NATIONAL UNIVERSITY

Syllabus
Department of Zoology

Three Year B.Sc. (Pass) Course
Effective from the Session: 2013–2014

National University

Syllabus for Three Year B.Sc. Pass Course

Subject: Zoology

Session: 2013-2014

Course content and marks distribution

Paper Code	Paper	Paper Title	Marks	Credits
First Year				
113101	Paper-I	Nonchordate	100	4
113103	Paper-II	Chordata	100	4
Second Year				
123101	Paper-III	Cytology & Histology, Ecology and Molecular biology.	100	4
123103	Paper-IV	Embryology, Physiology, Animal adaptation, Evolution, Palaeontology and Zoogeography	100	4
Third Year				
133101	Paper-V	Ethology and Animal Genetics	100	4
133103	Paper-VI	Economic Zoology and Systematics	100	4
133104	Paper-VII	Practical	100	4
		Total =	700	28

Detailed Syllabus

First Year

Paper Code	Paper	Paper Title	Marks	Credits
113101	Paper-I	Nonchordate	100	4

1. Broad classification of the following phyla up to orders with general and diagnostic characteristics of each taxonomic category with examples, particular reference to Bangladesh:

   Sarcomastigophora, Apicomplexa, Ciliophora, Porifera, Coelenterata, Platyhelminthes, Nematoda, Mollusca, Annelida, Onychophora, Arthropoda, Echinodermata and Hemichordata.

2. Type study of the followings with their systematic position, habitats, external morphology, organ systems, such as digestion, movement, circulation, respiration, excretion, nervous, reproduction; food and feeding habits, mode of life and development

   a. Phylum Sarcomastigophora: Euglena, Entamoeba

b. Phylum Apicomplexa: *Plasmodium*

c. Phylum Ciliophora: *Paramecium*

d. Phylum Porifera: *Scypha*,

e. Phylum Coelenterata; *Obelia*

f. Phylum Ctenophora: *Hormiphora*

g. Phylum Platyhelminthes: *Fasciola, Taenia*

h. Phylum Nematoda: *Ascaris*

i. Phylum Rotifera: Any rotifer

j. Phylum Mollusca; *Pila*

k. Phylum Annelida: *Neanthes*

l. Phylum Onychophora: *Peripatus*

m. Phylum Arthropoda; Prawn

n. Phylum Phorinida: *Phoronis*

o. Phylum Echinodermata; *Asteropecten*

p. Phylum Hemichordata: *Balanoglossus*

3. **Special study of the following**:

a. Protozoa: nuclear apparatus and nutrition

b. Porifera: canal systems

c. Coelenterata: polymorphism, Coral reef and reef formation

d. Platyhelminthes: parasitic adaptations

e. Annelida: segmental organs

f. Arthropoda: crustacean larvae

g. Echinodermata: larval forms

Books Recommended:

1. C. P. Hickman and L. S. Roberts. 199: Animal Diversity. Wm. C. Brown

2. J. W. Nybakken and J. McClintock. 1996: The Diversity of Invertebrates: Gulf of Mexico Version. Wm. C. Brown

3. L. S. Dillon. 1976: Animal variety; An Evolutionary Account. Wm. C. Brown Company Publisher Dubuque, Iowa

4. E. E. Ruppert and R. D. Barnes. 1994: Invertebrate Zoology (6" edition). Saunders College Publishing- Harcourt Brace College Publishers, New York, London

5. A. J. Marshal, W. D. William: Text Book of Zoology- Invertebrates. (Edited the edition of Text Book of Zoology, Vol. I, T. J. Parker and W. A. Haswell)

6. M. Sleigh. 1989: Protozoa and other Protists. Chapman and Hall Inc., New York

Paper Code	Paper	Paper Title	Marks	Credits
113103	Paper-II	Chordata	100	4

1. Broad classification of the followings up to orders with general and diagnostic characteristics of each taxonomic category with examples, particular reference to Bangladesh-

   Urochordata, Cephalochordata, Cyclostomata, Chondrichthyes,

   Osteichthyes, Amphibia, Reptilia, Aves and Mammalia

2. Type study of the followings with their systematic position, habitats, external morphology, anatomy including skeletal, digestive, circulatory, respiratory, excretory, nervous, reproductive and endocrine systems; food and feeding habits, mode of life and development
   a. Urochordata: *Ascidia*

   b. Cephalochordata: *Branchiostoma*

   c. Cyclostomata: Petromyzon

   d. Chondrichthyes: *Scoliodon*

   e. Osteichthyes: *Labeo*

   f. Amphibia: *Bufo/Rana*

   g. Reptilia: *Hemidactylus*

   h. Aves: *Columba*

   i. Mammalia: *Cavia*

3. Special study of the following:

   i. Poisonous and non poisonous snakes; snake venom and biting mechanism

   ii. Mesozoic reptiles

iii. Migration of birds

iv. Flying mammals and marsupials

v. Aquatic adaptations of mammals

vi. Integument and its derivatives: fish fins and scales; feathers, beak, bills and claw of birds; nails, hooves and horns of mammals; dentition, teeth and their development, types of dentition, dental formula of mammals

vii. Skeletal system: axial and appendicular skeletons of vertebrates

viii. Digestive system: modification of the alimentary canal in different chordates

ix. Circulatory system: modification of aortic arches and heart in reptiles, birds and mammals

X. Urinogenital system: excretory system; pro-, meso-, and metanephridic kidneys; reproductive system.

Books Recommended:

1. M. Hildebrand. 1994: Analysis of Vertebrate Structure. John Wiley & Sons. Inc., New York
2. G. C. Kent and L. Miller. 1997: Comparative Anatomy of the Vertebrates. McGraw Hill
3. J. Young, 1981: Life of Vertebrates. OUP, USA
4. F. H. Pough, J. B. Heiser and W. N. McFarland. 1997: Vertebrate Life. Prentice Hall
5. K. V. Kardong. 1997: Vertebrates: Comparative Anatomy, Function, Evolution. Wm. C. Brown
6. R. M. Alexander. 1977: The Chordates. Vikas Publishing House Pvt. Ltd., New Delhi
7. R. Pearson and J. N. Ball. 1981: Lecture Notes on Vertebrate Zoology. Blackwell Science.
8. T. J. Parker and W. A. Haswell: A Text Book of Zoology. Vol. II. Macmillan & Co., London
9. C. K. Weichert: Anatomy of the Chordates

Second Year

Paper Code	Paper	Paper Title	Marks	Credits
123101	Paper-III	Cytology & Histology, Ecology and Molecular biology.	100	4

Cytology & Histology

1. Definition of cytology and histology
2. History of cytology
3. Ultra-structures of cell; cell divisions; morphology of sperm and ovum
4. Tissue: types and functions

Books Recommended:

1. G. B. Wilson and J. H. Morrison: Cytology. Affiliated East-West Press Pvt. Ltd., New Delhi
2. J. R. Baker. 1966: Cytological Technique. John Wiley & Sons

Ecology:

1. Definition, structure, component and function of ecosystem; Energy and its flow in Ecosystem; Biogeochemical cycles: carbon, nitrogen and carbon dioxide; Aquatic Ecosystem of a pond
2. Definition of population; population growth forms: J and S- shaped growth forms Concept of carrying capacity
3. Major biomes of the world
4. Environmental pollution: air, water, soil and noise- their sources, effects and remedial measures
5. Conservation of natural resources; concept and classification of resources; renewable and non-renewable resources and their management
6. Consequences of the loss of natural resources
7. Concept of biodiversity.

Books Recommended:

1. R. L. Smith. 1998: Elements of Ecology. Longman
2. M. Begon, J. L. Harper and C. R. Townsend. 1996: Ecology: Individuals, Populations and Communities. Blackwell Science

3. C. J. Krebs. 1993: Ecology- The Experimental Analysis of Distribution and Abundance. Haiper Collins, New York

4. E. A. Laws. 2000: Aquatic Pollution: An Introductory Text. Wiley

5. A. Dobson. 1996: Conservation and Biodiversity. Scientific American

6. J. Turk, J. Wittes, R. Wittes and A.Turk: Ecosystems Energy, Population. W.B. Saunders Company, Philadelphia, London

7. B.Groombridge and M.D. Jenkins. 1996: Assessing Biodiversity Status and Sustainability. WCWC

8. K. J. Gaston and J. I. Spicer. 1998: Biodiversity: An Introduction. Blackwell Science

9. M. Jeffries. 1997: Biodiversity and Conservation. Routledge

10. E. P. Odum: Fundamentals of Ecology. W. B. Saunders Com. London

Molecular biology:

1. Gene: nature, chemical composition and functions

2. Chemistry and function of nucleic acids; DNA and RNA

3. Replication of DNA; Transcription of RNA

4. Types of RNA

5. Genetic engineering; concept and techniques; gene cloning

6. Biotechnology: concept, techniques and its scope in Bangladesh

Books Recommended:

1. A. Bruce, D. Brey and J.D. Watson. 1994: Molecular Biology of the Cell. (3rd Ed.) Garland Publ. Inc.

2. J. D. Watson et al. Modern Biology of the Gene. Benjamin Inc., California, London

3. S. M. Kingsman and A. J. Kingsman Genetic Engineering

4. A. Wiseman. Principles of Biotechnology

5. S. B. Primrose Modern Biotechnology

6. S. B. Primrose Principles of Gene Manipulation

7. J. Bulock and B. Kristeansen Basic Biotechnology

8. D. M. Glover Principles of Gene Cloning

9. J. M. Walker and E. B. Gingold Molecular Biology and Biotechnology

10. E. De Robertis and E. M.De Robertis, Jr. 1981: Essentials of Cell and Molecular Biology. Saunders College Publishing, New York

Paper Code	Paper	Paper Title	Marks	Credits
123103	Paper-IV	Embryology, Physiology, Animal adaptation, Evolution, Palaeontology and Zoogeography	100	4

Palaeontology and Zoogeography.

Embryology:

1. Gametogenesis- spermatogenesis and oogenesis in mammals
2. Types of eggs in animals
3. Fertilization and types of cleavage
4. Extra embryonic membranes in amniotes
5. Placentation in mammals
6. Development of Neanthes and Callus
7. Embryonic circulation and nutrition

Books Recommended:

1. S. F. Gilbert and A. M. Raunio (Editors). 1997: Embryology: Constructing the Organism. Sinauer
2. B. I. Balinsky: An Introduction of Embryology
3. B. H. Wilier and J. M. Oppenheimer. 1968: Foundations of Experimental Embryology. Prentice- Hall of India Pvt. Ltd., New Delhi

Physiology

1. Homeostasis: definition, role or various systems of body in homeostasis
2. Food and nutrition; definition and types; digestion and absorption of different types of food
3. Vitamins: sources, properties and deficiency symptoms
4. Metabolism: definition; carbohydrates, lipid and protein metabolism

5. Circulation: cardiac cycle; blood- components and functions; mechanism of coronary and pulmonary circulations
6. Respiration: mechanism of breathing, pulmonary ventilation, external and internal respiration
7. Excretion: excretory system, structure and functions of kidney, mechanism of formation of urea, ultra filtration and reabsorption, osmoregulation, regulation of blood pH, composition of urine
8. Hormones: types and functions

Books Recommended:

1. C. C. Chatterjee: Human Physiology. Vols. I & II
2. W. H. Davson: A Text Book of General Physiology
3. G. L. Presser and P. A. Brown: Comparative Animal Physiology

Animal adaptation:

1. Introduction and definition.
2. Adaptive diversity in nonchordates particular reference to their habitats and feeding habits
3. Adaptive radiation and the distribution of organisms

Books Recommended:

1. M. R. Rose and G. V. Lauder. 1996: Adaptation. Academic Press
2. R. N. Brandon. 1995: Adaptation and Environment. Princeton UP, USA

Evolution:

1. Theories of evolution: Lamarck, Darwin, Wallace and synthetic
2. Evidences of organicevolution: biogeography, comparative anatomy, physiology, embryology, Palaeontology and genetics
3. Convergent, divergent and parallel evolution

Books Recommended :

1. S. Stearus and R. Hoekstra. 2000: Evolution: An Introduction. OUP, USA
2. G. Bell. 1996: Selection: The Mechanism of Evolution. Chapman & Hall
3. J. B. S. Haldane. 1990: The Causes of Evolution. Princeton UP, USA
4. R. Lewin. 1997: Human Evolution. Blackwell Science
5. T. J. Givnish and K. J. Sytsma. 1997: Molecular Evolution and Adaptive

Radiation. CUP

6. R. Leakey. 1998: The Evolution of Man: An Illustrated History of Human Origins. Ebury Press

Palaeontology:

1. Process of fossilization, types of fossils, significance of fossils, fossil dating methods
2. Geological time table
3. Palaeontological history of horse and man

Books Recommended:

1. A. M. Davis: An Introduction to Palaeontology
2. H. H. Swinerton: Outlines of Palaeontology
3. Tyage A. P. and G. S. Rao: Introduction to Palaeontology
4. C. E. Brett and G. C. Baird (Editors). 1997: Palaeontological Events: Stratigraphic, Ecological and Evolutionary Implications. Columbia UP, USA
5. H. H. Converse. 1999: Handbook of Paleo-Preparation Techniques. Florida UP, USA

Zoogeography:

1. History of the distribution of the land and water bodies of the world,

   Gondwana land and continental drift theories
2. Zoogeographical regions and sub-regions of the world-their boundaries, physical characteristics, climatic conditions, vegetation and fauna with particular reference to Bangladesh
3. Pleistocene glaciation and its influence on the distribution of animals
4. Insular fauna

Books Recommended:

1. P. J. Darlington. 1998: Zoogeography: The Geographical Distribution of Animals. Krieger, USA.

Third Year

Paper Code	Paper	Paper Title	Marks	Credits
133101	Paper-V	Ethology and Animal Genetics	100	4

Ethology:

1. Orientation: taxes, kineses
2. Instinct behaviour
3. Learning behaviour
4. Communication behaviour: sounds, pheromones, etc.
5. Parental care of Amphibia
6. Migration of fishes
7. Social behaviour of honey bee
8. Breeding behaviour of three-spine stickle back and sea gull

Animal Genetics:

1. Introduction
2. Mendel's principles of segregation and of independent assortment
3. Modification of Mendelian ratio
4. Test cross and back cross
5. Linkage and crossing over
6. Mutation and chromosomal aberrations
7. Sex linked, sex limited and sex influenced inheritance
8. Sex determination

Books Recommended:

1. E.W. Sinnot, L.C. Dunn and Dobzhansky: Principles of Genetics. McGraw Hill Book Co. New York
2. A. S. Islam: Fundamentals of Genetics. Vikas Publishing House Pvt. Ltd

3. R. F. Weaver and P. W. Hedrick. 1995: Basic Genetics. Wm. C. Brown Publisher, Dubuque, Iowa

4. T. A. Brown. 1997: Genetics: A Molecular Approach. Chapman and Hall

Paper Code	Paper	Paper Title	Marks	Credits
133103	Paper-VI	Economic Zoology and Systematics	100	4

Economic Zoology:

1. Apiculture: life cycle of a honey producing bee species; types of hive; honey processing
2. Sericulture: 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; life cycle of a lac insect species; collection and processing of lac
4. Integrated Pest Management (IPM): concept; components of IPM
5. Carp culture: carp culture including induced breeding of carps in ponds
6. Prawn and shrimp culture: types, techniques and management
7. Poultry farming: varieties of fowls and ducks; techniques of poultry farming; diseases of poultry and their control; economic importance of poultry
8. Economic importance of Molluscs
9. Economic importance of amphibians and reptiles in Agriculture, Fisheries and Forestry
10. Animal husbandry: concepts, farming of domestic animals- cattle and goats, diseases of domestic animals and their control, economic importance of farm animals.

Books Recommended:

1. Dennis S. Hill. 1997: The economic importance of insects (1st edition). Chapman and Hall, London
2. D. Dent: Integrated Pest Management. Chapman & Hall, London
3. R. Wall and D. Shearer. 1997: Veterinary Entomology. Chapman and Hall
4. M. Huet. 1986: Text Book of Fish culture-Breeding and Cultivation of Fish (2nd Edition) Fishing News Books

5. V. G. Jhingran and R. S. V. Pullin. 1985: A Hatchery Manual for the Common Chinese and Indian Major Carps ADB/ICLARM

6. P. R. Boyle: Molluscs and man. Edward Arnold, London

Systematics:

1. Definition of taxonomy, systematics, classification and nomenclature

2. Taxonomic hierarchy

3. Species concept

4. Taxonomic keys- types and significance

5. International Code for Zoological Nomenclature (ICZN), rules of nomenclature

6. Type methods

7. Law of priority

Books Recommended:

1. G. G.Simpson. 1990: Principles of Animal Taxonomy. Columbia UP, USA

2. E. Mayr and P. D. Ashlock. 1997: Principles of Syatematic Zoology. McGraw Hill

3. V. C. Kapoor. 1988: Theory and Practice of Animal Taxonomy. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi

4. W. D. L.Ride et al. (Editors) 1999: International Code of Zoological Nomenclature (ICZN)

Paper Code	Paper	Paper Title	Marks	Credits
133104	Paper-VII	Practical	100	4

I. Nonchordates:

1. Study of museum specimens; representative of non-chordate phyla (minimum 50 specimens to be studied)

2. Study of permanent slides: whole mount, body parts, and various cells (at least 20 slides to be studied)

a. Whole animals- representatives of Protozoa and Arthropoda; mouth parts of Arthropoda

b. Parasites- Nematode and Platyhelminthes

c. Different larval forms of invertebrates

3. External morphology and dissection of various organ systems of earthworm, cockroach, prawn and Pila:

a. Digestive system of earthworm, cockroach, prawn and *Pila*

b. Circulatory system of earthworm and prawn

c. Nervous system of earthworm, cockroach, prawn and *Pila*

d. Reproductive system of earthworm and cockroach

4. Temporary mounting:

a. Brain, ovary and nephridium of earthworm

b. Salivary gland of cockroach

c. Statocyst of prawn

d. Mouth parts of mosquito

II. Chordates:

1. Study of museum specimens: representatives of all types of chordates particular reference to Bangladesh (minimum 50 specimens to be studied)

2. Dissection: dissection of the following specimens-

i. Lata fish- digestive system; afferent and efferent blood vessels

ii. Frog/toad- digestive system and circulatory systems

iii. Lizard- digestive and circulatory systems

3. Histological slides of vertebrates

4. Temporary mounting- scales and weberian ossicle of fishes; hyoid apparatus of toad; preparation of blood smear

5. Study of bones: Comparative study of the skeletons of amphibian, reptile, bird and mammal

III. Fresh water studies: identification of micro fauna in fresh water samples

IV. Field visit to observe local invertebrate and vertebrate fauna an their habitats, and prepare a report on the visit. Students will also collect specimens and submit these along with the report in the final practical examination to be held in the 3rd year.

Distribution of marks for final examination:

1. Dissection:

a.) Nonchordate: (dissection 7 + display 2 + drawing & labeling 3) = 12 marks

b) Chordate: (dissection 7 + display 2 + drawing & labeling 3) = 12 marks

2. Temporary mount: (any one from either nonchordates or chordates)

(Staining, mounting and displaying) = 6 marks

5. Spotting of museum specimens; invertebrates, vertebrates, whole mount slide, histological slide and bones

Items and numbers:

a) Invertebrate museum specimens: 7 specimens x 2 = 14 marks

b) Vertebrate museum specimens: (Chondrichthyes-1, Osteichthyes-1,

Amphibia-1, Reptilia-1, Aves-1, & Mammalia-1): 6 specimens x 2 = 12 marks

c) Slide whole mount- 1x2 = 2 marks

d) Histological slide-1x2 = 2 marks

e) bones- 3x2 = 6 marks

4. Fresh water studies: (3 micro species to be shown-

Identification 1 mark, classification 0.5 mark, and characters 0.5 mark)-

3 specimens x 2 marks for each = 6 marks

5. Collection of specimens (4 invertebrates and 2 vertebrates) and

report writing- (collection 4 + report writing 4) = 8 marks

6. Class records = 10 marks

7. Viva-voce = 10 marks