

Unified Syllabus of Zoology for U.P.State Universities (B.Sc. I, II, & III year)

Following Major title of papers of B.Sc. I, II, and III were finalized with their contents:

Theory Paper's duration is of Three hours and duration of practicals is Four hours

B.Sc. I		
Papers	Title of paper	Max. Marks
Paper I	Lower Non Chordata (<i>Protozoa- Helminths</i>)	50
Paper II	Higher Non Chordata (<i>Annelida- Echinodermata</i>)	50
Paper III	Cell Biology and Genetics	50
Practical	Practical Syllabus based on theory papers	50

B.Sc. II		
Papers	Title of paper	Max. Marks
Paper I	Chordata	50
Paper II	Animal distribution, Evolution and Developmental Biology	50
Paper III	Physiology and Biochemistry	50
Practical	Practical Syllabus based on theory papers	50

B.Sc. III		
Papers	Title of paper	Max. Marks
Paper I	Applied and Economic Zoology	75
Paper II	Biotechnology, Immunology, Biological Tools & Techniques and Biostatistics	75
Paper III	Ecology, Microbiology, Animal Behavior, Pollution and Toxicology	75
Practical	Practical Syllabus based on theory papers	75

Unified Syllabus of Zoology for U.P.State Universities
Subject- Zoology
B.Sc. - First Year
Practical

1-	Dissection (Major)	10 Marks
2-	Dissection (Minor)	05 Marks
3-	Cytological exercise	05 Marks
4-	One Permanent Mount	05 Marks
5-	Genetics Exercises	05 Marks
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

Unified Syllabus of Zoology for U.P.State Universities
Subject- Zoology
B.Sc. -Second Year
Practical

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

Unified Syllabus of Zoology for U.P.State Universities
Subject- Zoology
B.Sc. - Third Year
Practical

1-	Identification & Comment upon Sports 1-10 (Pests, Economically important animals)	15 Marks
2-	Life cycles of Silk worm, Honey bee & Lac insects.	05 Marks
3-	Ecological Experiments.	10 Marks
4-	Experiments on Biotechnology/Immunology/ Prostatistics.	10 Marks
5-	Exercises on Microbiology/Tools.	05 Marks
6-	Experiments on Pollution/Toxicology.	05 Marks
7-	Experiments on Animal behavior	05 Marks
8-	<i>Viva-voce</i>	10 Marks
9-	Project & Field Collection	10 Marks
	Total	75 Marks

Unified Syllabus of Zoology for U.P. State Universities B.Sc. Part I, II & III

There will be three written papers and one practical examination.

Question No. 1 in each class will be compulsory & comprehensive based on units I to IV and of short Answer type. This will carry 40% of total marks (*i.e.* 20 marks in I & II year and 30 marks in III year). There will be two questions from each unit carrying 60% of the marks, of which one question from each unit has to be attempted.

B.Sc. Part I

Paper I- 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:

Protozoa - *Euglena*, *Monocystis* and *Paramecium*.
Unit-I

Porifera - *Sycon*
Unit-II

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

Unit-IV
Platyhelminthes - *Fasciola* (liver fluke) and *Taenia* (tape worm)
Nematehelminthes - *Ancylostoma* (hook worm)

Paper II- 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:

Annelida - *Nereis*
Unit-I

Arthropoda - *Palaemon* (prawn)
Unit-II

Mollusca - *Pila* (apple-snail)
Unit-III

Unit-IV
Echinodermata - *Pentaceros* (excluding development)

Paper III- 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. Part I
ZOOLOGY PRACTICAL SYLLABUS

PROTOZOA

- (a) **Amoeba** : Examination of culture. Prepared Slide *Amoeba proteus* and *A. verrucosa*.
- (b) **Euglena** : Culture examination for *Euglena*/ Prepared slides.
- (c) **Monocystis** : Examination of contents of seminal vesicles of *Pheretima* or *Eutyphoeus* for different life- history stages and permanent preparation. Prepared slides.
- (d) **Plasmodium** : Preparation of blood film (Leishmen's stain). 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.

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**
Clolony-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), **Sagartia** or **Metridium** (sea anemone)

PLATHYHELMINTHES :

- (a) **Fasciola**
Specimens *in situ* and 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**, **Paramphistomum**, **Schistosma**, **Echinococcus** and **Dipylidium**
Cysticercus (Bladder worm) and Cysticercoid.
- (d) Examination of type worms of pigeon or fowl *in situ*
- (e) Permanent preparation of mature and gravid proglottids of **Cotugnia** and **Raellietina** . :

NEMATHELMINTHES

- (a) **Ascaris**
External characters.
Dissected specimens of male or 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.
Glycerine preparations of setae *in situ* and brain.
Permanent preparations of ovary and septal nephridia.
Prepared slides of transverse section through various regions.
- (c) **Heteronereis**, **Arenicola**, **Aphrodite**, **Eutyopoeus**, **Dero**, **Branchellion**, **Haemadipsa**,
Bonellia (female).

ARTHROPODA

(a) *Palaemon*

External characters; Examination of appendages.
Dissections.
Glycerine preparation of hastate plate.
Permanent and glycerine preparations of statocysts.

(b) *Periplaneta*

External characters. Differences between male and female.
Dissections.
Circulation of blood in the wing of cockroach.
Glycerine preparation of mouth appendages, salivary glands and trachea.
Permanent preparations of salivary glands, Malpighian tubules, ovaries and testes.

(c) *Anopheles and Cules*

Glycerine preparation of mouth parts of male and female. Wings-prepared slides.
Life history-prepared slides.
Difference between *Anopheles* and *Culex*

(d) *Musca*

External characters.
Glycerine preparation 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 *Ctenocephalus* (dog flea), *Thyroglutus* (millipede), *Scolopendra* (centipede).
Lycosa (wolf-spider), *Lxodes* (tick), *Limulus* (King crab).

MOLLUSCA

(a) *Lamellidens*

External characters
Dissection
Permanent preparations of gill lamella.
Transverse section through middle region of body-prepared slides.
Glochidium (larva) prepared slides.

(b) *Pila*

External characters.
Dissection.
Permanent preparations of gill lamella and osphradium.

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

ECHINODERMATA

- (a) *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. Part II (THEORY) Zoology

There will be three written papers and one practical examination. The following courses are prescribed.

Paper I: Chordata

Unit- I

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

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

Unit -II

Urochordata: Classification 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

Unit-IV

Classification of different classes of vertebrates (**Aves and Mammalian**) up to order with characters and examples. Dentition in mammals.

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

Unit-IV

Developmental Biology II: Process of Blastulation & Gastrulation. Fate Map.
Development of Chick up to formation of Primitive streak and mammal (*in out line*)
Extra embryonic membranes of chick.
Placentation and types of Placenta.

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

Unit-IV

General chemistry and classification of carbohydrates, lipids and proteins; Enzymes

B.Sc. Part II

ZOOLOGY PRACTICAL SYLLABUS

Heiuchordata

Urochordata

(a) Herdmania

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

Cephalochordata

Branchistoma (*Amphioxus*)

- (i) General features
(ii) (a) Permanent preparation 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) - & Myxine

Chondrichthyes

(a) Fish

- (i) External characters
(ii) Exo-skeleton Glycerine and permanent preparation of placoid scales

Heart, ventral aorta, dorsal aorta, arterial arches (afferent and efferent)

- (iii) Nervous system : Cranial nerves
(iv) internal ear
(v) Permanent preparation of ampullae of Lorenzini
(b) *Pritis* (Saw fish), *Astrape* (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 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 modles
(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) Crocodilia : Difference between Alligator, Crocodile and Gavialis.

- (e) 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) Neornithes:

- (a) Palaeognathae: ***Struthio*** (ostrich);
- (b) Neognathae: ***Gallus*** (fowl), ***Anser*** duck, ***Corvus*** (crow) , ***Psittacuca***
(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).
- (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* (hyanea), *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
- (a) Epithelia:
 - (i) Squamous (ii) Ciliated and (iii) Stratified
- (b) Muscular:
 - (i) Striped muscles (ii) Unstriped muscles.
- (c) Connective tissue
 - (i) Areolar tissue (ii) Tendon the leg muscles of frog (tease and examine in glycerine)
 - (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) Blood; Preparation of Vertebrate blood film, stain with Leishmann's stain.
- (e) Nervous: Neurons
- (f) 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.

Emliryology : Study of slider pertaining to developmental stages of frog, chick and manual

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. Part III (THEORY) Zoology

There will be three written papers and one practical examination. The following courses are prescribed.

PAPER-I 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.

PAPER-II Biotechnology, Immunology, Biological Tools and 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

PAPER-III Ecology, Microbiology Animal Behavior and Pollution and 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.

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B.Sc. Part III
ZOOLOGY PRACTICAL SYLLABUS

- Permanent Preparation of: *Euglena*, *Paramecium* and rectal protozoans from frog.
- Stool examination for different intestinal parasites.
- Study of prepared slides/ specimens of *Entamoeba*, *Giardia*, *Leishmania*, *Trypanosoma*, *Plasmodium*, *Fasciola*, *Cotugnia*, *Taenia*, *Rallietina*, *Polystoma*, *Paramphistomum*, *Schistosoma*, *Echinococcus*, *Dipylidium*, *Enterobius*, *Ascaris* and *Ancylostoma*; Cimex (bed bug)/ Pediculus (Louse), Haematopinus (cattle louse), Ticks & mites.
- Collection and identification of pests.
- Life history of silkworm, honeybee and lac insect.
- Different types of important edible fishes of India.
- Demonstration of counting of cells (blood and protozoan) by haemocytometer, haemoglobinometer, pH meter, Colorimeter
- Microbiological Techniques: Media Preparation and sterilization, inoculation and Monitoring.
- Study of an aquatic ecosystem, its biotic components and food chain.
- Project Report/ model chart making.
- Practical exercises based on Biostatistics, Biotechnology.
- Practical exercise based on Animal behavior.