



BACHELOR OF SCIENCE (B.Sc.)

(THREE YEAR DEGREE COURSE)

SUBJECT: ZOOLOGY

Session: 2018

B.Sc. (ZOOLOGY)

COURSE STRUCTURE

FIRST YEAR

PAPER –: Lower Non Chordata (<i>Protozoa- Helminths</i>)	50 MARKS
PAPER –: Higher Non Chordata (<i>Annelida- Echinodermata</i>)	50 MARKS
PAPER –: Cell Biology and Genetics	50 MARKS
PAPER –: PRACTICAL (Based on Paper 101, 102, 103)	50 MARKS

SECOND YEAR

PAPER –: Chordata	50 MARKS
PAPER –: Animal distribution, Evolution and Developmental Biology	50 MARKS
PAPER –: Physiology and Biochemistry	50 MARKS
PAPER –: PRACTICAL (Based on Paper 201, 202, 203)	50 MARKS

PAPER –: Applied and Economic Zoology	75 MARKS PAPER –
: Biotechnology, Immunology, Biological Tools & Techniques and Biostatistics	75 MARKS
PAPER –: Ecology, Microbiology, Animal Behavior, Pollution Toxicology	75 MARKS and
PAPER –: PRACTICAL (Based on Paper 301, 302, 303)	75 MARKS

Program Education Objectives (PEOs)

The graduate will

PEO-1: Be trained in basic knowledge, scientific temper, research potential and advanced techniques.

PEO-2: Be able to pursue higher studies and research.

PEO-3: Have leadership quality to handle all kind of circumstances in diversities by providing interdisciplinary and multidisciplinary learning environment.

PEO-4: Be a continuous learner and adopt new skills and techniques to overcome the problems related with new technologies.

PEO-5: Be able to formulate, investigate and analyze scientifically real life problems along with ethical attitude.

Program Outcomes (POs)

Students will be able to

PO-1: Apply knowledge of sciences to become competent professionals at global level.

PO-2: Identify and solve scientific problems for higher studies at national and international levels.

PO-3: Investigate problems related to sciences using knowledge for analysis and interpretation of data.

PO-4: Select, design and apply appropriate experimental techniques along with IT tools to solve problems related to sciences.

PO-5: Apply contextual knowledge to assess societal, health, safety, and cultural issues relevant to the science practices.

PO-6: Investigate and demonstrate the scientific knowledge in environmental contexts for sustainable development.

PO-7: Apply ethical principles and responsibilities of a science graduate to serve the society.

PO-8: Communicate effectively through soft skills, report writing, documentation and effective presentations.

PO-9: Perform effectively as an individual and as a member or leader in diverse teams in multidisciplinary settings.

PO-10: Engage in independent and lifelong learning in the broadest context of science and technological changes.

PO-11: Enhance skills for future employability through activities such as internship, MOOC courses, seminars, summer trainings and project work.

PO-12: Learn and perform experiments to apply their knowledge in learning of advances in sciences for job opportunities.

PSO1. Ability to connect and apply biological knowledge to other disciplines and to integrate knowledge into their personal and professional lives.

PSO2. Explain the origin of life with context to the origin of eukaryotic cell and endosymbiosis theory of origin. Fossil records, Darwinism and Neo- Darwinism, experimental evidences.

PSO3. Illustrate zoological science for its application in branches like medical entomology, apiculture, aquaculture and agriculture etc.

PSO4. Understand animal interactions with environment and identify the major groups of organisms with an emphasis on animals and classify them within a Phylogenetic framework.

Syllabus and Lecture Plan: B.Sc. I (Zoology)

Syllabus and Lecture Plan: B.Sc. I (Zoology)

(a) Subject Name: Lower Non chordates

(b) Subject Code: Paper I (BSZL-101)

(c) Why you need to study this course

1. To study general characters of phylum protozoa to Helminthes.
2. Study of Euglena, Monocystis, Paramecium, Scon, obelia Fasciola, Taenia, Ancylostoma with Particular reference to habits, morphology, physiology, reproduction development .

(d) Course Objectives:

1. To understand the taxonomic position of protozoa to helminthes.
2. To Understand the general characteristics of animal belonging to protozoa to helminthes and its classification upto order.
3. To understand the body organization of phylum from protozoa to helminthes.
4. To Understand the habits, morphology, physiology reproduction, development of phylum from protozoa to helminthes.

(e) Course Outcome (CO):

1. Student should be able to describe unique characters of protozoa, porifera , Coelenterate and helminthes.
2. Student should be able to recognize life function of protozoa, porifera coelenterate and helminthes.
3. Student should be able to recognize the ecological role of phylum protozoa, porifera, coelenterata and helminthes.

(f) Syllabus

Unit-I

Protozoa - *Euglena, Monocystis, Paramecium, protozoa and human diseases.*

Unit-II

Porifera - *Sycon, Canal System in Sponges*

Unit-III

Coelenterata - *Obelia, polymorphism in coelenterate.*

Ctenophora - *Salient features*

Cnidaria - *General characters, Corals and Coral reef formation with their significance.*

Unit-IV

Platyhelminthes - *Fasciola* (liver fluke) and *Taenia* (tape worm)

Nematehelminthes - *Ascaris ancylostoma*, helminthes human diseases.

Book & References :

1. A text Book of invertebrate Zoology, author – Dr. S.N. Prasad
2. Invertebrate Zoology Author – E.L. Jordan and P.S. Verma
3. Text Book of Invertebrate Zoology, Author – G.S.Sandhu
4. Modern text of zoology Invertebrate, Author – R.L. Kotpal
5. Invertebrate zoology Author – D.T. Anderson
6. Invertebrate zoology Author – Ruppert, Fox and Barnes

Reference :

1. Barner, R D. (2006). Invertebrate zoology, 7th Edition, cenage Learning, India.
2. Pechenik J.A. (2015) Biology of the invertebrates. 7th Edition, Mcgraw – Hill Education.

Syllabus

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 Syllabus and Lecture Plan: B.Sc. I (Zoology)

(g) Subject Name: Higher Non- chordate

(h) Subject Code: Paper - II (BSZL-102)

(i) Why you need to study this course

1. The course would provide on insight to the learner about the existence of different life forms on the Earth and appreciate the diversity of animal life.
2. It will help the student to understand the features of kingdom Animalia and systematic organization of animals based on their evolutionary relationships and structural and Functional affinities .
3. The course will also make the students aware about the characteristics morphological and anatomical features of diverse.

(j) Course Objectives:

1. To understand the animal kingdom.
2. To understand the taxonomic position of annelids to Echinodermata.
3. To understand the general characteristics and classification of animals belonging to annelids upto Echinodermata.
4. To understand the habits, morphology, physiology reproduction, development of phylum from annelids to Echinodermata.

(k) Course Outcome (CO):

1. Student should be able to describe unique characters of annelids, to arthropods, mollusk and Echinoderms.
2. Student should be able to recognize the ecological role of phylum annelid, arthropoda, mollusk, Echinoderms.
3. Student should be able to recognize life function of annelids, arthropods, mollusk, Echinoderms
4. To recognize the diversity

Book & References :

7. A text Book of invertebrate Zoology, author – Dr. S.N. Prasad
8. Invertebrate Zoology Author – E.L. Jordan and P.S. Verma
9. Text Book of Invertebrate Zoology, Author – G.S.Sandhu
10. Modern text of zoology Invertebrate, Author – R.L. Kotpal
11. Invertebrate zoology Author – D.T. Anderson
12. Invertebrate zoology Author – Ruppert, Fox and Barnes

Reference :

3. Barner, R D. (2006). Invertebrate zoology, 7th Edition, cenage Learning, India.
4. Pechenik J.A. (2015) Biology of the invertebrates. 7th Edition, Mcgraw – Hill Education.

study of the types given in each:

Unit-I

Annelida - Nereis, *Leech*

Unit-II

Arthropoda - Palaemon (prawn) Grasshopper, Economic

importance of Insects

Unit-III

Mollusca -*Pila* (apple-snail), Economic importance of mollusca

Unit-IV

Echinodermata -Asterias, Water-vascular system in Asteriodia

Syllabus and Lecture Plan: **B.Sc. I (Zoology)**

(l) Subject Name: Cell biology and Genetics

(m) Subject Code: Paper III (BSZL-103)

(n) Why you need to study this course

1. The genetics and cell biology course provides you with the theoretical and practical resources for a career in the health care industry.
2. This course provide a full appreciation of now the improved knowledge of genetics and cell biology impact on society.
3. The generics and cell biology maser a specialization track for pre medicine students and minor in master's program.

(o) Course Objectives:

1. The objective of this course is to provide the conceptual knowledge about cell biology and genetics.
2. To understand the structures and purposes of basic components of prokaryotic and eukaryotic cell, plasma membrane, cell organelles.
3. To understand the process of cell division.
4. To Understand the law of inheritance, To understand gene describe mutation and their role incusing interactions variation in populations.

(p) Course Outcome (CO):

1. Student should be able to understand basic principles of mandolin inheritance, gene interaction, mutation generic code, Linkage, Cussing over, sec, determination sex linked inheritance, Gaelic diseases, Chromosomal aberration.
2. Student should be able to describe the function and the composition of the plasma membrane, The structure and function, various cell organelles, cell divisions of the cells.
3. Explain the principle of cell type, cell theory,

(q) Syllabus

Unit-I

Cell Biology I: Classification of cell types, Bacteria, Archaea (prokaryotic) and eukaryotic cells. 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, lysosomes, nucleus, ribosome and endoplasmic reticulum.

Unit-III

Genetics-I: Structure of Chromosomes, Watson & Crick Model of DNA, Nucleic acid. DNA replication, transcription, translation . Differences between DNA & RNA, Cell Cycle, 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 and mutation.

Unit-IV

Genetics II: Sex determination, sex differentiation, prenatal detection of genetic diseases (amniocentesis), Sex-linked characters, Mutation, Genetic diseases and abnormalities, chromosomal aberrations, Eugenics, Pedigree analysis, Patterns of inheritance: autosomal dominant, autosomal recessive, X-linked recessive and X-linked dominant

B.Sc. (ZOOLOGY)

FIRST YEAR DETAILED SYALLBUS PAPER –

IV PRACTICAL

1-	Dissection (Major)	12 Marks
2-	Dissection (Minor)	05 Marks
3-	One Permanent Mount	05 Marks
4-	One temporary Mount	03 Marks
5-	Cytology & Genetics Preparation/Prepared slides	05 Marks
6-	Identify and Comment upon spots (1-10)	10 Marks
7-	<i>Viva-Voce</i>	05 Marks
8-	Practical class record	05 Marks
	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.

- (g) Examination of pond water for different kinds of protozoa with special reference to *Arcella* and *Vorticella*.
- (h) Study of prepared slides : *Polystomella*, *Gregarina*, *Trypanosoma* and *Noctiluca*, *Ceratium*.
- (i) Prepared slides of Upaline, Balontidium and Nyctotherum.

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, 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**
Clolony-prepared slide.

Medusa-prepared slide.
- (c) **Aurelia**
General morphology.

Tentaculocyst-prepared slide.

Prepared slides and models of life-history stages.
- (d) **Physalia** (Portguese man of war), *Corallium* (red coral),
Fungia (Mushroom coral), *Madrepora* (staghom 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 vermicularis (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

Circulation 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 Culex***

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).

Larval forms Nauplius, Zoea), *Lepisma* (Silver fish), *Schistocerca* (locust),

Odontotermes

(white ant), *Cimex* (bed bug), *Pediculus* (louse), *Papilio* (butterfly), *Bombyx* (Silk moth), *Apis* (honey- bee), *Polistes* (wasp), *Camponotus* (Black ant), *Xenopsylla* (rat flea), or *Thyroglutus* (millipede), *Scolopendra* (centipede). *Lycosa* (wolf-spider), *Lxodes* (tick), *Limulus* (King crab).

MOLLUSCA

- (a) *Lamellidens*
External characters
Dissection through multimedia / models Slides
of gill lamella.
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

Subject Name : B.Sc. IInd Year Paper Ist (Chordata)

Subject Code : BSZL - 201

(e) **Course Outcome (CO) :**

- On complete of this course students should be able to describe unique character of Hemichordate, Urchordate, cephalochordate.
- To understand the ecological role of different classes of vertebrate.

- Students should be able to describe unique characters of class amphibian, reptiles, aves and mammals.
- To understand the diversity of vertebrates.

B.Sc. (ZOOLOGY)

SECOND YEAR DETAILED SYLLBUS PAPER – I

Chordata

Unit- I

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

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

Unit -II

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

Cyclostomata: General characters of cyclostomata. Study of Petromyzon.

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 amphibia and migration in fishes.

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 and flight adaptation in birds.

Subject Name : B.Sc. IInd Year Paper II (Animal distribution, Evolution and Developmental Biology)

Subject Code : BSZL - 202

(e) Course Outcome (CO) :

- On complete of this course student should be able to describe evolutionary history of man.
- To understand again of species on earth.
- Understand the placentation.
- Understand the gametogenesis.

B.Sc. (ZOOLOGY)

SECOND YEAR DETAILED SYALLBUS PAPER – II

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 and vitellogenesis.

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 regeneration. Embryonic induction and cell specification.

Subject Name : B.Sc. IInd Year Paper II (Physiology and biochemistry)

Subject Code : BSZL - 203

(e) Course Outcome (CO) :

On complete of this course student :-

- Understand the concept enzymes, vitamins.
- Students are able to design and conduct scientific experiments and analyze the resulting data.
- Understand the blood, excretory system, digestion.
- Understand the carbohydrate, protein.

B.Sc. (ZOOLOGY)

SECOND YEAR DETAILED SYLLBUS PAPER - III

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 and pheromones.

Unit-IV

General chemistry and classification of carbohydrates, lipids and proteins; Enzymes, nucleic acid, vitamins and minerals.

B.Sc. (ZOOLOGY)

SECOND YEAR DETAILED SYALLBUS PAPER –

IV

PRACTICAL

1-	Dissection (Major)	10 Marks
2-	Permanent Mount	05 Marks
3-	Comment upon Physiology Apparatus	05 Marks
4-	(i) Suitable preparation of Hemin crystals from the blood	05 Marks
	(ii) Detect the Sugar /albumin / acetone from urine sample	
5-	Slides of (i) Striped or Unstriped muscles	05 Marks
	(ii) Cartilage (hand cut Section)	
	(iii) Blood film/Aereolar tissue	
5-	Identify and Comment upon spots (1-10)	10 Marks
6-	<i>Viva-Voce</i>	05 Marks
7-	Practical class record	05 Marks
	Total	50 Marks

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 tubercle).

(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.

Osteichthyles

- (a) *Labeo rohita* (rohu)- General morphology and dissected specimen.
- (b) *Acipenser* (sturgeon), *Lepidosteus* (gar-pike), *Hippocampus* (sea horse) *Antennarius* (Indian angler), *Anguilla* (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 : *Ichthyopnis*

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) Lacertilla

- 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* (cobra), *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)

- (i) External Characters. Structure of Feather. Varieties of feathers. 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: *Dasybus* (Armadillo)
- (b) Pholidota: *Manis* (Scaly ant-eater).
- (c) Cetacea: *Platanista* (Ganges dolphin).
- (d) Perissodactyla: *Equus caballus* (horse), *Equus vulgaris* (ass), *Equus zebra* (zebra), *Rhinoceros unicornis* (rhinoceros).
- (e) Artictyla: *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 familiari* (dog), *Ursus* (bear) *Hyaena* (hyaena), *Phoca* (seal)
- (h) Rodentia: *Mus* (domestic rat), *Hystrix* (Porcupine)
- (i) Lagomorpha: *Lepus* and *Oryctolagus* (hare and rabbit)
- (j) Insectivora: *Erinaceus* (hedge-hog), *Crocidura* (chhachhundar)

- (k) Chiroptera: *Pteropus* (Flying-fox).
- (l) Primates: *Macaca* (rhesus monkey), *Hylobates* (gibbon), *Simia* (Orang-utan), *Anthropo pithecus* (chimpanzee), *Gorilla*, *Homo sapiens* (man).

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).

Physiology

- (d) Nervous: Neurons
- (e) Histology of various organs-prepared slides.
 - (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.

Subject Name : B.Sc. IIIrd Year Paper I (Applied and Economic Zoology)

Subject Code : BSZL - 301

(e) Course Outcome (CO) :

- Understand concepts of fisheries, fishing tools and site selection
- Aqua culture systems, induced breeding techniques, post harvesting techniques.
- Gives knowledge of silkworm rearing, honey bee rearing lac insect rearing.
- Perform procedures as per laboratory standards in the areas of applied and economic zoology.
- Gain knowledge about parasites, vectors, pests and wild life of India.

B.Sc. (ZOOLOGY)

THIRD YEAR DETAILED SYALLBUS PAPER – I

Applied and Economic Zoology

Unit-I

Parasitolog : General account of parasitism

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

Unit-II

Vectors and pests: Life cycle and their control of following pests: Gundhi bug, Sugarcane leafhopper. 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. Causes of extinction of wild life. Important sanctuaries; national parks of India; Different projects launched for the preservation of animal species; *in-situ* and *ex-situ* conservation of wild life.

**Subject Name : B.Sc. IIIrd Year Paper II
(Biotechnology, Immunology, Biological Tools &
Techniques and Biostatistics)**

Subject Code : BSZL - 302

(e) Course Outcome (CO) :

Unit-I

- Imparts the knowledge to culture animal cells in artificial media.
- Techniques of microscopy and immunology.
- Types of immunity, antigens-antibodies and their properties.
- Perform procedures as per laboratory standards in the areas of biotechnology, immunology, biological tools & techniques and biostatistics.
- Students gain knowledge about statistical methods like measure of central tendencies (mean, median, and mode), sampling, dispersion (variance, standard deviation, and standard error), correlation and regression.
- Students gain knowledge about various tools and techniques used in biological systems.

C. (ZOOLOGY)

THIRD YEAR DETAILED

SYALLBUS PAPER – II

B

Biotechnology, Immunology,

Biological Tools & Techniques and

S

Biostatistics

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, interferon.

Unit-III

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

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

Unit-IV

Biostatistics: Introduction to biostatistics, application of biostatistics Sampling, Measures of central tendency (mean, median and Mode) and dispersion (variance, standard deviation and standard error).

**Subject Name : B.Sc. IIIrd Year Paper III (Ecology, Microbiology
Animal Behavior and Pollution & Toxicology.)**

Subject Code : BSZL - 303

(e) Course Outcome (CO) :

- Understand animal behavior and response of animal to different instincts.
- Imparts knowledge to the student regarding ecology, microbiology animal behavior, pollution and toxicology.
- It gives the opportunities to the students in assessing the effects of toxic pollutant on environment and in the food chain.
- Skill development in environmental toxicology.
- Gain knowledge about bacteria and virus.
- Understands air, water and radiation pollution and their control.

B.Sc. (ZOOLOGY)

THIRD YEAR DETAILED SYALLBUS PAPER – III

**Ecology, Microbiology Animal Behavior and
Pollution & Toxicology.**

Unit- I

Ecology: Ecosystem: Concept, components, fundamental operations, energy flow, food-chain, foodwebs and trophic levels, ecological niche, abiotic and biotic factors. Population: Characteristics and regulation. Ecological succession. Adaptation: Aquatic, terrestrial, aerial and arboreal.

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 SYALLBUS

PAPER – IV

PRACTICAL

1-	Dissection (Major)	12 Marks
2-	Permanent Mounting	06 Marks
3-	Temporary Mounting	05 Marks
4-	Identify and Comment upon Spots (1-8)	16
Marks	5- Economic Zoology (<i>Comments on a suitable Specimen/ life cycle of Silk worm, Honey bee, Lac insect & Food Fishes</i>) (02)	06
Marks		
6-	Biological Tools and Techniques	06
Marks		
7-	Ecology/ Pollution/ Toxicology (Exercise or Comment	06
Marks		
8-	Biostat./Microbiology /Immunology/Behavior	06
Marks		

9- *Viva-voce* 06

Marks

8- Practical Class record / Project / Collection 06

Marks Total 75

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.
- Permanent mount of wings, mouth parts and developmental stages of mosquito and house fly. Permanent preparation of ticks/ mites, abdominal gills of aquatid insects viz. Chironomus larva, dragonfly and mayfly nymphs, preparation of antenna of housefly.
- 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.