आज दिनांक 19.10..2011 को विश्वविद्यालय परिसर में निम्न विषय की पाठ्यक्रम समिति की एक आवश्यक बैठक हुई, जिसमें निम्न प्राध्यापकगण उपस्थित हुए :–

Date :- 19.10.2011 Subject :- Zoology Committee Place :- Committee Hall

1. Prof. P. K. Mittal
2. Dr. Agam Dayal
3. Dr. R. K. Poowal
4. Dr. V. K. Tyagi

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 *(Protozoa- Helminths)*	50
Paper II	Higher Non Chordata *(Annelida-Echinodermata)*	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)	12 Marks
2-	Dissection (Minor)	05 Marks
3-	One Temporary Mount	03 Marks
4-	One Permanent Mount	05 Marks
5-	Cytology & Genetics Preparation/Prepared slides	05 Marks
5-	Identify and Comment upon spots (1-10)	10 Marks
6-	*Viva-Voce*	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-	Permanent Mount	05 Marks
3-	Comment upon Physiology Apparatus	05 Marks
4-	(i) Suitable preparation of Hemin crystals from the blood (ii) Detect the Sugar /albumin / acetone from urine sample	05 Marks
5-	Stained Preparation of (i) Striped or Unstriped muscles (ii) Cartilage (hand cut Section) (iii) Blood film/Aereolar tissue	05 Marks
5-	Identify and Comment upon spots (1-10)	10 Marks
6-	*Viva-Voce*	05 Marks
7-	Practical class record	05 Marks
	Total	**50**

Marks

Unified Syllabus of Zoology for U.P.State Universities

Subject- Zoology
B.Sc. - Third Year
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	*(Comments on a suitable Specimen/ life cycle of Silk worm, Honey bee, Lac insect & Food Fishes)* (02)	06 Marks
6-	Biological Tools and Techniques *(Comment)*	06 Marks
7-	Biostat / Microbiology / Immunology / Behavior	06 Marks
8-	Ecology/ Pollution/ Toxicology (Exercise or Comment	06 Marks
9-	*Viva-voce*	06 Marks
10-	Practical Class record / Project / Collection	06 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:

Unit-I

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

Unit-II

Porifera - *Sycon*

Unit-III

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

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:

Unit-I

Annelida - *Nereis*

Unit-II

Arthropoda - *Palaemon* (prawn)

Unit-III

Mollusca -*Pila* (apple-snail)

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.

(i) Examination of rectal protozoans *Opalina, Balantidium* and *Nyctotherus.*

PORIFERA

(a) **Sycon**

General characters

Spicules glycerine preparation.

Transverse and longitudinal sections-prepared slides.

(b) Gemmule of *Spongilla* permanent preparation.

(c) Different kinds of spnge 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*** (Portguese man of war), *Corallium* (red coral), *Fungia* (Mushroom coral), *Madrepora* (staghom coral), *Pennatula* (sea pen), *Sagartia* of *Metridium* (sea anaemone)

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 of fowl *in situ*

(e) Permanent preparation of mature and gravid proglottids of *Cotugnia* and *Raellietina.* **:**

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.
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, Eutypoeus, 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 nmale and female.
Dissections.
Cirulation 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, Zoaea), *Lepisma* (Silver fish), *Schistocerca* (locust), O*dontotermes*
(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* (trick), *Limulus* (King carb).

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) ***Pentaceros:***

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. 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

Urochordata

(a) Herdmania

(i) External characters
(ii) Dissection
(iii) (a) Permanent preparation of branchial wall
(b) Section of test and glycerine prepration of spicules.
Glycerine and permanent prepration on 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) Permanent prepration 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 Glycerine and 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
(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) Permanent preparation of ampullae of Lorenzini
(i) Section through various regions of the body of adult and embryo
(j) Embryo with yolk-sac placenta

(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), *Lepiodosteous* (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* (cobara), *Vipera* (viper), *Typhlops* (burrowing snake) and *Python*. Biting mechanism of a poisonous snake (model).

(d) Chelonia : Derman armature

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

(f) Extinct reptiles, Models (five)

Dimetrodon, Diplodocus, Pteranodon, Tyrannosaurus* and *lchthyosaurus

Aves

(A) *Columba livia intennedia* (pigeon)

(i) Esternal 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) Pelivic girdle and hind-limb.

(B) (i) Archaeornithes-Archaeopteryx (cast)

(ii) Neornithes:

(a) Palaeognathae: ***Struthio*** (ostrich);
(b) Neognathae: ***Gallus*** (fowl), ***Anser*** duck, ***Corvus*** (crow) , ***Psuttacuka*** (parrot) and ***Pavo*** (peacock).

Perching mechanism: Model
Skulls and Beaks of Birds.
Feet of birds: Models

(C) Embryonic membrances-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 cabalus* (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), C*anis 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: *Erinaceu*s (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: Preparation 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 (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.

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*;
- 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.
- Collection and identification of pests.
- Life history of silkworm, honeybee and lac insect.
- Different types of important edible fishes of India.
- Prepared slides of plant nematodes.
- 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.
- Preparation of chromosomes, Test for carbohydrate Photochemical demonstration of proteins and lipids, using hand sections using hand sections, endocrine glands (Neurosecretory cells) of cockroach.
- Demonstration of developmental stages of chick.
- Project Report/ model chart making.
- **Dissections** :
- **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.

Recommendation

The unified syllabus is well-knit and is passed as such. However, following minor corrections should be added;

1. B.Sc. Part I

Paper I- Lower nonchordata (Protozoa -Helminthes).- The habits, morphology, physiology reproduction, development (in outline) and classification upto orders of the following groups of animals-

Unit-I : Protozoa- Euglena and Paramecium
Unit-II : Sycon, Canal system in sponges.
Rest as such.

Paper II- Higher Non-chordate (Annelida to Echinodermata)- The habits, morphology, physiology, reproduction, development (in outline) and classification upto orders of the following groups of animals.

Unit-I : Annelida- Hirudeniaria
Unit-II : as such
Unit-III :as such
Unit-IV : Echinodermata-Asterias (sea-star) (excluding development)

Paper III- Call Biology & Genetics

Unit-I : Cell Biology : Structure and function of cell, ultra structure and function of plasma membrane.
Unit-II : as such
Unit-III : Differences between DNA & RNA, cell division should be like this differences between DNA, & RNA, cell cycle and cell division. Rest as such.

Unit-IV : Geneties II Ist 2 times as such. + Genetic diseases and syndromes, structural and numerical aberrations- Deficiency duplication, translocation, inversion, euploidy, aneuploidy, monosomic, nullisomic, trisomic etc.
Last Eugenics- should be cancelled.

B.Sc. II

Paper I- as such
Paper II- as such
Paper II- Physiology and Biochemistry
Unit -I : Physiology of digestion, Breathing and internal respiration and blood: strucutre, junction and clotting, physiology of heart beat.

Unit-II : as such
Unit-III: as such
Unit-IV: as such

B.Sc. III

Paper I- Applied & Economic zoology
Unit-I : Parasitology-Giaradia should be cancelled. Rest as such.
Unit-II: as such
Unit-III: as such
Unit IV: Wild life of India: Endanagered species. Important sanctuaries, national parks, biosphere reserves, hot spots of India. Different projects .... as such.

Paper II
Unit-I :as such
Unit-II :as such
Unit-III : pH meter, colorimeter. Rest as such

Unit IV :In the second line:- correlation and Regression can be cancelled. Graphical representation of data- may be added.

Paper III
Unit-I :as such
Unit-II :as such
Unit- III :as such
Unit-IV :In the last line- categories of toxic effects- Teratogenic, careinogenic and mutagenic effects, Antidotes.

Practical Syllabus is passed as such.

M. Sc. (Previous) Zoology

There will be four written papers of 100 marks each and Practical 200. Each paper will have four Units.

PAPER I

Non-Chordata

Protozoa :

1. Nutrition
2. Reproduction
3. Parasitism with a brief account of the causative agents of following diseases of man Kala-azar., Diarrhoea & sleeping sickness.

Porifera :

4. Skeleton, canal system and affinities.

Minor Phylum :

5. Brief account and affinities of Ctenophora.

Coelenterata :

6. Polymorphism
7. Coral & Coral reefs

Helminthes :

8. Parasitism in helminthes with a brief account of the life cycle and pathogenicity of (1) Schistosoma, (2) Echinococcus and Wuchereria.
9. Parasitic adaptations.

Minor Phylum :

10. Short notes on Rotifera, Entoprocta, Acanthocephala, Ectorocta, Phoronida, Brachiopoda, Sipunculoidea.

Annelida :

11. Adaptive radiation in Polycheeta.
12. Asexual reproduction
13. Segmental Organs (Excretory Organs)

Mollusca :

14. Torsion in gastropoda
15. Pearl industry

Echinodermata: 16. Larval forms

17. Water vascular system

18. Affinities of Echinodermata

Arthropoda: Brief account and affinities of Trilobita and Onychophora

20. Parasitism in Crustacea

21. Larval forms in Crustacea

22. Economic importance of insects and pest control.

PAPER II

Cytogenetics and Biostatistics

Section (A)

Cytogenetics

1. Ultrastructure of animal cell
2. Chemical nature of gene, gene action, genetic code and Protein synthesis.
3. Chromosome structure and its behaviour in cell division.
4. Mendelism, interaction of genes, lethal genes.
5. Sex linked inheritance, linkage and crossing over, chromosome mapping.
6. Sex determination with a note on gynadromorphism
7. Multiple allelism with a note on the blood groups in man.
8. Structural and numerical chromosomal aberrations and their significance.
9. Gene mutation and their artificial production.
10. Cytoplasmic inheritance.

Section (B)

Biostatistics

1. Introduction—graphs, bar diagrams and histograms.

2. Variance and difference of means, standard deviation and standard error.
3. Rates and ratios.
4. Chisquare test.
5. Analysis of variance, degrees of freedom and level of significance

Note : Candidates will be required to attempt atleast one question from section (B) Biostatistics.

PAPAR III

Physiology And Related Biochemistry :

1.	Nutrition :	(a) Digestion, digestive enzymes and their role in digestion of carbohydrates, proteins and fats.
		(b) Absorption and biotransformation of digested food.
		(c) Chemical structure and biological significance of carbohydrates, lipids, proteins and amino acids.
		(d) Gastro-intestinal hormones
2.	Respiration :	(a) Breathing mechanism and its control.
		(b) O_2 & CO_2 transport.
3.	Circulation :	(a) Control of Heart beat, Myogenic and Neurogenic Heart
		(b) Functions of blood with special reference to immunization
4.	Osmorequlation	(a) Mechanism of water-salt balance in fresh water, marine and estuarine forms
5.	Neuro-muscular system	(a) Ultrastructure and function of muscle fibres
		(b) Origin and conduction of nerve impulse in a nerve fibre through a synapse

6. Excretion
   (a) End products of carbohydrate. protein and fat eatabolism.
   (b) Ultrastructure and function of verterbrate nephron.
7. Molecular Properties : Gibbs-Donnan Equilibrium, $_{p}H$ and Buffer
8. Chemical equilibrium : Law of mass action, Elementary thermodynamics in relation to life, Oxidation-reduction and coupled reactions
8. Enzymes
   (a) Classification, mode of action and factors influencing the enzyme activity
   (b) Co-enzymes
10. Structure and Function of A T P

PAPER IV

Ecology, Taxonomy And Evolution

Ecology :

1. Basic concepts of Ecology, its scope and relationship with other sciences.
2. Ecosystem : Principles and dynamics. development and evolution.
3. Population : Density, biotic potential, mortality rate, natality rate. age, distribution and growth curve.
4. Community : Its organization and dynamics.
5. Fresh water : marine and desert ecology.
6. Effects of radiation and pollution on animal life and Green house Effect.
7. Biogeochemical cycles (C, P, S, O, and N)

Taxonomy :

8. Theories of classification.
9. Taxonomical categories.
10. Zoological nomenclature.

11. Modern trends in taxonomy.

Evolution :

12. Synthetic theory of evolution.
13. Genes in population : Hardy weinberg Law and Sewell wright effect.
14. Isolation-barriers and their role in speciation.
15. Origin of species, speciation.
16. Variations.
17. Micro and Mega evolution.

M. Sc. Previous Zoology Practical

Candidates will be expected to submit the collection and microscopical preparations and a note-book containing a complete record of Laboratory work, seminars and field work. Atleast one excursion will be held to enable the students to familiarize with Indian Fauna. The excursion will be compulsory and the institution will be expected to provide the financial assistance for the excursion, a part of which will be borne by the students also.

The duration and distribution of marks shall be as follows :—

Duration : Two Days. 5 hours each day.

FIRST DAY

Major Dissection	20 Marks
Minor Dissection	10 Marks
Permanent Preparations A & B with identification	15 ,,
Spotting (10 spots of Protozoa to helminthes and Minor Phyla)	20 ,,
Physiology & Biochemistry experiment	15 ,,
	80 Marks

SECOND DAY

Major Dissection	20	Marks
Cytology Preparation	10	,,
Spotting (10 spots of Annelida to Echinodermata and Cytology)	20	,,
Comments & Ecology experiments	10	,,
Viva-Voce	20	,,
Record note-book and microscopical preparations, Collection and Report on Seminars and Excursions.	40	,,
	120	Marks

Total Marks : 200

MAJOR DISSECTIONS

General Anatomy and nervous system of :-

Mollusca :—Unio, Mytilus, Pila, Apiysia Sepia, Loligo, and Octopus.

Arthropoda :—Squilla, Palamnaeus, Periplaneta, Grasshopper, Wasp and Honeybee.

MINOR DISSECTIONS

Anneliaa :—Pheretima (Nerve Ring and Reproductive system).
Hirudinaria : Alimentary canal

Arthropoda :—Palamnaeus (Book Lung)

Echinodermata :—Aslerias [General Anatomy and water vascular system)
Echinus (General Anatomy and Aristotle Lantern)
Holothuria (General Anatomy only)

PERMANENT-PREPARATION/MOUNTING

Protozoa :— Amoeba, Paramecium, Euglena, Noctiluca, Ceratium Elphidium, Polystomella, Radiolarion, Foraminifera.

Porifera :— Gemmule, Spicules and Spongin fibres.

Coelenterata :— Hydra, Obelia, Obelia medusa, Companularia, Sertularia, Eudendrum, Diphyes.

Helminthes :— Trematode-Larvae (Different stages)
Taenia : Proglottid and Scolex
Fasciola sp. and Oxyuris and Ancylostoma.

Annelida : Pheretima : Blood Gland, Nephridium, Ovary and Setae.

Arthropoda :— Mysis, Nauplius, Daphnia, Cypris, Cyclops, Zoea and Megalopa.

Scorpion :— Book-Lung, Sting-Apparatus, Poison gland and Pecten.

Grasshopper :—Tantorium

Periplaneta :—Testes, Salivary glands, Trachea Tantorium and Malpighian Tubules and Gizzard.

Palaemon : Hastate Plate, Statocyst.

Mollusca :— Unio : Sections of Gill, Mantle and Shell.

Pila : Radula and Ospharidim, Glochidium and Veliger larvae.

Echinodermate :—Polian Vesicle. Pedicellariae, Tube-foot and Bipinnaria Larva.

Minor Phyla :— Sagitta, Bugula, Phoronis, Rotifer.

Examination of Culture :

(a) Amoeba, Euglena and Paramecium : Examination of Culture and preparation of permanent mounts.

In Paramecium experiments will be made to study feeding with Congro Red and Yeast and staining the nucleus with Congro and

Yeast and staining the nucleus with methyl green and restraining active movements by adding Mucilage.

(b) Monocystis :—Examination of contents of seminal vesicles of Pherctima for different life history stages and making permanent preparation.

(c) Examination of Opalina, Balantidium and Nyclotherus (Rectal ciliates) from the rectum of Frog and their permanent preparations.

SPOTTING

MUSEUM SPECIMENS

Phylum—Porifera

Hyalonema, Sycon, Euspongia, Euplectella, Clathrina, Olynthus, Microcioud Hircinea, Poterion, Chalina, Halichondria, Cliona, Leucosolenia, Grantia, Ephidatia, Spongilla.

Phylum – Coelenterata.

Aurelia, Zoanthus, Porpita, Pennatula, Gorgonia Fungia, Telisia, Eudendrium, Alcyonium, Tubipora, Meandrina, Coralliumrubrvm Pleroides, Adamsia (Sea anemone). Phgsalia, Hydractina, Millepora, Velella, Charybdea, Favia.

Phylum – Helminthes.

Ascaris male and female, Taehia solium Liver fluke.

Phylum—Annelida

Aphrodite, Amphitrite, Nereis, Sipuncnlus, Pheretima, Heteronereis, Cyaetopterus, Pontobdella, Arenicola, Sabella, Lumbricus, Bonellia peripatus, Syllis Hirudinaria.

Phylum :—Arthropoda

Limulus, Balanus, Julus, Hermit crab, Hippa, Grasshopper, Scorpion, Cicada, Spider, Prawn, Sacculina on crab, Praying mantis, Scolopendra, Lepas, Sgullia, Palaemon Scorpion, Gryllotalpa, Schistocerca.

MUSEUM SPECIMENS

Phylum – Mollusca

Chiton, Sepia, Loligo, Pecten. Patella, Octopus, Aplysia, Mytilus, Doris, Cyprea, Haliotis, Oyster, Solenocurtis, Nautilus shell, Isochiton.

Phylum - Echinodermata

Antedon, Echinus, Pentacerus, Brittle star, Clypeaster.

STUDY OF SLIDES

Phylum – Protozoa.

Paramecium w. m., Entomoeba cyst w. m. in liver abscess, trophozoite abscess, Eugtena w. m., Monocystis trophozoite in section, Noctiluca, Paramoeciu ı fission w. m. Paramoecium conjugation w. m., Heliozoa w. m., Polystomella, Vorticella, Ceratium, Actinospherium, Nyctotheeus, Foraminifera shell w. m. Volvox vegetative, Radolarian ooze, Amoeba, Plasmodium, Trypanosoma.

Phylum—Porifera

Sponge Gemmules, Gemmules internal structure, Leucosotenia w. m., Sycon T. S. and L. S., Sycon & Ciliatum spicuies, Spongin fibres. Grantia T. S.

Phylum—Colentrata.

Ephyra of Aurelia w. m., Companularia, w. m., Diphyes w. m., Hydra—Bud w. m., L. S. through gonad testis, Sec. gonad testis. T.S. vegetative.

Obelia—Medusa, Aydroid, gonothecad, colony.

Pinnaria w. m. Plumularia, Sertularia w. m,, Tubularia w. m. sea anemone T. S,, stomoedium, Sea anemone T. S. below stomodaecum. Eudendrium w. m, Nematocyst of physalia, Gorgonium spicules, Spicules of Alcyynium.

Phylum—Helminthes

Ascaris T.S. male and female, Ascaris T.S. general structure (T. S. ant.

region), Planaria w. m, Planaria T. S.. Liver fluke ovary, Liver fluke Redia w. m. Liver fluke, T.S. Proboscis, Fasciola hepatica w.m. Fasciola sporocyst, Echinococcus w. m., Echinococcus hydrated cyst, Tapeworm scolex w. m., T. S. Gravid Proglottid Taenia Wuchreia brancofti w. m. in blood, Trichinella spiralis in muscles w.m., Cercaria larvae, Metacercaria, Fasciola T. S. through acetabulum Amphistoma w. m. Tubifex w. m., Schistosoma.

Phylum—Annelida

Hirudinaria—T. S. crop, T, S. through uterus, T. S. through reproductive region, T. S. through Jaw.

Nereis T. S. body, Parapodium Nereis, young Nereis entire, Earthworm T. S. through spermathecae through typhlosole, through blood gland, through pharynx, through gizzard, through clitellar region., Earthworm L. S., State of earthworm.

Phylum—Arthropoda.

Culex larva, Cypris, sting apparatus of honeybee, Cycoys male and female. Mouth parts of housefly, Housefly proboscis (lateral view), Butterfly mouth parts Larva of May fly, Cockroach gizzard T. S., Malpighian tubules of Cockroach, Nauplius larva, Astacus fluviatilis, Dapnnia, Collembola spring tale w. m. Crayfish T. S. thorax, Lepas entire, Periplanata v. s. eye, Hastate plate of Palaemon, Periplanta orientalis Head and mouth parts, T. S. statocyst of Palaemon, pecten of Scorpion. zoea larva, Sacculina T. S.

Phylum—Mollusca

Raduia [Aplysia and Pila], Glochidium larva, Limax T. S. head, T. S. gill Mytilus, Redula of Pila, Sepia embryo T. S. eye, Sepia embryo T. S. body, T. S. shell Unio, T. S. Mantle Unio, T. S. gill lamina Unio, T. S. through body Unio, Veliger larva, Unio T. S through post region.

Phylum—Echinodermata

Ophiopluteus larva w. m., Pluteus larva w. m., Starfish embryology, Starfish young w. m., Starfish tubefeet w. m. Pinnaria larva, Antedon pennule.

Minor phyla

Sagitta, Rotifera, Achinotrocha larva, Bugla, Cristatella, Lucifer, Cresis.

CYTOLOGY SLIDES

Different stages of Mitosis, Interphase, Prophase, Metaphase, Anaphase, Telophase, Different stages of Meiosis. Ist prophase Leptotene, Zygotene, Pachytene, Diplotene, Metaphase I, Anaphase I, Tetophase, Diakinesis, Chiasma formation, Metaphase II, Anaphase II, Telophase II, Golgi Apparatus, Mitochondria.

M. Sc. (Previous) Physiology and Biochemistry Experiments

1. Estimate of total leucocyte and erythrocyte number per cubic mm. of frogs, pigeon and human's blood.
2. Differential count of Leucocyte in the fish, frog, pigeon and rat blood.
3. Determination of clotting time of mammalian blood and its comparison with that of frog's blood.
4. Determination of hemoglobin (gn%) in human blood; also to calculate the colour index and the mean corpuscular hemoglobin concentration concentration (M C H C)
5. Formation of hemin or hematin crystals.
6. Cell permeability of R. B. C. of human blood in saline solution of different concentration.
7. Blood groups test of human blood.
8. pH determination of blood, urine and different parts of alimentary canal of frogs.
9. Determination of rate of heart beat of amphibians and action of cold, heat and drugs such as :—Atropine, adrenaline of its normal beat.

10. Formation of Urea crystal.
11. Action of amylase, pepsin and lipase on their respective substrates.
12. Chemical tests ror urine urea, sugar, proteins, ketone, and lipids.
13. Determination of respiratory rate of rats or fish.

ECOLOGY EXPERIMENTS

1. Study of adaptive modifications in animals due to different ecological conditions.
2. Recording of physical factors like temperature, humidity, rainfall and pressure.
3. Estimation of O_2 and CO_2 concentrations of fresh wa er bodies.
4. Determination of the primary productivity of a fresh water body (Dark and light bottle method.)
5. Qualitative and quantitative study of plankton of a fresh water body.
6. Experim nts showing percent preference of light by insects.

CYTOLOGY EXPERIMENTS

1. Preparation of temporary mounts of Polytene chromosomes and bar bodies.
2. Preparation of temporary mounts to demonstrate stages of meiosis and mitosis.
3. Study ef permanent slides of salivary gland, chromosomes, lampbrush chromosomes, stages of mitosis and meiosis and chromosomal aberrarions.
4. Study of living cells with vital dyes.
5. Collection and culture methods for Drosophila.
6. Study of Drosophila (wild type and mutant flies, vestigeal wings, white eye, sepia eye)
7. Study of the life cycle of Drosophila (From prepared slides).
8. Demonstration of salivary gland chromosomes of Drosophila and Chironomus larva.

M. Sc. Final Zoology

There will be four written papers of 100 marks each and a practical of 200 marks.

Paper I and II will be compulsory for all the candidates. Paper III and IV may be opted from any of the followig groups (to be announced at least one year prior to the date fo examinaticn).

(a) Fishes (including Fisheries), (b) Entomology, (c) Cytology

(d) Animal Physiology and Biochemistry.

Each theory paper will have four units.

PAper I- CHORDATA

1 Reproduction and colony formation in ascidians.
2. Notes on : Salpa. Doliolum, Pyrosoma, Branchial Basket and distinction between petromyzon and Myxine
3. General characters and classifiction of Fishes.
4. Evolution and Phylogeny of Fishes.
5. Structure and affinities of Ostracoderms and placoderms
6. Fins and locomotion in Fishes.
7. Air Blader and Weberian ossicles of Fishes
8. Origin of Tetrapoda.
9. Structure and affinities of Gymnophiona and Stegocephalia
10. Structure and affinities of Dipnoi and Holocephali.
11. Temporal region in Reptiles and its role in the classification.
12. Origin and Evolution of Reptiles
13. Brief account of structure and affinities of Rhynchocephalia. Chelonia and Dinosaurs.

14. Origin and evolution of Birds.
15. Palate in Birds.
16. Brief account of Limbles Lizards, Snake venom and antivenine, Ratitae and Flight Mechanism.
17. Origin and evolution of Mammals.
18. General Organization, distribution and affinities of prototheria and Metatheria.
19. Dentition in mammals.
20. Aquatic adaptations in mammals.
21. Evolution of Man

PAPER II DEVELOPMENTAL BIOLOGY AND ANIMAL BEHAVIOUR

1. Fertilization and its biochemical aspects.
2. Cleavage.
3. Gastrulation.
4. Germ layers and their fate,
5. Development of Brain, Eye and Heart in chick.
6. Amniogenesis and placentation in Mammals.
7. Induction and organizer concept.
8. Ageing and cellular Death.
9. Role of nervous system and receptors in behaviour.
10. Orientation with particular reference to Birds and Batsi.
11. Migratory behaviour of Fishes and Birds.
12. Reproductive behaviour, courtship, mating and parental care in fishes and Amphibia.
13. Territorial behaviour in Birds.
14. Pheromones and their role in reproduction.

GROUP—A

PAPER III- (a) FISH AND FISHERIES

1. Skin and scales in fishes
2. Colouration and colour change in fishes
3. Food and feeding habits of fishes, alimentary canal and physiology of digestion
4. The respiratory system, accessory respiratory organs and physiology of respiration
5. The cardiovascular system and Physiology of circulation.
6. Excretion and osmoregulation
7. Nervous system
8. Urinogenital system
9. The swimbladder and weberian oscicles and their homologies.
10. Endocrins organs.
11. Migration in fishes.
12. Electric, luminous and sound producing organs.
13. Larvivorous fishes and their significance.
14. Viviparity.

PAPER IV (a) :

The Syllabvs proposed for paper IV (a) is as follows :—

1. Preparation and maintenance of fish aquarium.
2. Fisheries of Indian including molluscan and crustacean fisheries.
3. Hill-stream and Deep sea fishes.
4. Different types of fishering gears and crafts.
5. Problems of fishing industry caused by physio-chemical Properties of fishery waters and effects of pollution.
6. Plankton in relation to fish, production.

7. Fish bye-product industry with special reference to fish oil, fish manure, i.e., in glass etc.
8. Breeding of fish under natural and artificial conditions and pond culture.
9. Pre ervations of fishes, refrigeration, smoking and timming.
10. Some important diseases of cultured fishes and remedial measures.

PAPER III : ENTOMOLOGY

(Insect Morphology, Physiology, Development and Ecology)

1. Insect Morphology :

(i) Structure of head, thorax and abdomen and their principal modifications. Elementary knowledge of musculature of head and thorax.

(ii) Structure of the digestive, excretory, respiratory, circulatory, nervous and endocrine systems.

(iii) Reproductive organs, male and female genitalia and their principal modifications.

(iv) Physiology of digestion, Role of enzymes and digestion of different types of food.

(v) Physiology of malpighian tubules and their secondary functions.

(vi) Production and reception of sound.

(vii) Light producing organs, Physiology of photoluminescence. Theory of mosavision.

(viii) Hormones Neurosecretion.

2. Development.

(i) Structure of the insect egg, maturation, cleavage, early embryonic development.

(ii) Germ layers, blastokinesis, segmentation.

(iii) Organogenesis.

(iv) Metamorphosis, types of metamorphosis, Physiology and hormonal cor trol of metamorphosis, significance of metamorphosis.

(v) Types of Larvae and pupae, significance of larval life.

3. Ecology :

(i) General principles of ecology. Habitats and communities of insects.

(ii) Abiotic factors and their effect on insect development and population with special reference to temperature and humidity.

(iii) Biotic factors, Associations and insect behaviour. Parasitism in insects. Insects predators, symbiosis, Parental care and social life in insects.

PAPER IV : ENTOMOLOGY

(Systematics. Phylogeny and Economic Entomology)

1. Principles of Insect Classification :

(i) Fundamentals of classifications, Basis of classification.

(ii) Brief history of insect classification.

2. Fossil insects and Insects Phylogeny :

(iii) Fossilization of Insects and general survey of fossil orders of insects with special reference to Palaeodyctioptera.

(iv) Ancestry of insects and the evolution of holometabolic insects.

3. Insect Orders :

(i) Principles of construction and use of dicliotomus keys in the insect identification, characters of taxonomic importance Cemstock-Needhan nomenclature of wing vanation.

(ii) Detailed knowledge of the special structure, habits and importance of the following orders, with special reference to the families mentioned :—

1. Ephemerida
2. Placoptera
3. Odonata
4. Embioptera
5. Orthoptera-Acrididae, Gryilidae, Tettigonidae, Locust and Phase theory of Locust.
6. Phasmida
7. Dermaptera
8. Blattaria
9. Mantoidae
10. Phithioptera-Anoplura and Malophaga
11. Psocoptera
12. Isoptera
13. Thysanoptera
14. Tricoptera
15. Aptera
16. Protura
17. Collembola
18. Thysanura

1. Heteroptera : Pentatomide, Coreidae, Pyrrhocoridae, Reduvidae. Lygaeledae, Tingidae, Belostomatidae, Nepidae, Gerridae.
2. Homoptera : Flgoridae, Membracidae, Jassidae, Aleurodae, Psyllidae, Aphidae and Coccidae.
3. Coleoptera : Carabidae, Dytiscidae, Paussidae, Staphylinidae. Dermestidae, Hydrophyllidae, Chrysomelidae, Meloidae.

Coccinellidae, Buprestidae, Elateridae. Tenerbrionidae, Cerembycidae, Scarabacidae, Cu-culionidae.

4. Trichoptera.

5. Lepidoptera : Noctuidae, Sphingidae, Pyrallidae, Geometridae, Bombycidae. Papilionidae, Nympnalidae, Pieridae and Lycinidae.

6. Hymenoptera—Ten hredenidae, Cynipidae, Ichneumonidae, Braconidae, Evanidae, Chalcidonae Serphidae, Vespidae, Formicoidae, Apidae.

7. Diptera—Tipulidae, Mycetophylidae, Psycholidae, Chironomidae, Simulidae Culcidae, Itonididae, Tabanidae, Asilidae, Syrphidae, Drosophilidae, Muscidae, Trypetidae, Hippoboscidae.

8. Aphonaptera

9. Economic Importance :

(i) Insects in relation to man. Insects as friends, enemies, benefactors.

(ii) Insects injurious to agriculture and forestry. Life histories of the following pests of agriculture :

(Paddy, Cotton, Sugarcane, Rice and Vegetables)

Dysdercus Roenigli, Aphis gossypii. Leptocorisa variocornis, Hispa armigera, Sitophilus oryzae (Calandra oryazae) Bruchus chinesis, Bagrada picta, Aulacophora fuveicollis. Epilachnasp.

(iii) Insects injurious to industry.

(iv) Insects in medicine and veterinary science.

(v) Silkworm, Honeybee, Lac Insect.

(vi) General principles of insect control.

(vii) Elementary knowledge of insecticides.

PAPER III CYTOLOGY AND CYTOGENETICS

(EXTRA NUCLEAR CYTOLOGY)

1. Elementary concept of the methods in Cytology and theory microscopy
   (a) Phase contrast, Interference, Polarizing, ultra violet and Electron microscopy. (b) Histoimmunology (c) Autoradiography (d) Biological computing and (e) Tissue culture.
2. Protoplasm—Physical, chemical and Biological properties.
3. Viruses. Protokaryota, Mesokaryota.
4. Plasma membrane :—Various models of molecular structure, Chemistry, specializations and function, Phagocytosis, Pinocytosis.
5. Endoplasmic reticulum :—Configurations of cytoplasmic membrane, types of E.R. Granular and Agranular. Modifications of agranular reticulums and Myeloid body.
6. Golgi Apparatus :—Morphology, Ultra structure, Cytochemistry functions, and origin.
7. Ribosomes :—Physical characteristics and structure, stoichiometry, and biogenesis.
8. Mitochondria:—Morphology, distribution, Ultrastructure compartmentation and molecular organization, Variations in mitochondrial patterns, Pathological changes and Role of mitochondria in cell physiology.
9. Lysosomes and related bodies :—Morphology, chemistry and origin of lysosomes. Cytolysosomes, peroxisomes Glyoxysomes and Sphersomes.
10. Lilia and Flagella :— Structure, chemical composition, Specialization, Physiology of ciliary action.
11. Microtubules, Microfilaments, vacuoles and crystals.
12. Stratification of extra nuclear cell components in centrifuged cells.
13. Cytomorphological aspects of cell secretion.
14. Role of Cytoplasm in heredity.

GROUP—C

PAPER IV CYTOLOGY AND CYTOGENETICS

(Nuclear Cytology and Cytogenetics)

1. Cytologic and cytochemical techniques :— Cell culture, fixation, chemical basis of staining, cytochemical and histochemical methods.
2. Nucleus :—Number, position, size, shape and significance of nucleus.
3. Nuclear Membrane :— Ultrastructure, Nuclear pores and annuli, chemical composition and origin.
4. Nuclear transport : Role of the pore complex on nuclear sap.
5. Nucleolus :—Morphology, Ultrastructure, Thermosensitivity, Chemistry and functions.
6. Chromortin :— Distribution and structure, Heterochromortin and its properties, classification of heterochromatin.
7. Sex chromortian and Dosage compensation.
8. Morphology, Ultrastructure, and Physical and chemical organization of chromosomes.
9. Giant chromosomes :— Salivary and lamp-brush and their functional significance.
10. Chromosomal Mechanism of sex Determination :—Simple and multiple systems, Genic balance mechanism and dominant Y system.
11. Sex Determination in Mama :—Human sex anomalies, Autosomal disorders, Cancer and Chromosomes.
12. Cytological aspects of fertilization:—Transportation of gametes, gametic union, nuclear fusion, and Abnormal fertilizations.
13. The Cytology of Parthenogenesis :— Haplodiploidy, Thelytoky and cyelical parthenogenesis.

14. Chromosomal Polymorphism :—Inversion, translocation, fusion and dissociation polymorphism. Adaptive significance of inversion polymorphism.

15. Chromosomal Rearrangements and speciortion with special reference to insects and mammals.

16. Genetic code and genetic engineering.

GROUP—D

Paper III : ANIMAL PHYSIOLOGY

1. Nutrition : (a) Balanced diet for human beings. Role of vitamins and minerals.

   (b) Structure, function and control of secretion in salivary. gastric, intestinal gland, pancreas and liver in vertebrates.

2. Excretion (a) Urine formation and its constituents.

   (b) Excretory products in different animals.

   (c) Renal clearance and control, acid base balance.

3. Respiration : Respiratory organs, regulation and mechanism of respiration. Respiratory gas exchange and transport. Adaptations in parasitic, aquatic, deep sea, and high altitute. Effects of abnormal concentrations of respiratory galses. R.Q.

4. Temperature Regulation : Regulatory centres and vasomotor reflexes.

5. Circulation : (a) Types of heart, regulation of beat, cardiac, cycle effects of drugs and salts, electrocardiogram and blood volume. Immunization.

   (b) Blood, Respiratory pigments O_2 and CO_2 carriage in blood.

6. Biological membranes and Osmotic and ionic regulation in aquatic and terrestrial animals.

7. Muscles :— The structure and function, chemistry and molecular physiology.

8. Nervous system :- (a) Properties of nerve motor unit, Transmission of impulse. Humoral mediation of nervous stimulation.
   (b) Central automonic and peripheral system. Brain centres. Blectroencephalogram. Types of reflexes.
9. Reproductive System :— Male and female reproductive organs in human body, hormonal control, ovulator implantation, Menstural cycle and its endocrinology.
10. Endocrine System :— Structure and function of pituitary, thyroid parathyroid, adrenal, thymus, and islets of langerhans.
11. Principles and uses of common physiological apparatus.

GROUP—D

Paper IV : BIOCHEMISTRY

1. Molecular Properties : Electronic configuration of an atom, Association of atoms into molecules. Physical properties of molecules (Diffusion, Osmosis, Gibbs Donnan Equilibrium. Colloids Ions and radicals, Viscosity and Surface Tension)
2. Biochemical Techniques :—Introductory idea of calorimetry, chromatography and electrophoresis.
3. Bioenergetics : Law of mass action, Laws of thermodynamics, free energy, changes in biochemical process, sources of free energy and chemical equilibrium.
4. Biological effects of radiation.
5. Chemical kinetics : Orders and molecularity of reactions with biological examples, activitation energy, oxidation. reduction, pK and pH [Handerson Harselbalch equation] pH scale. Buffers and Buffering mechanism of the body.
6. Action of enzymes : Enzyme kinetlcs, factors influencing the enzyme activity, effect of activators and inhibitors, isoenzymes.

7. Chemical structure and biological significance of : Carbohydrates, lipids, proteins and Vitamins. Nucleic acids and their role in protein synthesis.
8. Metabolism : Basal metabolism. H.M.P. pathway and oxidative phosphorylation.

M. Sc. FINAL ZOOLOGY PRACTICAL

Candidates will be expected to submit the collection and microscopical preparations and a note-book containing a complete record of Laboratory work, seminars and field work. Atleast one excursion will be held to enable the students to familiarize with Indian Fauna. The excursion will be compulsory and the institution will be expected to provide the financial assistance for the excursion, a part of which will be borne by the students also.

The duration and distribution of marks shall be as follows :—

Duration : Two days : 5 hours each day.

FIRST DAY (GENERAL)

Major dissection other than fishes	20 Marks
Minor dissection	10 ,,
Embryology experiment	10 ,,
Permanent preparation with identification	10 ,,
Spotting (10 spots)	20 ,,
Microtomy	10 ,,
Viva-Voce	10 ,,
Sessional record [Both general and special]	30 ,,
	120 Marks

SECOND DAY [FISHES/ENTOMOLOGY]

Major dissection	20 Marks
Minor dissection	10 ,,
Spotting [5 spots]	15 ,,
Identification of local fauna	15 ,,
Experiment	10 ,,
Viva-Voce	10 ,,
	80 Marks

SECOND DAY [PHYSIOLOGY/CYTOLOGY]

Major experiment	40 Marks
Minor experiment/Comments on spots or Apparatus	30 ,,
Viva-Voce	10 ,,
	80 Marks

Total marks 200

MAJOR DISSECTIONS

Pisces : General anatomy of Scoliodon, Dasyatias, Labeo and Wallago.

Scoliodon :—Afferent Branchial Artery.
Efferent Branchial Artery.
Cranial nerves V, VII, IX, X.

Amphibia : Frog :— Cranial Nerves V, VII, IX, X.

Aves : Columba :—Air Sacs.

Mammalia : Squirrel :— Neck Nerves.

MINOR DISSECTION

Pisces :	Membranous Labyrinth.
Amphibia :	Hyoid Apparatus, Columella auris.
Aves :	Arterial and Veinous systems of Pigeon, Flight Muscles, Perching Muscles.
Reptilia :	Arterial and veinous system of Uromatix.
Mammalia :	Ear Ossicles, Muscles. Arterial and veinous system of rat Male and female urinogenital system.

PERMANENT PREPARATION/MOUNTING

Protochordata :	Salpa, Doliolum, Oikopleura, and Branchiostoma (oral hood, Pharyngeal wall, Velum) Herdmania (Neural Complex, Spicules, Phary.)
Pisces :	Placoid, Ctenoid, Ganoid, and Cycloid Scales. Ampulla of Lorenzini.
Amphibia :	Rana : Buccal Epithelium, Striated and
Aves :	Columba : Pecten, Columella, Filoplume.
Mammalia :	Rat : Medullated and Non-medullated.

EXPERIMENTS ON EMBRYOLOGY

1. Study of the life history stages of frog.
2. Removal of egg membranes and mounting.
3. Study of morphogenetic movements in the embryo of frog with vital dyes.
4. Hormonal control of amphibian metamorphosis.
5. Incubation and mounting of chick embryos.

6. Study of the embryological slides of frog, chick and any mammal.
7. Microtomy of embryonic stages.

SPOTTING

MUSEUM SPECIMENS

Protochordates :

Balanoglossus, Herdmania, Branchiostoma.

Cyclostomes :

Petromyzon, Myxine; Ammocoetus larva of Petromyzon.

Fishes :

Echeneis, Tetradon [Globe fish], stegostoma, Pteroid, Anguilla, Diodon. Ostraction cubicus, Sphryna, Trygon [Sting ray] Astrape [Electric ray] Hippocampus, Rostrum of Pristis, Syngnathus, Acipensor, Anabas.

Amphibia :

Uraeotyphlus, Siren, Alytes, Axolota larva, Rhacophorus, Bufo, Hyla, Ambystoma, Ichthyophis, Salamander, Pipa.

Reptiles :

Draco, Gecko, Calotes, Pharynosoma, Typholops, Chammaeleon, Mabuya, Russel viper, Tree snake, Hydrophis, Krait, Crotalus. Dendrophis, Naja.

Mammal :

Squirrel, Bat (Chiroptera), Pangolin, Rat, Platypus (Model), Echidna (Model).

STUDY OF SLIDES

PROTOCHORDATA :

Hemichordata : Balanoglossus M. L. S. and T. S. passing through various parts of the body. Tornaria Larva W. M.

Urochordata: Herdmania : Nevral Complex, Pharyngeal wall and spicules, Olkoplevra W. M; Pyrosoma, W. M; Botrylus W. M.; Doliolum (Sexual and Asexual Forms) Salpa [Sexual and Asexual Forms].

Cephalochorda : Branchiostoma W. M., L. S. anterior end, oral hood W. M , Branchial Wall, T. S. passing through different parts of the body.

[i] PISCES : Larva W. M., L. S., fish, T. S. Shark embryoeye and T. S. passing through different regions of the body. Different types of scales.

[ii] AMPHIBIA : Complete histology and Embryology.

[iii) REPTILIA : Sections passing through different regions of the body of Lizard/Snake and Scales of Snakes.

(v) AVES : Complete histology and Embryology, W. M. and T. S. of embryos, Different types of feathers, and Pecten.

[v[MAMMAL : Complete histology including placenta.

OSTEOLOGY : Study of articulated and Disarticulated bones of appendicutians and axial skeleton of Frog, Varanus, Fowl and Rabbit.

PRACTICAL

FISH AND FISHERIES

DISSECTIONS :

1. General anatomy and cranial nerves of Mystus; Wallago, Sting-ray and Electric ray.
2. Membranous Labyrinth of Sociodon and Wallago.
3. Weberian Osscles of certain fishes.
4. Accessory respiratory organs and their blood Supply Co. Channa, Clarias, Heteropneustes and Anabas.
5. OSTELOGY of any fresh water fish.

6. EXPERIMENTS ON :

[a] Respiratory rate of a fish.

[b] Study of Physical conditions of freshwater pond including light, temperature, turbidity, transparency, wind velocity. wind direction etc.

(c) Estimation of protein, Glycogen and lipids in Skeletal muscles of fish.

7. Qualitative and Quantitative estimation of Plankton.

8. Determinations of age : growth and length-weight relationships.

9. Qualitative and Quantitative analysis of gut contents of a carnivorous, herbivorous and omnivorous freshwater fish.

10. Chemical analysis of water including measurement of oxygen and carbon-di-oxide cycles and salinity.

11. General survey of local fish fauna.

PRACTICAL

ENTOMOLOGY

1. Detailed study of the external features of grasshopper.

2. Dissections and preparation of the various organ systems of cockroach, grasshopper, Gryllotalpa, Musca, wasp, honeybee, Dysdereus, a coleopteran and a lepidopteran adult and larva.

3. Comparative study of the mouth parts, legs antennae and wings of insects.

4. Study of the life history stages of Butterfly and Mosquito.

5. Mounting of eggs, pupal and larval stages of certain coleopteran and lepidopteran and Dipterous insects.

6. Microtomy of the embryonic stages of an insect.

7. Determination of the pH of insect gut and blood.
8. Demonstration of uric acid in the fat body and malpighian tubules of insects.
9. Study of respiratory-rate of an insect [Cockroach]
10. Insects collection.
11. Insect identification of all the orders given in paper IV (B) and Diptera.
12. Spotting.
13. Practical Record.

PRACTICAL :

CYTOLOGY AND CYTOGENETICS

1. Cytological techniques for the demonstration of nucleus. chromosome mitochondria, Golgi-bodies, ribosomes, fat etc.
2. Squash preparation of onion roots tip and grasshopper testis to demonstrate mitosis and meiosis respectively. Intravital staining of buccal epithelium.
3. Cytochemical demonstration of Proteins, Nucleic acids, and Lipids.
4. Preparation of chromosomes from salivary glands of Chironomus and Drosophila larvae and malpighian tubules and rectal epithelium of dipterous.
5. Demonstration of sex-chromatin in human female using buccal smear and hair root.

PRACTICAL :

ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

1. Identification and separation of sugars amino acids by paper chromatography.
2. Determination of acid phosphatase and alkaline phosphatase in blood serum.
3. Estimation of non protein nitrogen (NPN), Calcium, Magnesium and Inorganic phosphate.
4. Isolation of liver glycogen and its hydrolysis.
5. Isolation and estimation of casein from milk.
6. Determination of total amino acids calorimetrically,
7. Muscles and nerve : Contraction of voluntary and smooth muscles, excitation and conduction.
   Study af action potential through pen orcillograph.
8. Heart and circulation; Capillary circulation, heart beat and contraction of heart muscle, arterial blood pressure.
9. Blood : Differential count, haematocrit, total RBCs and WCBs counts, estimation of haemoglobln percentage. Determination of blood sugars and serum protein, specific gravity and buffering capacity of blood. E. S. R. and blood pressure determination.
10. Respiration Measurement of oxygen consumption of fish by Winkler's method.
11. Digestion : Detection and the effect of various factors i. e. pH, temperature enzyme concentration and substrate concentration on any digestive enzyme.
12. Excretion : Estimation of urea, glucose and physical properties of urine.
13. Endocrine : Microscopic observation of major endocrine glands.
14. Reproductive System : Pregnancy Test.

Course outcomes (Zoology)

B.Sc. (Zoology) CO1 Habits, morphology, life cycle of important invertebrates; classification, characteristics of important invertebrate Phyla.
B.Sc. (Zoology) CO2 Structure, anatomy of important invertebrates; Basic knowledge about reproduction of common invertebrates.

B.Sc. (Zoology) CO3 Detailed knowledge about cell structure and function; cell division; concepts of genetics; eugenics

B.Sc. (Zoology) CO4 Classification and affinity of different vertebrate Phyla; Habits, myphology of anatomy of important chordate belonging to different Phyla.

B.Sc. (Zoology) CO5 Geological time scale; Geographical distribution of animals; origin of life, evolution of animal; basic concepts of evolutions.
B.Sc. (Zoology) CO6 Elementary knowledge about physiology of digation, respiration, circulation, excretion; basic concepts of biochemistry.

B.Sc. (Zoology) CO7 Structure and life cycles of important parasites, pest control, basics of animal breeding and culture; wild life of India.
B.Sc. (Zoology) CO8 Basics of biotechnology, genetics, Engineering and immunology; Biological tools and techniques; Elementary biostatistics.

B.Sc. (Zoology) CO9 Concepts of Ecology; Basic microbiology; concepts of animal behaviour; knowledge about pollution and toxicology.

M.Sc. (Zoology) CO1 Classification, characteristics and salient features of different Phyla of chordates; parasites and parasitic adaptation; larval forms of crustacea; economic importance of insects; pest control.

M.Sc. (Zoology) CO2 Detailed knowledge about cell structure and function; concept of genetics; data collection, analysis and uses of biostatistics.
M.Sc. (Zoology) CO3 Physiology of digestion respiration, excretion, osmoregulation, circulation and nerve impulse transmissions; basic biochemistry.

M.Sc. (Zoology) CO4 Knowledge about taxonomic rules, binomial classification; detailed knowledge about ecosystem; ecology, concept of evolution.

M.Sc. (Zoology) CO5 Classification and evolution of different Phyla of chordates; ostracoderms, placoderms; structure and affinity of fishes; gymnophiona, stegocephalia, dentition in mammals, aquatic adaptation; evolution of man.
M.Sc. (Zoology) CO6 Detailed knowledge of gastrulation, cleavage, amniogenesis and placentation, ageing and cellular death; concept of animal behaviour pheromones and their use in evolution.

M.Sc. (Zoology) CO7 Origin, classification and affinity of fishes; fish physiology, fish anatomy; viviparity in fishes; larvivorous fishes.
M.Sc. (Zoology) CO8 Fish breeding and culture, induced fish breeding; fish by products; problems of fish industry; preparation and maintenance of aquaria; Preservation and refrigeration of fishes.

Programme outcomes (Zoology)

B.Sc. (Zoology) PO1 Habit, morphology, reproduction of selected invertebrate belonging to different invertebrate Phyla; structure of cell and cell division; elementary knowledge of genetics.

B.Sc. (Zoology) PO2 Classification, habit, morphology and physiology selected chordates belonging to different Phyla; elementary knowledge of animal distribution and evolution; basics of embryology; basics of physiology and biochemistry.

B.Sc. (Zoology) PO3 Elementary knowledge about structure and life cycles of parasites; vectors and pests; animal breeding and culture techniques; endangered species and wild life of India.

B.Sc. (Zoology) PO4 Basic biotechnology, immunology and genetic engineering. Different biological tools and techniques; concept of animal behaviour, pollution and toxicology.
M.Sc. (Zoology) PO1 knowledge about origin, classification and affinity of different invertebrate and vertebrate Phyla; knowledge about the task of zoologist, taxonomist and taxidermist.

M.Sc. (Zoology) PO2 Basics of physiology and biochemistry; knowledge about biological tools and techniques; knowledge about biostatics and genetics.
M.Sc. (Zoology) PO3 Specified knowledge about fish culture, breeding, induced breeding; fish by products; fish processing and refrigeration.

Programme specific outcomes (Zoology)

B.Sc. (Zoology) PSO1 Basics of laboratory techniques required for working in pathology. Knowledge required for breeding the animals in artificial medium.

B.Sc. (Zoology) PSO2 Knowledge about animal fauna of India, their habits and life cycle. Observation of animals in natural habitat; wild life of India and endangered species.

B.Sc. (Zoology) PSO3 Knowledge required for in vitro and in-vitro assay of toxicants; techniques required for working in toxicology lab.

M.Sc. (Zoology) PSO1 Knowledge of biological tools and techniques needed for technician in biology lab; techniques in lab of toxicology, immunology and cell biology.

M.Sc. (Zoology) PSO2 Basics training of technique in pathology; identification of blood cells and training for haematologist.

M.Sc. (Zoology) PSO3 Training for Apiculture (bee culture), Lac culture; taining for fish farming and fish culture; Knowledge about marketing of fish.