceans.

Paper Code	313121	-------	**Credits: 4**	**Class Hours: 120 hrs.**
Paper Title:	**Aquaculture and Fisheries Technology & Harvesting**			

Aquaculture:
History & scope
Aquaculture techniques for finfish& shell fish
Hatcheries –type, essential components, fry production methods. Water quality monitoring, water supply& treatment.

Site selection &construction of inland and coastal fisheries habitat
Species selection, stocking densities & ratio used in Carp culture.
Induced spawning – Egg handling & incubation, fry rearing.
Transportation of live fry, fingerlings & brood fishes.
Composite culture
Mariculture
Coastal and open sea fish & shell fish firming.
Ornamental fish culture techniques
Genetics &hybridization.

Fisheries technology & harvesting:
Principles of fishing
Fishing gears – trawls, nets & longlines & their operations.
Fish crafts – types and operations
Methods of harvesting of bottom, mid water & surface fisheries
Plankton monitoring, echo-sounding.

Paper Code	313123	**-------**	**Credits: 4**	**Class Hours: 120 hrs.**
Paper Title:	**Fish Processing & Handling, Fisheries Resources & Management and Extension, Economics, Rural sociology, Marketing & Cooperation**			

Processing &Handling:
Principles and methods of fish preservation and processing
Refrigeration, canning, curing, drying, salting, smoking & pickle
Post mortem changes, Spoilage &contamination.
Handling & transportation.
Fisheries byproduct
Quality control and methods of examining fish products –HACCI
Design of a cold storage & fish processing plant.

Fisheries resources &management:
Fisheries resources of Bangladesh and its role in economy.
Issues & threats to fisheries resources, causes for decline in it.
Concepts & principles of fisheries management open, estuarine& marine
Role of government, autonomous & voluntary organization
Fish conservation Act & New fisheries management policy
Community based fisheries management.

Extension, Economics, Rural sociology,Marketing &Cooperation:
Principles, objectives & methods of extension
Basic element, panning and evolution of extension works in Bangladesh
Fisheries economy contribution to national economy, nutrition, & employment
Socio economics & livelihood standard of fishermen
Marketing within and abroad Concept, present status
Fish production Statistics of Bangladesh
Co-operative – present status & future prospect of it in Bangladesh

Paper Code	313125	-------	Credits: 4	Class Hours: 120 hrs.
Paper Title:	Fish Genetics and Fish Pathology & Parasitology			

A. Fish Genetics:

Phenotypes:Chromosomes and fertilization; colour, scale patterns, body and fin shape, variance and selection.

Sex determination: inheritance associated with sex, sex determination, sex-linked and sex-limited inheritance in fishes.

Chromosomal manipulation: sex reversal, mono sex population, polyploidy, gynogenesis, hybrids, inbreeding, dominant genetic hybridization, cross-breeding, heterosis, genetic drifts, hybridization and its advantages & disadvantages, gene and transgenic fishes.

Concepts of cryopreservation: protocol, preparation of extender and diluent, equilibration, ampouling, freezing, sorting, thawing. Insemination and post insemination management.

B. Fish pathology & parasitology:

Concept of fish pathology & parasitology

Diseases of fish – cause, mode of infection, pathogenicity,

Symptoms & control measures of – bacterial, viral, fungal,

Noninfectious, nutritional environmental.

Cause, mode of infection, life cycle, etiology symptoms & control measures of parasites of fishes.

Quarantine & certifications

Paper Code	313122	-----	Credits: 6	
Paper Title:	Thesis/Theory			

Paper Code	313124	-----	Credits: 2	
Paper Title:	Viva-Voce			

Paper Code	313126	----	Credits: 6	
Paper Title:	Practical			

Taxonomic identification of 15 freshwater and 15 marine fishes (06 Chondricthyes and 09 Osteichthyes) of Bangladesh

Taxonomic identification of freshwater and marine crustaceans and molluscs of Bangladesh

Study of planktonic and benthic fauna of water body and making a report on its productivity

Study of fish pathogens from diseased fish

Study of mouth structure of fish in relation to food and feeding habits

Study of fishing gears & crafts

Study of fish bones

Determination of age of fish and making comment on growth of fish in relation to length and weight

Dissection of digestive, circulatory, respiratory, nervous, reproductive and muscular system of fishes, crustaceans and molluscs

Preparation and submission of class records

Field report on Marine habitat, and Estuarine and freshwater fish cultures

M. Sc. Final Practical Examination, 2014 (Group –A)

Fisheries Branch

Day	Question no.	Experiments and reports	Marks
1st	01	One crustacean, mollusk and one fish dissection (Dissection 8 + Display 2 + Drawing and labeling 4 =14)	14×3=42
	02	Identification of pathogen from diseased fish	3×2=06
	03	Identification of Crustacean 2, Mollusc 2, Parasite w2, Gear / Crafts 2, Chondricthyes 2, Osteichthyes 2, Fish bone 2	14×2=28
2nd	04	Taxonomic study of fish (Chondricthyes 1, Osteichthyes 1	10×2=20
	05	Study of freshwater (micro 5, Benthos 2) and report on productivity	7×2=14
3rd	06	Taxonomic study of crustacean and Mollusc	10+10=20
	07	Study of food and feeding habit of fish (1 specimen)	05
	08	Determination of age by studying scale and making comment on growth in relation to length and weight (Figure 2, discussion and comment 8)	10
	09	Submission of a skeleton of fish	05
4th	**Viva-Voce**	Taxonomy and practical note book	10
		Excursion and field report	10
		Viva voce	30

Paper Code	313128	**-----**	**Credits: 2**	
Paper Title:	Viva-Voce			

Entomology Branch

Paper Code	Paper Title	Credits
313101	Advance Biology	4
313127	Insect Morphology and Insect Taxonomy	4
313129	Insect Physiology and Insect Embryology	4
313131	Insect Ecology and Insect Behavior	4
313133	Medical Entomology and Veterinary Entomology	4
313135	Toxicology, Agricultural and Forest Entomology and Pest Management	4
313137	Insect Genetics and Molecular Biology	4
313130	Thesis/Theory	6
313132	Viva-Voce	2
	Or	
313134	Practical	6
313136	Viva-Voce (Field record and practical Note Book) Practical Group = A, Thesis Group = B	2
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Detailed Syllabus

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[**Common compulsory paper for Wildlife Biology, Fisheries &Entomology group]**

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Conservation and Management Strategies including ex situ and in situ
Legislation: National & International Convention Case study of
Biodiversity and Resource Management, Coral Reefs, Tropical Rain
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Human types and their physical features, distribution and mode of living in relation to social, cultural, religious and other activities Ecological impacts on Man's physical features, social and cultural life. Impacts of Human population on environment
Development activities and their impacts on environment.
History of Agriculture revolution, industrial revolution and green revolution.
Impacts of scientific and technological development on Human ethics.

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Group properties of population: Density, natality, mortality, biotic potential, age distribution, dispersion.
Concept of Carrying Capacity
Population Growth Forms: J and S-shaped growth forms
Population Interactions: Coexistence, competition, Predation and plant- herbivore interaction.
Life Table: Definition, types, construction and analysis.

Genetic Ecology:
Importance of Genetic Ecology
Patterns of Genetic Variation
-External Influence
-Isolation of populations
-Ecotype and Clines.

Books Recommended:

1. E. J. Milner – Gulland and R. Mace. 1998. The Conservation and Use of Biological Resources. Blackwell Science.
2. A Dobson. 1996. Conservation and Biodiversity. Scientific American.
3. J. Turk, J. Witters, R. Witters and Turk. Ecosystems, Energy. Population. W.B. Saunders Company. Philadelphia, London.
4. B. Groombride and M. D. Jenkins. 1996. Assessing Biodiversity Status and Sustainability. WCWC.
5. K. J. Gaston and J. I. Spicer. 1998. Biodiversity: An Introduction Blackwell Science.
6. M. Jeffries. 1997. Biodiversity and Conservation. Routkedge
7. J. Trewek. 1999. Ecological Impact Assessment. Blackwell Science
8. M. Liddle. 1997. Recreation Ecology: The Ecological Impact of Outdoor Recreation and ecotourism. Chapman & Hall.
9. G.W. Suter. 1993. Ecological Risk Assessment Lewis, USA
10. Instant Basics, Dr. M.A. Basher, 2004, Positron publication, Bangla Bazar, Dhaka.
11. B‡KvjwR I cwi‡ek, `~lY, kvnAvjgbexGes G. †K. Gg. dRjyjKwig †Pxa~ix 2003, ZvRjvB‡e^{a}ix, PÆMÖvg|

Paper Code	313127	-------	**Credits: 4**	**Class Hours: 120 hrs.**
Paper Title:	**Insect Morphology and Insect Taxonomy**			

A. Insect morphology:

Body wall: Structure and derivatives
Head: Types, segmentation, sutures and areas
Mouth parts: Types, modifications, and feeding adaptations
Wing: Structure, venation and modifications
Muscles: structure and types
Morphology of alimentary canal; filter chamber
Circulatory system: haemocytes and types
Respiratory systems: Terrestrial, aquatic and end parasitic insects: Structure and types of spiracles
Excretory system: Types of Malpighian tubules; cryptonephridia
Nervous system and various sense organssound and light producing organs
Reproductive system

B. Insect Taxonomy

Principles of insect classification: detailed classification of insect orders and suborders
Description of ordersand principal families includingtheir morphology, diagnosis habit, habitats and reproduction
Biological notes of principal insect orders
Economic importance of major insect order and families
Collection and preservation of insects

Paper Code	313129	-------	Credits: 4	Class Hours: 120 hrs.
Paper Title:	Insect Physiology and Insect Embryology			

A. Insect Physiology:

Physiology of digestion; dietary requirements of insects; the role of micro-organisms in insect nutrition and digestion
Circulatory system: Structure and physiology of circulation, haemocytes and plasma
Hormones and physiology of moulting
Exocrine glands, pheromones and defensive secretions

Tracheal system and respiration in terrestrial insects; respiration in aquatic and endoparasitic insects
Excretion: salt and water regulation: physiology of excretion
Physiology and integration of nervous system
Eye and vision; light production

B. Insect Embryology:

General concepts of embryology
Branches of embryology
Insect eggs
Egg maturation
Vitellogenesis
Metamorphosis: Incomplete and complete metamorphosis
Role of hormones in inset development and metamorphosis
Unusual types of development-viviparity, parthenogenesis, and paedogenesis

Paper Code	313131	-------	Credits: 4	Class Hours: 120 hrs.
Paper Title:	Insect Ecology and Insect Behavior			

A. Insect ecology:

Introduction; ecological factors affecting insect life, abundance and development; impact of weather and climate on the life of insects
Insect dispersal and migration
Photoperiodism
Diapause & cold-hardiness
Trophic relationship
System analysis
Population dynamics

B. Insect behaviour:

Basic responses and patterns of behaviour: Innate behaviour, reflexes, kineses and taxes; learned behaviour; habituation, associative learning, latent learning, insight learning
Behavioural periodicity and clocks
Functional aspect of behaviour
Displacement
Orientation, navigation and homing

Communication: chemical communication, audio-communication, visual communication, tactile communication, interspecific communication
Reproduction: mate location, rivalry and terristoriality; courtship
Host selection and feeding: host selection by phytophagous insects, host selection by blood feeding insects, host selection by entomophgous insects
Defense: Behaviouraldefense, structural defense, chemical defense, colourational defense (e. g. cryptic colouration, flash patterns, warning colouration, mimicry and group defense
Social behaviour (honey bee, termites, ants and wasps)

Paper Code	313133	-------	**Credits: 4**	**Class Hours: 120 hrs.**
Paper Title:	**Medical Entomology and Veterinary Entomology**			

A. Medical Entomology:

Concept, history and objectives of medical entomology
Medical importance of Arthropoids and Arthropod borne diseases
Concept of vectors, Mode of transmission of pathogen by insect vectors
Life cycle of pathogen, symptoms, prevention and control measure of following diseases: a) malaria, b) filariasis, c) leishmeniasis and d) dengue fever
Medical importance of the following:

a) Ticks b) mites, c) mosquitoes d) cockroaches e) scorpions and f) spiders

Morphological characteristics, life history, host-parasite relationship and control measure of the following insects:

a) Housefly b) sand fly c) tsetse fly d) bedbug and e) lice

Brief outline of forensic entomology and maggot therapy

B. Veterinary Entomology:

Concept, history and importance of veterinary entomology. Relationship and veterinary entomology with other branches of entomology.
Identifying characteristics, life history, host- parasite relationship and control measure of following:

a) Stable fly b) horse fly c) blow fly d) deer fly and e) beetles.

Pathogenesis, clinical signs and symptoms, diagnosis, treatment, prevention and control of following diseases:

b) Foot and mouth disease b) rotavirus infection c) brucellosis d) babesiosis e) rabies and f) theileriasis.

Concept of zoonosis. Brief outline of following zoonotic diseases:

c) Anthrax b) avian influenza c) plague d) cow pox and e) nipah fever.

Recommended Readings

Lane, R. P. and R.W. Crosskey. 1993. Medical Insects and Arachnids. Chapman & Hill, London.
Mullen, G. and L. Durden, 2002. Medical and veterinary Entomology. Academic press, London.
Service, M.W. 1995. Medical Entomology for students. Chapman and Hall, London.
Soulsby, E. J.L. 1986. Helminthes, Arthropods and protozoa of Domesticated Animals. English Language Book Society, William Clowes Ltd, London.
Urquhart, K.M, J. Armour, J. L. Duncan, A. M. Dunn, and, F. W. Jennings. 1996. Veterinary parasitology. Blackwell Science Ltd. USA.

Kamaruddin, K.M. 2007. Handbook on Livestock and poultry Diseases in SAARC Countries. Prakash Printing and packaging, Panthapath, Dhaka- 1205, Bangladesh.

Paper Code	313135	-------	Credits: 4	Class Hours: 120 hrs.
Paper Title:	**Toxicology, Agriculture and Forest Entomology and Insect Pest Management**			

A. Toxicology:

Classification of toxic compounds.

Inorganic insecticides: arsenic, fluorine, lead and sulfur compounds: method of use and mode of action of these compounds.

Synthetic organic insecticides; chlorinated hydrocarbons, organophosphates, carbamates; systematic insecticides for plants and animals.

Organic insecticides of plant origin; pyrethrines, nicotine, rotenone source, use and mode of action of these compounds.

Fumigants: methyl bromine, HC, chloropicrin, carbon tetrachloride, ethyl dibromide –use, mode of action and general precautions to be followed in fumigation.

Miscellaneous chemicals: attractants, repellants, antifeedants, chemosterilants, insect growth regulators and synergistic compounds.

Insecticides resistance including detoxification mechanisms.

Formulation of insecticides.

B. Agriculture and Forest Entomology:

General information on insects relatedto agricultural crops, stored grains, grain products, vegetables, fruits and forest trees

Status of insect pest in relation to agro-ecological changes

Biology, life history, nature of damage and control measures of the following:

Rice pests: brown plant hopper,yellow stem borer, rice hispa, ear-cutting caterpillar

Jute pests: jute hairy caterpillar, jute stem weevil

Tea pest; tea mosquito bug, yellow tea mite

Potato pest; potato tuber moth

Brinjal pest; brinjal fruit and shoot borer

Sugarcane pest; sugarcane top shoot borer

Fruit pest: melon fruit fly

Stored product pests; red flower beetle, rice weevil, pulse beetle

Dry fish pest: hide beetle

Forest tree pests: termite, wood borer, defoliators

C. Insect Pest Management:

Introduction; concept of pest and pest management, types of pest, causes of pest problem, strategies and tactics of pest management

Pest control measures:

Chemical control: various methods, merits and demerits

Biological control: various agents, merits and demerits

Hormonal control; historical background, various hormones used in insect control

Genetic control; sterile insect technique and autocidal control techniques

Forecasting pest outbreak; concept, causes, directions for predictions of forecasting outbreak

Integrated Pest Management (IPM): integrated tactics, steps, advantages, disadvantages and status in Bangladesh

Sampling techniques: types, common sampling techniques, assessment of pest infestation in field

Insect pest-plant interaction; types, insects and host plant resistance, insect weeds and crop interactions, insect pollinator-plant interactions

Paper Code	313137	-------	**Credits: 4**	**Class Hours: 120 hrs.**
Paper Title:	**Insect Genetics and Molecular Biology**			

A. Insect Genetics:

Introduction; concept, scope and applications

Sex-linked inheritance: definition, kinds of sex linked genes, sex linked inheritancein *Drosophila*

Sex determination in insects:

a. *Drosophila* and *Lucilia*

b. Hymenoptera: Hone bee

c. Orthoptera: grasshopper

B. **Molecular Biology**:

Molecular basis of development: oocyte formation, embryogenesis and postembryonicdevelopment in D. melanogaster.

Molecular basis of behaviour: biological / photoperiodic clock, learning and memory, odour behavior, courtship behaviour

Genetics of insect resistance: types and mechanisms (biochemical, genetic and detoxification)

Transgenic insects: transformation methods, application and controversies.

Insect transposable elements: types transposition methods, application

Recommended Readings

Denholm, I.1999. Insecticide Resistance from Mechanism to Management. Prentice and Hall. London.

Elsevier. 2003. Insect Molecular Genetics, An Introduction to principles and Applications.

Elsevier. 2005. Comprehensive Molecular Insect Science. Oxford

Glick, B. R &Pasternak, jj. 1998. Molecular Biotechnology: principles and Applications of Recombinant DNA. ASM Press Washington DC

Hoy, M.A. ---- Insect Molecular Genetics. Elsevier Science, Santiago, California.

Tlo, D.& Webber, B. 1992. Insecticides Mechanism of Action of Resistance. Intercept Ltd. UK.

Paper Code	313130	**----**	**Credits: 6**	
Paper Title:	Thesis/Theory			

Paper Code	313132	**------**	**Credits: 2**	
Paper Title:	Viva-Voce			

Paper Code	313134	**-----**	**Credits: 6**	
Paper Title:	**Practical**			

Taxonomy:
Collection, identification and preservation of insects. Students will have to submit their insect collections at the time of the practical examination. For common and economically i88mportant insects, identification up to species level is essential.
Techniques for insect collection and preservation
Aquatic insects of all stages; study and preparations of report.

Morphology:
Dissection of common insects for the study of their major systems, preparation of whole mounts of minute insects and insect parts.

Physiological experiments:
Coagulation of blood haemocytes, blood circulation

M. Sc. Final Practical Examination, 2014 (Group –A)

Entomology Branch

Day	Question no.	Experiments and reports	Marks
1st	01	Dissection- (dissection 9 and display 3 +drawing and labeling 4)	16×1=16
	02	Temporary mount-(dissection and mounting 6+ staining 2 + drawing and labeling 4)	10×1=10
	03	Collection and identification of terrestrial insects and report writing	10+6=16
2nd	04	Spotting (10 specimens ×2)	10×2=20
	05	Identification of economically important insects	10×2=20
	06	Taxonomy up to family, 2 specimens	2×6=12
3rd	07	Taxonomy up to genus, 2 specimens	2×8=16
	08	Taxonomy up to species, 1 specimen	1×10=10
	09	Collection and identification of different stages of aquatic insects, and preparation of a report	10+4=14
	10	Collection box submission	14
4th	**Viva voce**	Taxonomy and practical note book	10
		Excursion and field report	10
		Viva voce	30

Paper Code	313136	**Marks: 50**	**Credits: 2**	
Paper Title:	Viva-Voce			