BACHELOR OF SCIENCE (B.Sc.)

(THREE YEAR DEGREE COURSE)

SUBJECT

ZOOLOGY
B.Sc. (ZOOLOGY)

COURSE STRUCTURE

FIRST YEAR

PAPER – 101: Lower Non Chordata (*Protozoa-Helminths*) 50 MARKS

PAPER – 102: Higher Non Chordata (*Annelida-Echinodermata*) 50 MARKS

PAPER – 103: Cell Biology and Genetics 50 MARKS

PAPER – 104: PRACTICAL (Based on Paper 101, 102, 103) 50 MARKS

SECOND YEAR

PAPER – 201: Chordata 50 MARKS

PAPER – 202: Animal distribution, Evolution and Developmental Biology 50 MARKS

PAPER – 203: Physiology and Biochemistry 50 MARKS

PAPER – 204: PRACTICAL (Based on Paper 201, 202, 203) 50 MARKS
THIRD YEAR

PAPER – 301: Applied and Economic Zoology 50 MARKS

PAPER – 302: Biotechnology, Immunology, Biological Tools & Techniques and Biostatistics 50 MARKS

PAPER – 303: Ecology, Microbiology, Animal Behavior, Pollution and Toxicology 50 MARKS

PAPER – 304: PRACTICAL (Based on Paper 301, 302, 303) 50 MARKS
B.Sc. (ZOOLOGY)
FIRST YEAR DETAILED SYLLABUS

PAPER – 101

Lower Non Chordata (Protozoa to Helminths)

The habits, morphology, physiology, reproduction, development (in outline) and classification of the following groups of animals including a detailed study of the types given in each:

**Unit-I**
Protozoa - *Euglena, Monocystis*

**Unit-II**
Porifera - *Sycon*

**Unit-III**
Coelenterata - *Obelia*
Ctenophora - Salient features

**Unit-IV**
Platyhelminthes - *Fasciola* (liver fluke) and *Taenia* (tape worm)
Nematehelminthes - *Ascaris*
B.Sc. (ZOOLOGY)
FIRST YEAR DETAILED SYLLABUS

PAPER – 102

Higher Non Chordata (Annelida to Echinodermata)

The habits, morphology, physiology, reproduction, development (in outline) and classification of the following groups of animals including a detailed study of the types given in each:

Unit-I

Annelida           - *Nereis*

Unit-II

Arthropoda         - *Palaemon* (prawn)

Unit-III

Mollusca           - *Pila* (apple-snail)

Unit-IV

Echinodermata      - *Asterias*
B.Sc. (ZOOLOGY)  
FIRST YEAR DETAILED SYLLABUS  
PAPER – 103  

Cell Biology & Genetics  

Unit-I  

**Cell Biology I:** Structure and function of cell, Ultra structure of Plasma membrane  

Unit-II  

**Cell Biology II:** Structure and function of cell organelles with special emphasis on mitochondria, golgi bodies, nucleus, ribosome and endoplasmic reticulum.  

Unit-III  

**Genetics I:** Structure of Chromosomes, Watson & Crick Model of DNA, Differences between DNA & RNA, Cell Division: Mitosis and Meiosis. Mendel’s principles of heredity on chromosomal basis, Monohybrid cross, test cross, dihybrid cross, back cross incomplete dominance, Multiple Alleles, Blood group inheritance. Linkage and crossing over, interaction of genes. The role of DNA in heredity.  

Unit-IV  

**Genetics II:** Sex determination, sex differentiation, prenatal detection of genetic diseases (amniocentesis), Sex-linked characters, Genetic diseases and abnormalities, chromosomal aberrations, Eugenics.
B.Sc. (ZOOLOGY)  
FIRST YEAR DETAILED SYALLBUS  
PAPER – 104  
PRACTICAL
1- Dissection (Major)  
2- Dissection (Minor)  
3- One Permanent Mount  
4- Cytology & Genetics Preparation/Prepared slides  
5- Identify and Comment upon spots (1-10)  
6- Viva-Voce  
7- Practical class record  
Total 50 Marks

SYLLABUS – B.SC. (PART 1) PRACTICAL

PROTOZOA

(a) Amoeba: Examination of culture. Prepared Slide *Amoeba proteus* and *A. verrucosa.*

(b) Euglena: Culture examination for *Euglena.*

(c) Monocystis: Prepared slides.

(d) Plasmodium: Prepared slides showing the parasites.

(e) Paramecium: Culture examination.

(f) Demonstration of ciliary movements in *Paramecium.*

Addition to mucilage to restrain active movement. Treatment with Methyl green for staining. Feeding experiment with Congo Red and Yeast. Trichocysts (discharged), Prepared slides for structure, binary division and conjugation.
**PORIFERA**

(a) **Sycon**: General characters, Spicules glycerine preparation. Transverse and longitudinal sections-prepared slides.

(b) Gemmule of *Spongilla* permanent preparation.

(c) Different kinds of sponge spicules and sponging fibres of *Euspongia*-prepared slides.

(d) *Euplectella* (Venus's flower-basket) *Spongilla* (fresh-water sponge), *Euspongia* (bath sponge).

**COELENTERATA**

(a) **Hydra**

Live specimens.

Prepared slides of entire specimens.

Longitudinal and transverse sections-prepared slides.

(b) **Obelia**

Clony-prepared slide.

Medusa-prepared slide.

(c) **Aurelia**

General morphology.

Tentaculocyst-prepared slide.

Prepared slides and models of life-history stages.

(d) **Physalia** (Portuguese man of war), *Corallium* (red coral), *Fungia* (Mushroom coral), *Madrepora* (staghorn coral), *Pennatula* (sea pen), *Metridium* (sea anaemone)
PLATHYHELMINTHES :

(a)  **Fasciola**  
Prepared slides.  
Transverse sections and prepared slides.  
Larval forms-prepared slides.

(b)  **Taenia**  : Prepared slides of scolex, mature and gravid proglottids and transverse section of mature proglottid.

(c)  **Planaria, Polystomum, Schistosma, Echinococcus**  
Cysticercus (Bladder worm) and Cysticercoid.

NEMATHELMINTHES

(a)  **Ascaris**  
External characters.  
Dissected specimens of male of female.  
Transverse section of male and female-prepared slides.

(b)  **Ascaris lumbricoides** (from man) specimens  **Enterobius vermicularisi**  (from man).  
Ancylostoma duodenale  **(from man)** prepared slides.

ANNELIDA

(a)  **Nereis**  
External characters.  
Dissected specimens.  
Parapodium-permanent preparation.  
Transverse sections-prepared slides.

(b)  **Pheretima**  
External characters.  
Dissection through multimedia / models.  
Slides of setae  **in situ** and brain.  
Slides of ovary and septal nephridia.
Prepared slides of transverse section through various regions.

(c) *Heteronereis, Arenicola, Aphrodite, Branchellion, Haemadipsa, Bonellia* (female).

**ARTHROPODA**

(a) *Palaemon*
External characters; Examination of appendages.
Dissections through multimedia / models

(b) *Periplaneta*
External characters. Differences between male and female.
Dissections through multimedia / models
Cirulation of blood in the wing of cockroach.
Slides of mouth appendages, salivary glands and trachea.
Slides of salivary glands, Malpighian tubules, ovaries and testes.

(c) *Anopheles and Cules*
Permanent preparation of mouth parts of male and female. Wings-prepared slides.
Life history-prepared slides.
Difference between *Anopheles* and *Culex*

(d) *Musca*
External characters.
Slides of proboscis

(e) *Daphnia, Cyclops, Balanus, Eupagurus* (hermit crab) *Scylla* (crab), *Sacculina* (on crab).
MOLLUSCA

(a) *Lamellidens*
External characters

Dissection through multimedia / models

Slides of gill lamellae.

Transverse section through middle region of body-prepared slides.

Glochidium (larva) prepared slides.

(b) *Pila*
External characters.

Dissection through multimedia / models

Slides of gill lamella and osphradium.

(c) Chiton, *Teredo, Turbinellai* (Shankh), *Laevicaulis* (slug), *Doris, Aplysia, Dentalium Nautilus, Sepia* and *Margaritifera* (Pearl Oyster).

ECHINODERMATA

(a) *Asterias:*
External characters

Dissected specimens.

Pedicellaria-prepared slides.

Transverse section of arm-prepared slide.

(b) *Echinus* (Sea urchin), *Ophiothrix* (brittle star), *Holothuria* (sea cucumber) and *Antedon* (feather star).

CYTOLOGY

(a) Cell-Structure – Prepared slides
(b) Cell Division – Prepared slides
(c) Preparation of giant chromosomes
(d) Preparation of onion root tip for the stages of mitosis
B.Sc. (ZOOOLOGY)
SECOND YEAR DETAILED SYALLBUS

PAPER – 201

Chordata

Unit- I

Hemichordata: Classification, affinities and detailed study (habit, morphology, anatomy, physiology and development) of Balanoglossus

Cephalochordata: Classification, affinities and detailed study (habit, morphology, anatomy and physiology) of Branchiostoma (Amphioxus).

Unit -II

Urochordata: Classification, affinities and detailed study (habit, morphology, anatomy, physiology and post embryonic development) of Herdmania

Unit-III

Classification of different classes of vertebrates (Pisces, Amphibia, Reptilia,) up to order with characters and examples. Poisonous and non poisonous snakes and biting mechanism. Neoteny, parental care in amphilia.

Unit-IV

Classification of different classes of vertebrates (Aves and Mammalian) up to order with characters and examples. Dentition in mammals. Respiration in pigeon, migration in birds.
B.Sc. (ZOONOLOGY)
SECOND YEAR DETAILED SYALLBUS
PAPER – 202

Animal distribution, Evolution and Developmental Biology

Unit-I

**Animal distribution:** Geological and geographical distribution with their characteristic fauna; fossils.

Unit-II

**Origin of Life,** concept of species (classical & modern concept)

**Evolution:** Evidences (including physiological and serological); Theories of evolution (including Neo-Lamarckism, Darwin-Wallace theory of natural selection, Neo-Darwinism, Modern synthetic theory). Evolution of Man. Mutation

Unit-III

**Developmental Biology I:** Aims and scope of Developmental Biology.

Gametogenesis, Fertilization, Egg: structure and types. Types & patterns of cleavage.

Unit-IV

**Developmental Biology II:** Process of Blastulation & Gastrulation. Fate Map.

Development of Chick up to formation of Primitive streak. Extra embryonic membranes of chick. Placentation and types of Placenta.
B.Sc. (ZOОLOGY)
SECOND YEAR DETAILED SYALLBUS

PAPER – 203

Physiology and Biochemistry

General physiology (in outline) with special reference to mammals

Unit-I

Physiology of digestion, respiration, and blood and circulation

Unit-II

Physiology of excretion and osmoregulation, neural transmission, muscles

Unit-III

Physiology of endocrine system, thermoregulation

Unit-IV

General chemistry and classification of carbohydrates, lipids and proteins; Enzymes
### B.Sc. (Zoology)
#### SECOND YEAR DETAILED SYLLABUS

**PAPER – 204**

**PRACTICAL**

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<td>1-</td>
<td>Dissection (Major)</td>
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<td>2-</td>
<td>Permanent Mount</td>
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<td>3-</td>
<td>Comment upon Physiology Apparatus</td>
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<td>4-</td>
<td>(i) Suitable preparation of Hemin crystals from the blood</td>
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<td>(ii) Detect the Sugar /albumin / acetone from urine sample</td>
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<td>5-</td>
<td>Slides of (i) Striped or Unstriped muscles</td>
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<td>(ii) Cartilage (hand cut Section)</td>
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<td>(iii) Blood film/Aerolar tissue</td>
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<td>5-</td>
<td>Identify and Comment upon spots (1-10)</td>
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<td>6-</td>
<td><em>Viva-Voce</em></td>
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<td>7-</td>
<td>Practical class record</td>
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#### SYLLABUS – B.SC. (PART 2) PRACTICAL

**Urochordata**

**(a) Herdmania**

(i) External characters  
(ii) Dissection through multimedia / models  
(iii) (a) Slides of branchial wall  
(b) Section of test and glycerine preparation of spicules.
Slides of neural gland complex (neural gland, nerve ganglion and dorsal tubrcele).

(iv) Larva and metamorphosis- prepared slides.

(b) (i) Thaliacea: Pyrosoma, Doliolum
(ii) Larvacea: Oikopleura.

Cephalochordata

Branchistoma (Amphioxus)

(i) General features
(ii) (a) Slides of the pharyngeal wall
(b) Oral hood and velum- prepared slides
(c) Transverse section through the body – prepared slides.
(d) Models illustrating development

Cyclostomata

Petromyzon (Lamprey) - External characters

Chondrichthyes

(a) Fish

(i) External characters
(ii) Exo-skeleton permanent preparation of placoid scales
(iii) Myotomes
(iv) Endoskeleton
   (1) Axial skeleton
      (a) skull
      (b) Visceral Skeleton
      (c) Vertebral column
   (2) Appendicular skeleton
      (a) Pectoral girdle and fins
      (b) Pelvic girdle, fins and claspers
      (c) Median fins
(v) Dissection through multimedia / models
    (a) Digestive system
       Examination of the folds of stomach and “scroll valve”
(b) Vascular system, Heart, ventral aorta, dorsal aorta, arterial arches (afferent and efferent)
(c) Gills
(d) Urinogenital system
(e) Nervous system: Cranial nerves
(f) Internal ear
(g) Eye muscles
(h) Ampullae of Lorenzini
(i) Section through various regions of the body of adult and embryo
(j) Embryo with yolk-sac placenta

(b) Pristis (Saw fish), Torpedo (Indian electric ray) Chimaera (rabbit fish) Slide showing development of placoid scales.

Osteichthyes

(a) Labeo rohita (rohu)- General morphology and dissected specimen.
(b) Acipenser (sturgeon), Lepidosteous (gar-pike), Hippocampus (sea hourse) Antennarius (Indian angler), Angulla (eel), Pleuronectes (sole), Exocoetus (flying fish), Clarius (cat fish), Anabas (climbing perch) and Neoceratodus (lungfish).
(c) Different kinds of scales- prepared slides

Amphibia

(a) Rana tigrina (The Indian bull-frog) Development of frog from models
(b) Urodela: Necturus, Ambystoma and Axolotal larva
(c) Anura: Bufo, Rhacophorus (tree frog), Alytes (midwife toad).
(d) Gymnophiona: Ichthyopsis

Reptillia

(a) Varanus
   (i) External characters
   (ii) Skeleton
(1) **Axial Skeleton**
   (a) Skull
   (b) Vertebral column
   (c) Ribs and sternum

(2) **Appendicular Skeleton**
   (a) Pectoral girdle and fore-limb.  
   (b) Pelvic girdle and hind-limb.

(b) **Lacertilia**
   *Varanus* (Indian monitor), *Holoderma* (poisonous lizard)  
   *Hemidactylus* (wall lizard), *Chamaeleon* (garden lizard) *Draco*  
   (flying lizard).

(c) **Ophidia**
   Difference between poisonous and non-poisonous snakes, *Naja* (cobara),  
   *Vipera* (viper), *Typhlops* (burrowing snake) and *Python*. Biting  
   mechanism of a poisonous snake (model).

(d) **Chelonia**: Dermal armature

(e) **Crocodilia**: Difference between Alligator, Crocodile and Gavialis.

(f) Extinct reptiles, Models (five)

*Dimetrodon, Diplodocus, Pteranodon, Tyrannosaurus and Ichthyosaurus*

**Aves**

(A) **Columba livia intermedia** (pigeon)
       Developments of feather-prepared slide.
   (ii) Skeleton of fowl Axial skeleton:
        (a) Skull
        (b) Vertebral column
        (c) Ribs and sternum

(2) Appendicular skeleton.
    (a) Pectoral girdle and fore-limb
    (b) Pelvic girdle and hind-limb.

(B) (i) **Archaeornithes-Archaeopteryx** (cast)
   (ii) Neornithes:
(a) Palaeognathae: *Struthio* (ostrich);
(b) Neognathae: *Gallus* (fowl), *Anser* duck, *Corvus* (crow), *Psittacula* (parrot) and *Pavo* (peacock).

Perching mechanism: Model

Skulls and Beaks of Birds.

Feet of birds: Models

(C) Embryonic membranes-whole mount of 72 hour’s chick embryo

**Mammalia**

(A) (i) Prototheria: *Ornithorhynchus* (Platypus)

(ii) Metatheria: *Macropus* (Kangaroo).

(iii) Eutheria:

(a) Edentata: *Dasypus* (Armadillo)

(b) Pholidota: *Manis* (Scaly ant-eater).

(c) Cetacea: *Platanista* (Ganges dolphin).


(e) Articyla: *Camelus dromedaries* (A rabian camel), *Giraffa camelopardalis* (giraffe) Box (ox), *Ovis* (sheep), *Capra* (goat), *Cervus* (deer), *Sus* (dog).

(f) Proboscidea: *Elephas indicus* (elephant).

(g) Carnivora: *Felis domesticus* (Cat), *Panthera leo* (lion), *Acinonyx tigris* (Cheetah), *Canis familiaris* (dog), *Ursus* (bear) *Hyaena* (hyana), *Phoca* (seal)

(h) Rodentia: *Mus* (domestic rat), *Hystric* (Porcupine)

(i) Lagomorpha: *Lepus* and *Oryctolagus* (hare and rabbit)

(j) Insectivora: *Erinaceus* (hedge-hog), *Crocidura* (chhachhundar)
(k) Chiroptera: *Pteropus* (Flying-fox).


**Histology**

(i) Tissues: Slides of the following

(a) Epithelia:

(i) Squamous (ii) Ciliated and (iii) Stratified

(b) Muscular:

(i) Striped muscles (ii) Unstriped muscles.

(c) Connective

(i) Areolar tissue (ii) Tendon the leg muscles of frog

(ii) Adipose tissue from insect and frog (iv) cartilage (free hand sections of frogs hyoid and suprascapula, train with haematoxyline and (v) Bone (Decalcified).

(d) Nervous: Neurons

(e) Histology of various organs-prepared slides.

**Physiology**

(i) Experiments to be performed by candidates: Test for amylase. Osmolarity of blood, Hemin crystals and test for sugar and acetone in urine Determination of haemoglobin % in blood sample (s).

(ii) Detection of amino acids in blood of an animal by paper chromatography.
General:

Candidates will be required, to show knowledge of the method of microscopic techniques and to examine, describe or dissect the types prescribed. Candidates will also be required to submit their notebooks containing a complete record of laboratory work initiated and dated by the teacher for the determination of result of examination.
B.Sc. (ZOOLOGY)
THIRD YEAR DETAILED SYLLABUS
PAPER – 301

Applied and Economic Zoology

Unit-I

Parasitology:

(a) Structure, life cycle, pathogenicity, including diseases, causes, symptoms and control of the following parasites of domestic animals and humans: *Trypanosoma, Giardia* and *Wuchereria*,

Unit-II

Vectors and pests: Life cycle and their control of following pests: Gundhi bug, Sugarcane leafhopper, Rodents. Termites and Mosquitoes and their control

Unit-III

Animal breeding and culture: Aquaculture, Pisciculture, Poultry, Sericulture, Apiculture, Lac-culture.

Unit-IV

Wild Life of India: Endangered species. Important sanctuaries; national parks of India; Different projects launched for the preservation of animal species; *in-situ* and *ex-situ* conservation of wild life.
B.Sc. (ZOOLOGY)
THIRD YEAR DETAILED SYALLBUS

PAPER – 302

Biotechnology, Immunology, Biological Tools
& Techniques and Biostatistics

Unit-I

Biotechnology: Genetic Engineering (concept and recombinant DNA technology) and its application in agriculture & medical areas and energy production. Biotechnology of food-processing, pharmaceuticals (e.g. use of microbes in insulin production) and fermentation.

Unit-II

Immunology. Concepts of immunity, types of immunity, Antigen and Antibodies, vaccines of different diseases and immunological reactions.

Unit-III

Biological Tools and Techniques: Principles and uses of instruments: pH Meter, Calorimeter, Microtome, Spectrophotometer & Centrifuge.

Microscopy (light, transmission and scanning electron microscopy) Chromatography and Electrophoresis.

Unit-IV

Biostatistics: Sampling, Measures of central tendency (mean, median and Mode) and dispersion (variance, standard deviation and standard error); Correlation and Regression
B.Sc. (ZOOLEGY)
THIRD YEAR DETAILED SYLLABUS

PAPER – 303

Ecology, Microbiology Animal Behavior and Pollution & Toxicology.

Unit- I


Unit-II

Microbiology: Morphology, physiology and infection (outline) of bacteria and viruses. Bacterial and viral diseases.

Unit-III

Animal Behavior: Introduction to Ethology, Patterns of behavior (taxes, reflexes, instinct and motivation); biorhythms; learning and memory, Migration of fishes & birds.

Unit-IV

Pollution and Toxicology: Concept, sources, types (air, water, soil, noise & radiation), and control of environmental pollution. Exposure of toxicants (routes of exposure, and duration and frequency of exposure); dose -response relationship categories of toxic effects.
B.Sc. (ZOOLOGY)
THIRD YEAR DETAILED SYLLABUS

PAPER – 304

PRACTICAL

1- Dissection (Major)................................................................. 10 Marks
2- Permanent Mounting........................................................... 06 Marks
3- Identify and Comment upon Spots (1-8)............................... 08 Marks
4- Economic Zoology (Comments on a suitable
Specimen/ life cycle of Silk worm, Honey bee,
Lac insect & Food Fishes) (02)............................................. 08 Marks
5- Ecology/ Pollution/ Toxicology (Exercise or Comment)........... 06 Marks
6- Viva-voce........................................................................... 05 Marks
7- Practical Class record / Project / Collection.......................... 07 Marks

Total .................................................................................. 50 Marks

SYLLABUS – B.SC. (PART 3) PRACTICAL

• Permanent Preparation of: Euglena, Paramecium
• Study of prepared slides/ specimens of Entamoeba, Giardia, Leishmania,
  Trypanosoma, Plasmodium, Fasciola, Cotugnia, Taenia, Rallietina, Polystoma
  Schistosoma, Echinococcus, Enterobius, Ascaris and Ancylostoma;
• Permanent Preparation of Cimex (bed bug)/ Pediculus (Louse), Haematopinus
  (cattle louse), fresh water annelids, arthropods; and soil arthropods.
• Larval stages of helminths and arthropods.
• Identification of pests.
• Life history of silkworm, honeybee and lac insect.
• Different types of important edible fishes of India.
• Slides of plant nematodes.
• Demonstration of counting of cells (blood and protozoan) by haemocytometer, haemoglobinometer, pH meter, Colorimeter
• Study of an aquatic ecosystem, its biotic components and food chain.
• Preparation of chromosomes, Test for carbohydrate Photochemical demonstration of proteins and lipids, using hand sections using hand sections, endocrine glands (Neurosecretory cells) of cockroach.
• Project Report/ model chart making.
• **Dissections** : through multimedia / models
• **Cockroach** : Central nervous system
• **Wallago** : Afferent and efferent branchial vessels, Cranial nerves, Weberian ossicles.
• Practical exercises based on Biostatistics, Microbiology, Immunology, Biotechnology, Animal Behavior, Pollution & Toxicology.