NEHRU GRAM BHARATI VISHWAVIDYALAYA

KOTWA- JAMUNIPUR- DUBAWAL

ALLAHABAD (UTTAR PRADESH)

[From Academic Session 2017-18 onwards]

SYLLABUS

For the

B.Sc. – ZOOLOGY

(A Three Yours Course)

B.Sc. - First Year
Zoology

Paper - I	**:**	**Diversity of Life (Non Chordates) & Taxonomy**	**34 Marks**
Paper - II	**:**	**Cell Biology, Immunology & Genetics, Evolution**	**33 Marks**
Paper - III	**:**	**Biochemistry & Biostatistics**	**33 Marks**
Practical			**50 Marks**

B.Sc. - Second Year
Zoology

Paper - I	**:**	**Diversity of Life (Chordates)**	**34 Marks**
Paper - II	**:**	**Animal Physiology & Comparative anatomy**	**33 Marks**
Paper - III	**:**	**Ecology & Wildlife Management**	**33 Marks**
Practical			**50 Marks**

B.Sc. - Third Year
Zoology

Paper - I	**:**	**Economic Zoology**	**50 Marks**
Paper - II	**:**	**Environmental Biology & Instrumentation**	**50 Marks**
Paper - III	**:**	**Molecular Biology, Genetic Engineering & Ethology**	**50 Marks**
Practical			**75 Marks**

Pattern of theory papers & allocation of marks

1. B.Sc. I (Three papers)

- **Paper-I - 34 Marks**
  - Divided into 3 parts, **Total no. of questions** – **11**
  - **Part 1:** Question **1**(Compulsory) – **9 marks** (9 Objective / Very short answer questions)
  - **Part 2:** Section A – **Six Questions from Unit 1, 2 & 3** (Question 2 - 7) (Students shall **attempt any three**), Each question Carries **5 Marks**
  - **Part 3:** Section B - **Four Questions from Unit 4 & 5** (Question 8 - 11) (Students shall **attempt any two**), Each question Carries **5 Marks**

- **Paper-II & III - 33 Marks**
  - Divided into 3 parts, **Total no. of questions** – **11**
  - **Part 1:** Question **1**(Compulsory) – **8 marks** (8 Objective / Very short answer questions)
  - **Part 2:** Section A – **Six Questions from Units 1, 2 & 3** (Question 2 - 7) (Students shall **attempt any three**), Each question Carries **5 Marks**
  - **Part 3:** Section B - **Four Questions from Units 4 & 5** (Question 8 - 11) (Students shall **attempt any two**), Each question Carries **5 Marks**

2. B.Sc. II (Three papers) – (Pattern similar to B.Sc. I)

- **Paper-I - 34 Marks**
  - Divided into 3 parts, **Total no. of questions** – **11**
  - **Part 1:** Question **1**(Compulsory) – **9 marks** (9 Objective / Very short answer questions)
  - **Part 2:** Section A – **Six Questions from Units 1, 2 & 3** (Question 2 - 7) (Students shall **attempt any three**), Each question Carries **5 Marks**
  - **Part 3:** Section B - **Four Questions from Units 4 & 5** (Question 8 - 11) (Students shall **attempt any two**), Each question Carries **5 Marks**

- **Paper-II & III - 33 Marks**
  - Divided into 3 parts, **Total no. of questions** – **11**
  - **Part 1:** Question **1**(Compulsory) – **8 marks** (8 Objective / Very short answer questions)
  - **Part 2:** Section A – **Six Questions from Units 1, 2 & 3** (Question 2 - 7) (Students shall **attempt any three**), Each question Carries **5 Marks**
  - **Part 3:** Section B - **Four Questions from Units 4 & 5** (Question 8 - 11) (Students shall **attempt any two**), Each question Carries **5 Marks**

3. B.Sc. III (Three papers)

- **Paper-I, II & III - 50 Marks**
  - Divided into 3 parts, **Total no. of questions** – **11**
  - **Part 1:** Question **1**(Compulsory) – **10 marks** (10 Objective/Very short answer ques)
  - **Part 2:** Section A – **Six Questions from Units 1, 2 & 3** (Question 2 - 7) (Students have to **attempt any three**), Each question Carries **8 Marks**
  - **Part 3:** Section B - **Four Questions from Units 4 & 5** (Question 8 - 11) (Students have to **attempt any two**), Each question Carries **8 Marks**

B.Sc. - First Year
Zoology
FIRST PAPER
Diversity of Life (Non-Chordates) & Taxonomy

Section A: Diversity of Life (Non-Chordates)

Unit - 1

General Classification of non-chordate phyla upto classes. Functional morphology of type forms.

Protozoa - Type study: ***Trypanosoma, Paramecium***

Unit - 2

Porifera - Type study: ***Sycon (Scypha)***
Cnideria - Type study**: *Obelia***
Platyhelminthes - Type study: ***Echinococcus***
Aschelminthes - Type study: ***Wuchereria bancrofti***

Unit - 3

Annelida - Type study: ***Nereis***
Arthropoda - Type study: ***Palaemon***
Mollusca - Type study: ***Unio***, ***Pila***
Echinodermata - Type study: ***Asterias***
Hemichordata - Type study: ***Balanoglossus*** and its affinities.

Unit - 4

Affinities of Ctenophora
Canal system in sponges: cell types, spicules; Parasitic adaptations in helminthes
Insect Metmorphosis, Torsion and detorsion in Gastropods

Section-B: Taxonomy

Unit - 5

Principles of taxonomy and hierarchy
International code of Zoological Nomenclature
Numerical taxonomy – Meristic and non-meristic data
Chemical taxonomy

References:

1. Parker, Haswell and Williams - Text book of Zoology (Non Chordata) Vol. I A.Z. T.B.S. Publisher and Distributor.
2. Nigam H.C. - Zoology of Non Chordate, Vishal Publication
3. Hyman, L.H. - The Invertebrate (Vol 1 to 6.)
4. Kotpal R.L. - A text book of Invertebrate, Rastogi Publication
5. P.S. Verma - Invertebrate Practical
6. S.S. Lal - Invertebrate Practical.
7. Asthana, Agrawal and Jindal - Invertebrate practical.
8. Ashok Verma - Principal of Animal taxonomy

SECOND PAPER
Cell Biology, Genetics, Immunology and Evolution

Section-A: Cell Biology & Genetics

Unit -1

Introduction of Cell (Prokaryotic and Eukaryotic)
Cell theory, Cell organelles
Ultra structure: Mitochondria, Golgi bodies, Endoplasmic Reticulum, Lysosomes, Centrosome
Cell cycle & cell division: Mitosis and Meiosis

Unit - 2

Elements of Heredity and Variation
Mendel's Laws of inheritance
Linkage, Crossing over, Sex linked inheritance
Sex determination in Human beings and Drosophila. Dosage compensation.

Unit -3

Nucleic acids as genetic material (Hershey - Chase & Fraenkel - Conrat experiment)
Gene mutation and its molecular basis
Cytoplasmic or maternal inheritance
Blood Groups

Section-B: Immunology & Evolution

Unit -4

An Introduction to cellular basis of Immunity: Active & Passive immunity
Characteristics of antigen and antibody
Antigen -Antibody reaction
MHC Molecules.
Humoral and Cell mediated response, Immune disorder: AIDS.

Unit –5

Origin of life; Theories of evolution
Natural selection
Mutation, Isolation
Speciation, Mimicry

References:

1. Lewis C.D. and Levin, R. : Biology of gene, Mc. Grew Hill - Toppan Co. Ltd.
2. Strickberger : Genetics, Macmillan Publications.
3. Enderson : Genetics.
4. Verma P.S. and J.K. Agarwal: Genetics, S. Chand and Co.
5. Gupta P.K. : Genetics, Rastogi Publications
6. Moody : Introduction to Evolution (Indian Edition).
7. Strickberger : Evolution.
8. Colbert : Introduction to vertebrate evolution.
9. Robertes & Robertes : Cell & Molecular Biology.
10. Verma P.S. & Agarwal : Cell Biology.
11. Gupta P.K. : Cytology.
12. Lodish, H.et.al. : Molecular cell biology.
13. Karp G. : Molecular Cell Biology.
14. Kubey : Immunology
15. Instant notes of Immunology

THIRD PAPER
Biochemistry and Biostatistics

Section A: Biochemistry

Unit -1

Biomolecules, Structure & Classification: Proteins, Carbohydrates and fats
Glycolysis
Kreb's Cycle
Oxidative phosphorylation, Electron transport system

Unit -2

Gluconeogenesis,
Cori's cycle
Fatty acid synthesis
Urea cycle

Unit -3

Enzymes: Nature, Properties, Classification, action; co-enzyme; isozyme; abzyme; ribozyme; co-factors.
Vitamins: Classification, Importance and Sources.

Section B: Biostatistics

Unit -4

Variety and analysis of data, Data presentation
Measure of central tendency (Mean, Median, Mode)

Unit -5

Coefficient of correlation
Levels of significance: Student's t – test, Chi-square, Null hypothesis.

References:

1. Harper's : Review of Biochemistry.
2. Voet and Voet : Biochemistry William and sons, John Wiley & Sons.
3. Stryer L. : Biochemistry (Fifth edition)
4. Nelson & Cox : Lehininger's Biochemistry CBS
5. W.W. Daniel : Biostatistics, Wiley India, Publication
6. Arora P.N., P.K. Malhan : Biostatistics, Himalaya Publishing House.
7. Prasad S.G. : Biostatistics.

Practicals

Models	05
Permanent slide preparation	05
Genetic Exercise	05
Cytological Exercise	05
Biochemical test/Immunology	05
Biostatics Exercise	05
Comments on spots from 1-10	10
Viva-voce	05
Practical record	05
	50

Contents of Practicals:

Study of Museum Specimens and slides relevant to the type studies in theory:

1. Museum Specimens:

Porifera	**:**	*Leucosolenia, Sycon, Grantia, Cliona, Spongilla, Euspongia, Hylonem*
Cnideria	**:**	*Physalia, Millipora, Aurelia, Rhizostoma, Alcyonium, Tubipora Gorgonia, Pteroids, Adamsia, Madrepora, Fungia, Metridium, Fungia, Rhizostoma, Prorpita*
Platyhelminthes	**:**	*Planaria, Fasciola, Taenia solium.*
Aschelminthes	**:**	*Ascaris,* (Male & Female).
Annelida	**:**	*Nereis, Heteroneries, Aphrodite, Chaetopterus, Pontobdella.*
Mollusca	**:**	*Chiton, Dentalium, Patella, Aplysia, Doris, Pecten, Pinctada, Teredo, Loligo, Sepia, Octopus, Nautilus.*
Arthropoda	**:**	*Lepus, Balanus, Sacculina, Mysis, Eupagurus, Limulus, Julus, Scolopendra, Lepisma.*
Echinodermata	**:**	*Astropecten, Clypeaster, Holothuria, Antidon.*

2. Permanent Slides:

Protozoa	**:**	*Paramecium,* W.M. Binary Fission, Conjugation in *Paramecium, Monocystis, Opalina, Balantidium, Entamoeba, Leishmania.*
Porifera	**:**	Spongin fibres, gemmule, spicules, L.S. & T.S. of *Sycon.*
Coelenterata (Cnideria)	**:**	T.S. of *Hydra* through gonads, *Obelia* W.M., *Obelia* medusae, Ephydra Larva.
Helminthes	**:**	*Fasciola* through testes; Scolex, mature and gravid proglottid of *Taenia solium,* Miracidium, Redia, Cercaria, Metacercaria, Cysticercus larva.
Annelida	**:**	T.S. *Nereis*, parapodium of nereis and heteronereis, trochophore larva, T.S. of Leech through Crop.
Arthropoda	**:**	Megalopa, Mysis, Zoea, Nauplius, Daphnia, Cyclopes, Mouthparts of male and female *Culex* and *Anapheles*, *Pediculus* W.M., *Cimex* W.M.
Echinodermata	**:**	T.S. of arm of starfish, pedicellaria, bipinnaria larva.
Hemichordata	**:**	T.S. of *Balanoglossus* through anterior and branchiogenital regions.

3. Models:

Palaeomon **(Prawn) -** Appendages and nervous system.
Unio & Pila **-** External features, General anatomy and nervous system.

3. Biostatistics:

Numerical exercise on Mean, mode, medium, and test of significance

4. Mounting:

Gemmule, Parapodium of Nereis, Gill of Pila & Unio, Statocyst of Prawn, spermathecae, nephridium and ovary of Earthworm.

5. Genetics:

Problems on monohybrid, dihybrid crosses, back cross, blood groups, sex linked diseases and pedigree exercises.

6. Cytology:

Study of various stages of mitosis and meiosis. Slide preparation of onion root tip and grasshopper testis. Preparation of slides for Mitochondria and Barr body.

7. Biochemical tests:

Test for Carbohydrate (Glucose and Starch), Protein, Fats/Lipids.

8. Immunology:

Preparation of Blood Film from the blood of animal provided. Leishman's Staining to localize lymphocytes and other leucocytes. Structural knowledge of antibodies (IgG, IgM, IgA). Blood group detection with Rh factor.

References:

1. Genetics - P.K. Gupta, Rastogi Publications.
2. Invertebrate Practical - P.S. Verma
3. Invertebrate Practical - S.S. Lal
4. Verma P.S., P.C. Srivastava - Practical Zoology, S. Chand & Co.

B.Sc. - Second Year
Zoology

FIRST PAPER
Diversity of Life (Chordates)

General classification of chordates upto orders. Functional morphology of type forms.

Unit -1

Protochordata: Type study: ***Herdmania, Branchiostoma***
Retrogressive metamorphosis

Unit -2

Pisces: Type study ***Scoliodon***
Type of scales
Amphibia: Neoteny, parental care

Unit -3

Reptilia: Sphenodon a living fossil
Poisonous & non poisonous snakes
Snake biting mechanism.

Unit -4

Birds (Aves): Flight adaptations
Migration
Perching Mechanism

Unit -5

Mammals: Egg laying mammals
Marsupiales
Aquatic mammals

References:

1. Romer - The life of Vertebrates.
2. Colbert - Introduction to Vertebrate Evolution.
3. Parker & Haswel - Book of Zoology (Volume II), (Chordata). CBS Publishers
4. Yong J.Z. - Life of Vertebrates, ELBS
5. Nigam H.C. - Zoology of Chordates, Vishal Publications, Jalandhar.
6. Kotpal R.L. - Text book of vertebrates, Rastogi Publications.
7. Chapman G. & Baker, W.B. - Zoology, Longmans Greens, London.
8. Prasad S. N. & Kashyap V. - A Textbook of Vertebrate Zoology, (New Age)

SECOND PAPER
Animal Physiology & Comparative Anatomy

Section A: Animal Physiology

Unit -1

Digestion System: Alimentary canal, associated gland and neural control
Circulatory system: Structure of heart, blood, circulation
Respiratory System: Breathing, gaseous transport, control
Excretory system: Structure and function, control
Skeleton system

Unit -2

Solutions, Osmotic Pressure, diffusion, active and passive transport
Buffers, pK and pH
Mechanism of neuromuscular co-ordination
Homeostasis

Unit – 3

Origin of Pituitary: Structure and function
Hormones and endocrine glands: structure and function
Endocrine (Hormonal) disorders

Section B: Comparative Anatomy

Comparative anatomy of vertebrates with reference to following:

Unit -4

Circulatory system
Integumentary system

Unit -5

Urino-genital system
Nervous system with special reference to brain.

References:

1. Wood D.W. : Principles of Animal Physiology
2. Eckert and Randell :Animal Physiology CBS
3. Guyton A.C. : Medical Physiology
4. Berry A.K. : Animal Physiology
5. Srivastava, Agrawal and Kumar : Animal Physiology
6. Samson Wright :Applied Physiology, Oxford Medical Publications
7. Chaudhuri S. K. :Concise Medical Physiology
8. Baynara & Turner : General Endocrinology (W.B. Saunder's)
9. Saidpur, S.K. : Reproductive cycles.
10. Gorbamn, A & Burn H.A. : A text book of comparative endocrinology (Willey Eastern).
11. Yadav J.S. :Endocrinology

THIRD PAPER
Ecology and Wild Life Management

Section A: Ecology

Unit -1

Ecology: Definition, aim & scope
Ecological factors
Adaptation: Definition, types with adaptive features and examples

Unit -2

Definition and types of ecosystem
Energy flow in ecosystem,
Food chain, food web
Biogeochemical cycles

Unit -3

Ecological pyramids
Ecological succession
Population interactions: Intra and interspecific
Community- Definition and characteristics

Section B: Wild Life management

Unit -4

Wild Life in India
Endangered flora and fauna of India
Wild life management
Wild life conservation (*in-situ* and *ex-situ*): Zoos,
National Parks, Sanctuaries and biosphere reserves.

Unit -5

Rules and regulations of Wild life
Modern concept (IUCN categories)
Different projects for animal preservation
Important movements: Chipko movement, Narmada Bachavo Aandholan, Pani Panchayats, Seed Movement etc.

References:

1. Odum : Fundamental of Ecology (W.B. Saunders)
2. Ricklefy : Ecology (W.H. Freeman)
3. Willimer, P.G. Stone and John Stone : Environmental Physiology (Blackwell Sci. Oxford 4K)
4. Singh H.R. : Ecology & Environmental Science.
5. Sharma P.D. : Environmental Biology and toxicology.
6. S.K. Singh :Text Book of Wildlife Management, Ibdc, Publisher
7. M.M. Sulphey & M.M. Safeer :Introduction to Environment Management, PHI, Publisher

Practicals

Models	10
Permanent slide Preparation	05
Physiological Exercise	05
Ecological Exercise	05
Adaptation/Wild life exercise	05
Comments on spots from 1-10	10
Viva-voce test	05
Practical record	05
	50

Contents of Practical:

Study of Museum Specimens and slides relevant to the type studies in theory:

1. Museum Speciation

Protochordata	**:**	*Herdmania, Amphioxus*
Cyclostomes	**:**	*Petromyzon, Ammocoete* larva, *Myxine*
Pisces	**:**	*Trygon, Pristis, Torpedo, Protopterus, Hilsa, Labeo, Wallago, Exocoetus, Hippocampus, Anabas, Chiemera, Diodon, Synaptura, Echeneis, Tetradon*
Amphibia	**:**	*Icthyophis, Ambystoma,* Axolotal larva, *Salamendra, Amphiuma, Proteus, Siren, Alytes, Pipa,*
Reptilia	**:**	*Chelone, Testudo, Sphenodon, Chaemeleon, Phrynosoma, Draco, Iguana, Haloderma, Typhlops, Python, Bangarus, Naja, Hydrophis, Viper, Natrix, Crotalus*
Aves	**:**	*Pigeon, Fowl,* Chick, W.M. Flight Feather
Mammals	**:**	*Hedgehog, Manis, Hystrix,* Bat

2. Permanent Slides

Protochordata	**:**	W.M. *Salpa, Doliolum,* T.S. of *Amphioxus,* Spicules of *Herdmania.*
Amphibia	**:**	V.S. of Skin, T.S. through alimentary canal, C.S. of Liver, C.S. of Lung, T.S. of Kidney, T.S. of gonads.
Aves	**:**	W.M. of filoplumes, W.M. of down feather
Mammals	**:**	V.L.S. through Skin, T.S. of Liver, T.S. of Lung, T.S. of Kidney, T.S. of Gonads.

3. Models- *Scoliodon* : Afferent and efferent arterial system. Cranial nerves, Internal ear.

4. Osteology **:** Study of Endoskeleton of the following: Frog, *Varanus*, Fowl, Rabbit.

5. Mounting:

Scoliodon	:	Ampulla of Lorenzini, Placoid scales.
Frog	:	Striated and unstriated muscles.

6. Physiology:

Estimation of Haemoglobin, Counting of RBC and WBC in Human Blood, Preparation of Hemin Crystals, Preparation of blood film of frog.

7. Ecological Exercise:

Study of Physio-chemical factors (temperature, pH, salinity and light) and properties of water (turbidity, hardness, CO_2, acidity, alkalinity), ecological apparatus.

8. Adaptation:

Adaptive features of animals in relation to their habit and habitat: Synaptura, Exocoetus, Axoltle larva, Chameleon, Phrynosoma, Hedgehog, Bat.

References:

1. Practical Zoology - Robert William Hegner
2. Vertebrate Practical - P.S. Verma
3. Vertebrate Practical - S.S. Lal
4. Vertebrate Practical - Asthana, Agrawal and Jindal, Pragati Prakashan
5. Vertebrate Practical - O.P. Saxena

B.Sc. - Third Year
Zoology

FIRST PAPER
Economic Zoology

Unit -1

Protozoa and human diseases**.**

Diseases caused by ticks and mites.

Unit -2

Apiculture

Sericulture

Lac culture.

Unit -3

Prawn culture

Pearl culture

Pisciculture

Unit -4

Dairy Industry

Piggery

Poultry

Unit -5

Pest, types, characteristic features

Life cycle and control measure: Sugarcane, vegetables, stored grain pests

Biological control of pest

Integrated Pest Management (IPM)

References:

1. Shukla Upadhyay - Economic Zoology, Rastogi Publication, Meerut.
2. Srivastava - Text book of Applied Entomology.
3. Venkatraman - Economic Zoology

SECOND PAPER
Environmental Biology & Instrumentation

Section A: Environmental Biology

Unit - 1

Environmental Pollution - Water, air, soil and noise pollution
Greenhouse effect & global warming, acid rain, ozone layer depletion
Conventional and non-conventional sources of energy

Unit - 2

Environment & human health
Water quality & water borne diseases
Environmental hazards of radiations and safety measures
Environmental Impact Assessment, Bioindicators

Unit - 3

Biodiversity: Concept, types and values
Hotspots; Threats to biodiversity
Biodegradation, Biomagnification and Bioremediation
Solid waste management: Causes, effects and control

Section B: Instrumentation

Unit- 4

Principles and applications of pH meter, centrifuge
Principles and applications: spectrophotometer
Microscopy and type
Compound microscopy, Phase-Contrast microscope,

Unit- 5

Microtomy: Paraffin embedding of tissues, cutting of sections & processing.
Chromatography (Paper and TLC)
Electrophoresis

References:

1. Willimer, P.G. Stone and John Stone : Environmental Physiology (Blackwell Sci. Oxford 4K)
2. Singh H.R. - Ecology & Environmental Science.
3. Sharma P.D. - Environmental Biology and toxicology.
4. Introduction to instrumental analysis - Robert Brown, Mc.Graw Hill, International Edition.
5. Bisen B.S., Techniques in Life Sciences.
6. Taylor, Green, Stout - Biological Sciences, Cambridge Low Prize Editions.
7. Rana S. V. S. - Bio-techniques: Theory & Practice (Rastogi publications)
8. Bharucha E. – Textbook of Environmental Studies (University Press).

THIRD PAPER

Molecular Biology, Genetic Engineering and Ethology

Section A: Molecular Biology, Genetic Engineering

Unit-1

Structure & function of DNA: Types, Double helical model
Nucleosome organization, Transposons
RNA: Types, Clover leaf model of t-RNA,
Central dogma, Concept of gene expression, Reverse transcription, Split gene.

Unit -2

Replication of DNA,
Transcription and post-transcriptional modifications
Translation, Protein sorting, packaging and transport
Regulation of gene expression in prokaryotes (Operon model).

Unit-3

Genetic engineering- Aims and scope, Restriction enzymes
Gene Cloning, Cloning vectors & Gene Library
Applications of Genetic engineering: Edible vaccines, gene therapy
DNA finger and foot printing.

Section B: Ethology

Unit -4

Definition and scope of Ethology
Methods used in ethological studies
Patterns of Behaviour, Courtship Behaviuor
Migratory behaviour in fish

Unit -5

Socialism in animals
Learning, Motivation, Imprinting
Role of hormones in behaviour

References:

1. Singh B.D.: Biotechnology (Kalyani Pub.)
2. Mayers R.A.: Molecular Biology and Biotechnology.
3. Genetic Engineering - Principles and Methods (Vol 27) - J. Setlow, ed., (Springer, 2006)
4. Alfred Pingoud – Restriction Endonucleases, Springer Verlag Berlin Heildelberg New York
5. Lodish et al - Molecular Cell Biology 5th ed
6. Watson, J.D - Molecular Biology of the Gene
7. Mathur Reena - Animal Behaviour, S.Chand & Co.
8. Mannings - Ethology
9. Gundevia H.S. and Hargovind - Animal Behaviour.
10. Lucas J. R. and Simmons L. W. - Essays in Animal Behaviour

Practicals

Microtomy and Mounting	10 (5+5)
Chromatography (Paper)	10
Environmental Biology	10
Biotechnology	05
Economic Zoology (1 insect life cycle + 1 plant or stored grain pest)	10 (5+5)
Seminar	10
Project on Ethology	10
Viva and record	10
	75

Contents of Practical:

1. Microtomy : Fixation of Organs (Lung, Liver, Kidney, Gonads) of dissected Rat/Frog. Paraffin block preparation, section 'cutting, stretching. Double staining, Mounting

2. Paper chromatography : Pigment separation from Spinach extract, R_f calculation for Amino acids.

3. Environmental biology : Pond water analysis, Estimation of water quality & DO, comments upon the Apparatus related with environmental assessment.

4. Biotechnology : Molecular Worksheet, Model preparation of DNA, RNA and Proteins

5. Economic Zoology : Comments upon the life cycle of *Bombyx*, *Apis*, *Lacifer*.
Comments upon the life cycle and morphology of major crop and stored grain pests.

6. Seminar : Oral presentation on any biological topic for 10 minutes.

7. Ethology Project : Preparation of Project report based on behavioural observations of any animal. Reports should have sub categories as Acknowledgement; Introduction & Objectives; Methods; Observations; Results; Discussion and Bibliography.

References:

1. Practical Zoology - Robert William Hegner
2. Advanced Practical In Zoology - S.S. Lal
3. Practical Zoology - S.S. Lal
4. Practical Zoology - P.S. Verma and P.C. Srivastava
5. Bio-techniques: Theory & Practice - S. V. S. Rana (Rastogi publications)