

NATIONAL UNIVERSITY



Fourth Year Syllabus Department of Zoology

Four Year B.Sc. Honours Course
Effective from the Session: 2013–2014

National University
Syllabus for Four Year B.Sc. Honours Course
Subject: Zoology
Effective from the Session: 2013-2014
Year-wise Papers and marks distribution

FOURTH YEAR

Paper Code	Paper Title	Marks	Credits
243101	Applied and Economic Zoology	100	4
243103	Genetic Engineering and Biotechnology	100	4
243105	Biostatistics and Research Methodology	100	4
243107	Microbiology and Radiation Biology	100	4
243109	Parasitology	100	4
243111	Entomology	100	4
243113	Fisheries Biology	100	4
243115	Wildlife Biology	100	4
243116	Zoology Practical-IV	100	4
243118	Viva-voce	100	4
	Total =	1000	40

Detailed Syllabus

Paper Code	243101	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Applied and Economic Zoology			

- 1. Apiculture:** Concept and scope, profiles of honey producing bee species in Bangladesh, bee-flower relationship, bee-keeping, types of hive and their management, honey processing and marketing, diseases of bees and their management.
- 2. Sericulture:** Concept and scope, varieties of silkworm and their host plants, techniques of silkworm rearing, silkworm diseases and pests and their control.
- 3. Lac culture:** Systematic position and distribution of lac insects, host plants of lac insects.
- 4. Carp culture:** Types of culture, carp culture including induced breeding of carps in ponds.
- 5. Prawn culture:** Types, techniques and management.
- 6. Pearl culture:** Profiles of pearl-producing species, culture techniques.
- 7. Mericulture:** Concept and scope.
- 8. Aquaculture:**
 - a) Components of a hatchery, fish ponds, shrimp farms, cages and pens
 - b) Pond culture: Types, soil and water quality, pond preparation, species selection, stocking density and management techniques of carp, mass production of fry and fingerlings, brood fish.
- 9. Integrated fish farming:** Poultry, livestock and paddy-cum-fish culture; open water stocking in haors, baors, beels and floodplains.
- 10. Dairy farming:** Concept and scope, components of a dairy farm, major dairy farms in Bangladesh.
- 11. Poultry farming:** Varieties of fowls and ducks, techniques of poultry farming, major diseases of poultry and their control.

Books Recommended

1. Dennis S. Hill. 1997. *The economic importance of insects* (1st edition) Chapman and Hall, London
2. P. Southgate and J. Lucas (Editors). 1998. *Aquaculture Fish and Shellfish Farming* Fishing news
3. A. Midlen and T.A. Reading 1998. *Pollution Control and Environmental Management for Aquaculture*. Chapman & Hall
4. D.J. Baird. M.C.M. Beveridge. L.A. Kelly and J.F. Muir 1996. *Aquaculture and Water Resource Management* Fishing News
5. C.G. Scalet L.D. Flake and D.W. Willis. 1996. *Introduction to Wildlife and Fisheries: An Integrated Approach* W.H. Freeman
6. G.L. Hoff; A. Fairbrother and L.N. Locke (Editors). 1996. *Noninfectious Diseases of Wildlife*. Manson
7. M. Huet. 1986. *Text book of Fish culture-Breeding and Cultivation of Fish* (2nd Edition. Fishing News Books

8. P.H. Mine 1979 *Fish and Shellfish Farming in Coastal Waters*. Fishing News Books Ltd. England
9. J.E. Bardach; J.H. Ryther and W.O. McLaren 1972. *Aquaculture the Farming and Husbandry of Freshwater and Marine Organisms*. John Wiley & Sons.

Paper Code	243103	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Genetic Engineering and Biotechnology			

Genetic Engineering (50 marks)

1. Concepts and scopes of genetic engineering
2. Recombinant DNA technology
3. Extraction and preparation of genes
4. Plasmid vectors
5. Recipients of foreign genes
6. Production of insulin by genetically engineered *Escherichia coli*
7. Use of genetic engineering technologies in industries
8. Microinjection technology and creation of transgenic animal
9. Principles, techniques and applications of gene cloning
10. Human genome project

Biotechnology (50 Marks)

1. History, concepts and scopes of biotechnology
2. Processes and products in biotechnology
3. Biotechnology and microorganisms
4. Microbial screening, selection and strain improvement
5. Primary and secondary metabolism; primary and secondary metabolites in biotechnology
6. Fermentation technology in food production and brewing; lactic acid fermentation; alcoholic fermentation
7. Yeast cloning
8. Enzyme technology: industrial production of enzymes, immobilized enzymes, production of antibiotics
9. Biosensors
10. Recombinant DNA in food industry
11. Medical biotechnology: Monoclonal antibodies and their applications; methods in diagnosis of genetic diseases and gene therapies; antibiotic resistance

Books Recommended

1. S.M. Kingsman and A.J. Kingsman. *Genetic Engineering*
2. A. Wiseman. *Principles of Biotechnology*
3. S.B. Primrose. *Modern Biotechnology*
4. B. Robson and J. Garnier. *Introduction to Proteins and Protein Engineering*
5. S.B. Primrose. *Principles of Gene Manipulation*
6. D.M. Glover. *Principles of Gene cloning*
7. J. Bullock and B. Kristeansen. *Basic Biotechnology*

Paper Code	243105	Marks: 100	Credits: 4	Class Hours: 60 hrs.
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Biostatistics (50 marks)

1. Introduction, definition and scope of biostatistics.
2. Variables, data, population and observation.
3. Frequency distribution, histogram and polygon.
4. Measurements of central tendency: Mean, median and mode.
5. Z-test and its significance.
6. Measures of dispersion: Range, variance, standard deviation and standard error.
7. Hypothesis tests: Concept and interpretation of a hypothesis test, null and alternative hypothesis, critical region, one-tailed and two-tailed tests.
8. Student t-distribution: t-test for single mean and for difference of means.
9. Chi-square test of goodness of fit and contingency tables.
10. Regression and correlation: Scatter diagram, analysis of linear regression; estimation of correlation coefficient-r, its use, interpretation and limitations.
11. F-statistics: F distribution, one way analysis of variance (ANOVA), F-table, F-test for equality of population variance: multiple range test (MRT).
12. Probit analysis.
13. Sampling.

Research Methodology (50 marks)

1. **Introduction:** Meaning of research, objectives of research, research processes, criteria for good research, problems encountered by researchers in Bangladesh.
2. **Defining research problem:** Selecting research problem, techniques involved in defining a problem.
3. **Research design:** Need for research design, basic principles of experimental designs, different research designs, developing a research plan.
4. **Sampling design:** Steps in sampling designs, characteristics of a good research design, different types of sampling designs, how to select a random sample? Research conclusion, references, and summary/abstract.
5. **Use of biological records, biological abstracts, e-resources.**
6. **Use of GIS in biological research.**
7. **Bioinformatics:** Retrieval of literature and information databases; software for biological studies.
8. **Scientific Report Writing:** Title, by line, abstract, Key words, introduction, acknowledgements, study area, material and methods, results, discussion and literature Cited (reports should also contain tables, photographs, illustration and maps).

Books Recommended

1. Robert G.D. Steel and James II. Torrie. *Principles and Procedures of Statistics*
2. W.G. Cochran. *Sampling Technique*
3. C.R.Kottari. 1990. *Research Methodology: Methods and Techniques (2nd ed.)* Ram Printograph. Delhi
4. D.V. Huntsberger and B. Billingsley *Elements of Statistical Inference*
5. R.Sokal and J.Rohlf. *Biometry*

6. J.Rohlf and R.Sokal. 1994. *Statistical Tables* WH Freeman

Paper Code	243107	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Microbiology and Radiation Biology			

Microbiology (50 marks)

1. Definition and scope of microbiology.
2. Types of microorganisms in the living world.
3. Virus: Discovery, structure and types, multiplication (replication), viral diseases and their mode of transmission.
4. Bacteria: Structure and types, gram positive and gram negative bacteria, nutrition of bacteria, bacterial culture – growth and death sequences, bacterial multiplication, bacterial disease and their mode of transmission.
5. Rickettsiae, mycoplasma and actinomycetes: Discovery, structure and importance.
6. Soil, food and industrial microbiology: Composition and their uses.

Radiation Biology (50 marks)

1. Concepts and types of radiation and detectors.
2. Radioisotopes and their uses in biological, agricultural and medical researches.
3. Use of radiation in food preservation and protection.
4. X-ray, scanning, MRI, fMRI and its uses in biological and medical sciences.
5. Personal safety in radiation chambers.
6. Biological hazards of radiation.
7. Nuclear research facilities of food, agriculture and Medicine in Bangladesh: Mission and activities.

Books Recommended

1. F.C. Cunny. *Aim and Scope of Disaster Management*. Asian Institute of Technology, Bangkok, Thailand
2. M. Saidur rahman. 1992. *Diaster management Handbook for Bangladesh Vols I-V*. Bangladesh Diaster Preparedness Centre, Dhaka
3. C.W. Nick 1991. *Disaster management A Diaster managers Handbook*. Asian Development Bank (ABD), Manila, The Philippines
4. C.F. Norton 1981. *Microbiology*. Addition Wesley Publ. Co., California, USA.
5. M.R. Chowdhury 1996. *Modern Medical Microbiology*. Mohammad Iqbal, Dhaka, Bangladesh.
6. M.T. Pelezar, R.D. Reid and E.C.S. Chan 1993. *Microbiology: Concepts and Applications*. Tata McGraw Hill Inc., India.
7. R. Annanthanarayan and C.K.J. Paniker 2000. *Textbook of Microbiology*. Orient Longman Pvt. Ltd., India.

Paper Code	243109	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Parasitology			

1. Concepts of parasites and parasitism: Scope of parasitology.
2. Parasitic adaptation and Host-parasite relationship. Quantitative study of host-parasite relationships.
3. Life cycles: Reproduction and developmental stages of Protozoa to Helminthes. Illustrations of one, two and three host life cycles.
4. Epidemiology: Basic concepts, incidence, prevalence, intensity, abundance, control measures and designs of control measures.
5. Human diseases caused by parasites: Morphology and life cycle of the causal organisms, and pathogenicity, epidemiology and control of leishmaniasis, trypanosomiasis, filariasis, dengue, black fever, schistosomiasis, taeniasis, hookworm diseases, enterobiasis and plague.
6. Zoonosis: Concepts and scope; zoonotic diseases in Bangladesh.
7. Parasites of livestock, poultry and fish: Clinical and histopathological effects; major parasitic diseases of livestock, poultry and fish in Bangladesh and their control.

Books Recommended

1. T.C. Cheng 1973. *General Parasitology*. Academic Press London
2. T.C. Cheng (Editors). 1971. *The Biology of Symbiosis*. Butterworths London
3. G.D. Schmidt and L.S. Roberts. 1977. *Foundation of Parasitology*. The C.V. Mosvey Company
4. P.J. Whitfield. 1979. *The Biology of Parasites*. Edwards Arnold Ltd. London
5. J.D. Symth. 1976. *Introduction to animal Parasitology*. Hodder and Stoughton
6. K.D. Chatterjee. *Parasitology (Protozoology and Helminthology in relation to clinical Medicine)*. Chatterjee Medical Publishers. Calcutta
7. H.W. Brown. 1969. *Basic Clinical Parasitology*. Appleton-Century Crofts, New York
8. J.F.A . Sprent. 1963. *Parasitism*. Williams and Williams, Baltimore
9. T.V on Brand. 1973. *Biochemistry of Parasites*. Academic Press. London
10. C.R. Kennedy 1975. *Ecology Animal Parasitology*. Blackwell Scientific Publications. Oxford

Paper Code	243111	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Entomology			

1. **Insect form and function:** Head, thorax, abdomen and appendages.
2. **General classification of insects:** Diagnostic characters of all Orders, with examples, and reference to Bangladesh.
3. **Life history of insects:** Types of eggs, larvae, pupae, metamorphosis and roles of hormones in metamorphosis.
4. **Beneficial insects:** Commercial value of beneficial insects, Pollination by insects.
5. **Harmful insects:** Enemies of crops and stored products.
6. **Pest control measures:** Concepts of Physical, mechanical, cultural, chemical, biological and legal control methods.

7. **Pesticides:** Concepts of pesticides (insecticides, acaricides, nematicides and rodenticides). Uses of insecticides and their side-effects.
8. **Integrated Pest Management (IPM):** Concept, methods, and present status in Bangladesh.
9. **Agricultural entomology:** Biology, life history, nature of damage and control measures of Jute Hairy Caterpillar, Rice Hispa and Sugarcane Shoot Borer.
10. **Medical and Veterinary Entomology:** Biology and control measures of mosquitoes, sand flies, ticks and mites.

Books Recommended

1. M.D. Atkin. 1980. *Introduction to Insect Behaviour* Macmillan Publishing Co. Inc.
2. D.J. Borror. D.M. DeLong and C.A. Triplehorn 1981. *An Introduction to the study of Insects*. Saunders College Publishing Co.Ltd.
3. A.D. Imm's *A General Text Book of Entomology*. Revised by O.W. Richards and R.G. Daviies. The English Language Book Society and Mathuen & Co. Ltd. London
4. C.L. Metcalf and W.P. Flint 1973. *Destructive and useful insects their habits and control*. Tata McGraw-Hill Publishing Co. Ltd. New Delhi. India
5. T.R.E. Southwood. *Ecological Methods with particular reference to the study of insects population*. Chapman & Hall, London
6. D.S> Hill. 1997. *The economic importance of insects* (1st edition). Chapman and Hall, London
7. D.Dent. *Insects Pest Management* (2nd Edition), Chapman & Hall, London.
8. H.D. Catling, S.Alam. C.M. Nurufлах and Arifur Alam *Literature review of insects pests and diseases of rice in Bangladesh*, Bangladesh Rice Research Institute
9. J.W. Creffield. 1996. *Wood-Destroying Insects Wood Borers and Termites* CSIRO Australia

Paper Code	243113	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Fisheries Biology			

1. Definitions, phylogeny of fishes, placoderms and ostracoderms.
2. Structure, modification and functions of digestive, respiratory, circulatory, osmoregulatory and reproductive systems of fish.
3. Principles and techniques of fishery systematic study: Collection, preservation, taxonomic procedures, meristics and non-meristics studies.
4. Classification, status and distribution of freshwater fishes in Bangladesh.
5. Physiology of respiration (including accessory respiration), osmoregulation (including stenohaline and euryhaline fishes), digestion, reproduction with viviparity and ovoviviparity in fishes, atresia and endocrine organs. Their secretions and functions.
6. Structure, modification and functions of scales, fins, swim bladder, lateral line and electric organs. Physiology of swim bladder, lateral line and electric organs.
7. Biology of common fishes of Bangladesh: Life history, embryology, food and feeding habits, fecundity, spawning and economic importance of carps, hilsa, tilapia and catfish.

8. Limnology: Definition and importance of limnology, types of inland waters, dynamics of lotic and lentic environments, physical and chemical properties of water and their influences, biotic community of inland waters, productivity of waters.

Books Recommended

1. M. King 1995. *Fisheries Biology, Assessment and Management*. Blackwell Science.
2. K.F. Langer. J.E. Bardach, R.R. Miller and D.R.M. Passino. 1977. *Ichthyology*. John Willey and Sons, New York
3. A.K.A. Rahman 1989. *Fresh water Fisher of Bangladesh* Published by the Zoological Society of Bangladesh Dhaka
4. P.S. Welch. 1952. *Limnology*. McGraw-Hill Book Co. New York
5. J.Bartram and R. Balance (Editors), 1996. *Water Quality Monitoring: A Practical Guide to the Design and Implementation of Freshwater Quality Studies and Monitoring Programme*. Spon
6. W.S. Hoar and D.J. Randall (Editor) 1971. *Fish Physiology*. Vols, I-V. Academic Press. New York. London
7. G.K. Reid and R.B. Wood. 1976. *Ecology of Inland Waters and Estuaries*. Reinhold Publishing Co. New York
8. Y.C. Shang. 1982. *Aquaculture Economics: Basic Concepts and Methods of Analysis*. Croom Helm. Ltd., London
9. I.G. Cowx (Editors), 1998. *Stocking and Introduction of Fish*. Fishing News
10. J.F. Caddy and R.C. Griffiths. 1995. *Living Marine Resources and Their Sustainable Development: Some environmental and Institutional Perspectives*. FAO, Italy

Paper Code	243115	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Wildlife Biology			

1. Definitions, concepts, importance of wildlife and their role in ecological balance.
2. Status and distribution of the wildlife and their habitats in Bangladesh (forests, wetlands, village grooves, Cultivations, grasslands, bushes, etc.)
3. Species status assessment system of IUCN - global and national. Extinct wildlife of Bangladesh, with their causes of extinction. Threatened wildlife of Bangladesh and their threats.
4. Wildlife conservation: Ethics of conservation, priorities in conservation effort, *ex-situ* and *in-situ* conservation, conservation and rural development, role of culture and religion in conservation, National Conservation Strategy of Bangladesh.
5. Protected areas of Bangladesh: History, status, categories and management. Comanagement of protected areas.
6. Captive breeding and re-introduction of wildlife. Cage/fencing, habitat preparation and maintenance of wildlife for captive breeding. Zoos and Safari Park in Bangladesh.

7. Wildlife farming: Prospect and scope of wildlife farming in Bangladesh, general outline of wildlife farming, economic importance of wildlife farming, crocodile farming in Bangladesh.
8. Human-wildlife conflict in Bangladesh and its mitigation (snake bite, crop damage by elephants and macaques, poultry damage by wild cats and jackals, human and cattle deaths by tiger, etc.).
9. Laws and conventions related to wildlife: Bangladesh Wildlife Act, Forest Act 1973, Convention on Biological Diversity (1992), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973), Ramsar Convention (1971).

Books Recommended

1. G. Cubitt and G. Mountfort. 1985. *Wild India-The Wildlife and Sanctuaries of India and Nepal*. William Collins Sons and Co. Ltd. London.
2. S.H. Prater. 1971. *The Book of Indian Animals* (2) BNHS Oxford Univ. Chicago Press
3. J.C. Daniel. 1983. *The Book of Indian Reptiles*. Bombay Nat. Hist. Soc. Bombay
4. R. Whitaker. 1978. *Common Snakes of India* Macmillan Co. India
5. R.H. Giles 1971. *Wildlife Management Techniques*. The Wildlife Society, Washington, D.C.
6. M.A.R. Khan 2010. *Wildlife of Bangladesh – A Checklist*. Sahitya Prakash, Dhaka
7. M.M.H. Khan 2008, *Protected Areas of Bangladesh – A guide to wildlife*. Bangladesh Forest Dept., Dhaka
8. M. Bolton (Editor), 1997. *Conservation and the Use of Wildlife Resources*. Chapman & Hall
9. R.M. Degraff and R.I. Miller (Editors). 1996. *Conservation of Faunal Diversity in Forested Landscapes*. Chapman & Hall

Paper Code	243116	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Zoology Practical-IV			

1. **Economic zoology**
(3 harmful and 2 beneficial specimens; for each specimen: identification and classification - 1, characteristics and comment -1)
2. **Biostatistics**
 - a) Preparation of frequency distribution table; measures of arithmetic mean, mode, median, variance, standard deviation and standard error; coefficient of variation from grouped/ungrouped data
 - b) Correlation and probit analysis
 - c) Chi-square test
 - d) T-test
3. **Microbiology**
 - a) Microscopic examination of water, curd, dough and cheese
 - b) Morphology and reproductive structures of *Synchytrium*, *Phytophthora*, *Saprolegnia*, *Mucor* and *Rhizophorus*.
4. **Parasitology**

- a) Morphological study of common parasites of fishes, identification and classification.
 - b) Mounting helminths, nematodes and other parasites.
- 5. Entomology**
- a) Collection and identification up to Orders of economically important insects
 - b) Preparation of whole mounts of minute insects and insect pests.
- 6. Fishery**
- a) Study of plankton and benthic fauna
 - b) Study of fish bones
- 7. Wildlife**
- a) Morphological structures of amphibians, reptiles, birds and mammals including toes, claws, webs, scales, fangs, feathers; score counting, measurements, and key characters.
- 8. Internship:**
A Case study or Visit to research organizations having zoological activities or farms such as poultry, dairy, fish, crocodile, etc., and preparation of a scientific report following the style of a scientific journal.

Distribution of Marks for Fourth Year Final Practical Examination

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| 1. Economic Zoology | = 10 marks |
| 2. Biostatistics | = 10 marks |
| 3. Microbiology | = 10 marks |
| 4. Parasitology | = 10 marks |
| 5. Entomology | = 10 marks |
| 6. Fishery | = 10 marks |
| 7. Wildlife | = 10 marks |
| 8. Practical note book | = 10 marks |
| 9. Internship: Scientific report on casestudy or visit on research organization/farm
(Abstract – 03, Introduction and objectives-03, Materials and methodes-03, Results & discussion-05 and References-02)
Presentation of report - 04 | = 20 marks |

Total = 100 marks

Books Recommended

1. D.J. Borror, D.M. DeLong and C.A. Triplehorn 1981. *An Introduction to the Study of Insects*. McMillan Publishing Co., USA.
2. A.D. Imm. *A General Text Book of Entomology*. The English Language Book Society, London.
3. N.T.J. Bailey 1994. *Statistical Methods in Biology*. Cambridge University Press, Cambridge.

4. M.T. Pelczar, R.D. Reid and E.C.S. Chan. *Microbiology*. Tata McGraw Hill Co.
5. T.C. Cheng 1973. *General Parasitology*. Academic Press, London.
6. K.F. Langler, J.E. Bardach, R.R. Miller and D.R.M. Passino 1977. *Ichthyology*. John Willy & Sons, New York.
7. R.H. Giles 1971. *Wildlife Management Techniques*. The Wildlife Society, Washington, D.C.

Paper Code	243118	Marks: 100	Credits: 4	
Paper Title:	Viva-voce			