

**CBCS BASED)**

**ORDINANCE, REGULATION & SYLLABUS**

**For**

**B.Sc. [ZOOLOGY]**



***Offered by***

**NEHRU GRAM BHARATI**

**(DEEMED TO BE UNIVERSITY),**

**KOTWA-JAMUNIPUR-DUBAWAL**

**PRAYAGRAJ-221505**

**UTTAR PRADESH**

**Session:**

**From 2019 – 2020**

## **ORDINANCE AND REGULATIONS FOR B.Sc. DEGREE PROGRAMME**

### **A. ORDINANCE**

#### **1. The Degree of Bachelor of Science (B.Sc.)**

The Nehru Gram Bharati (Deemed to University) may confer the Degree of Bachelor's Programme in Science on Such candidates who, being eligible for admission to the Bachelor's Degree Programme, have received regular instruction in the prescribed course of study, passed successfully relevant examinations and being otherwise suitable by virtue of their character, have fulfilled such other condition as may be laid down from time to time by the appropriate authorities.

#### **2. Requirement for Admission**

##### **A. Registration:**

(i) Candidates of Bachelor Degree shall first be admitted to the first semester upon the reopening of the University after summer vacation every year.

##### **(ii) Subsequent Registration**

A candidate, who fails to clear a regular course of study during any of the second, third, fourth, fifth and sixth semesters may be registered in the appropriate term of any subsequent year to the semester concerned but within such time as enables him, to compete the study of all semester comprising Bachelor Degree Programme within a maximum period of five years from the date of his/her registration for the first semester.

##### **B. Minimum Qualification For Admission**

(i) Admission to the Bachelor's Degree Programme of study shall be open to those candidates who have passed the 10+2/intermediate exam from any Board (U.P Board/CBCS board/ICSC/or any other Govt. recognized board). Admission shall be made according to merit subject to the fulfillment of eligibility requirement as determined by the University and availability of seats in the Bachelor courses.

##### **C. Conditions of Admission:**

(i) No application for registration to the First Semester shall be entertained unless it is accompanied by:

(a) Original Transfer certificate of a candidate who has been a regular student in any Institution at any time prior to making application for registration in the Faculty.

(ii) Candidate shall give also a written undertaking to the effect that:

(a) He/She shall exclusively devote his/her time to the study of courses prescribed for Bachelor's Degree and in particular he/she shall not offer any other course leading to a degree of any description whatsoever, not shall he/she undertake any remunerative work, though with the prior permission of the Faculty, he/she may join certificate of or diploma courses in any foreign language.

(b) He/She shall abide by the provision of NGB (DU) Act, Statutes, Ordinances, Regulations and Rules that are framed or may be framed there under and the orders of Officers and authorities of the University and the concerned Faculty from time to time.

#### **3. Fees**

The students pursuing Bachelor's Degree Program of study shall have to pay fee as may be prescribed by the University from time to time.

4. The course of study, scheme of examination, result and promotion are covered in the regulation, and are given below.

### **REGULATIONS**

1. The syllabus for B. Sc. based on semester with credit based pattern comprises of six semesters. The examination shall be of Minimum 18 (eighteen) and Maximum 20 (twenty) theory papers and 6 practical. From semester I to IV, each theory and practical will be of 50 marks.
2. During semester V & VI, the marks for theory will be 75 or 50 and the marks of practical will be 75 or 100. The theory papers and practical in semesters I to IV will be of 2 credits, while in V and VI semester, theory will be of 3 or 2 credits and practical will be of 3 or 4 credits respectively. Thus total number of credits from I to IV will be 32 credits while in V and VI semester the number of total credits will be 24 credits. Thus the grand total of credits in B.Sc. will be 56 for each subject.
3. The semester I to IV has 8 credits (2X3=6 theory and 2x1=2 practical, Total=08 credit) and V to VI has 12 credits (3X3=9 theory and 3x1=3 practical, Total 12 credits or 2x4=8 theory and 4x1=4 practical, Total=12 credits). There shall be six practical and one seminar/project in complete course. The Examination in each theory paper shall be of three hours duration. The structure of syllabus for B.Sc. (Semester with credit based pattern) is given in the following table.
4. Each semester shall have minimum 90 teaching days, exclusion of holidays, admission and examinations.

#### **SCHEME OF EXAMINATION**

1. The evaluation scheme of examination consists of two parts: Internal Assessment (IA) and End Semester Examination (ESE). Internal assessment includes Assignments/Seminars/ Unit test/Group activities/Discussion, etc. The internal assessment will contribute 20% and the end semester examination will contribute 80% to the total marks.
2. There shall be continuous assessment of the student in each course. The course instructor shall hold a maximum of three and minimum of one internal test /assignment /presentation, etc.
3. In case of semester examination, there shall be no binding on the number of external paper setters/examiners, generally the course instructor shall be the paper setter and examiner. The duration of the End Semester Examination (ESE) of each course will be 3 Hours.

**Note: The ratio of internal assessment and end semester examination will be the same as determined by the University.**

**(Six Semester Credit System)**

<b>Sr. No.</b>	<b>Code</b>	<b>Paper</b>	<b>Title</b>	<b>IA</b>	<b>ESE</b>	<b>Total Marks</b>	<b>Credits</b>
<b>Semester I</b>							
1.	BOZ 101	Paper I	Lower Non-chordate	10	40	50	2
2.	BOZ 102	Paper II	Higher Non-chordate	10	40	50	2
3.	BOZ 103	Paper III	Taxonomy & Evolution	10	40	50	2
4.	BOZ 104	Practical				50	2
			Total Credits			200	8
<b>Semester II</b>							
5.	BOZ 201	Paper I	Chordate	10	40	50	2
6.	BOZ 202	Paper II	Animal Physiology	10	40	50	2
7.	BOZ 203	Paper III	Endocrinology & Comparative Anatomy	10	40	50	2
8.	BOZ 204	Practical				50	2
						200	8
<b>Semester III</b>							
9.	BOZ 301	Paper I	Cell Biology and Immunology	10	40	50	2
10.	BOZ 302	Paper II	Genetics	10	40	50	2
11.	BOZ 303	Paper III	Biochemistry	10	40	50	2
12.	BOZ 304	Practical				50	2
						200	8
<b>Semester IV</b>							
13.	BOZ 401	Paper I	Ecology	10	40	50	2
14.	BOZ 402	Paper II	Wild Life & Management	10	40	50	2
15.	BOZ 403	Paper III	Instrumentation	10	40	50	2
16.	BOZ 404	Practical				50	2
						200	8
<b>Semester V</b>							
17.	BOZ 501	Paper I	Economic Zoology	15	60	75	3
18.	BOZ 502	Paper II	Animal Behavior	15	60	75	3
19.	BOZ 503	Paper III	Environmental Biology	15	60	75	3
20.	BOZ 504	Practical				75	3
						300	12
<b>Semester VI</b>							
21.	BOZ 601	Paper I	Molecular Biology	15	60	75	3
22.	BOZ 602	Paper II	Genetic Engineering	15	60	75	3
23.	BOZ 603	Paper III	Biostatistics	15	60	75	3
24.	BOZ 604	Practical				75	3
						300	12

## Pattern of theory papers & allocation of marks (Seats - 120)

**B.Sc. - SEM I to SEM VI (Three theory papers+ One practical)**

### **1. THEORY:**

#### **I - IV SEM.**

**Total Marks: 50/Paper: Internal Assessment (10 Marks) + End Semester Exam (40 Marks)**

#### **Internal Assessment (IA):**

Cumulative test (CT) – Sessional/Group Discussion/Assignments - 10 Marks

#### **End-Semester Exam (ESE) – 40 Marks patterns**

- Divided into 2 parts, **Total no. of questions – 11**
- **Part 1:** Question 1(Compulsory) – **10 marks** (10 Objective / Very short answer ques)
- **Part 2:** Section A –**Five questions (2-7) from Unit I to III**
  - (Students have to **attempt any three**), each question carries **6 Marks**
  - Section B – **Four Questions** (Question 8 -11) **from Unit IV to V**  
(Students have to **attempt any two**), each question carries **6 Marks**  
(**Contains Short answer as well as long answer questions**)

#### **V - VI SEM.**

**Total Marks: 75/Paper: Internal Assessment (15 Marks) + End Semester Exam (60 Marks)**

#### **Internal Assessment (IA):**

Cumulative test (CT) – Sessional/Group Discussion/Assignments - 15 Marks

#### **End-Semester Exam (ESE) – 40 Marks patterns**

- Divided into 2 parts, **Total no. of questions – 11**
- **Part 1:** Question 1(Compulsory) – **15 marks** (10 Objective / Very short answer ques)
- **Part 2:** Section A- **Five questions (2-7) from Unit I to III**
  - (Students have to **attempt any three**), each question carries **-10 Marks**
  - Section B – **Four Questions** (Question 8 -11) **from Unit IV to V**  
(Students have to **attempt any two**), each question carries **-10 Marks**
  - (**Contains Short answer as well as long answer questions**)

## **PRACTICAL:**

### **a. B.Sc. - SEM I-SEM IV**

➤ **Total Marks** :50 Marks  
Practical (Based on Paper I ,II& III) : 50 Marks

### **b. B.Sc. - SEM V - VI**

➤ **Total Marks** :75 Marks  
Practical (Based on Paper I, II & III) : 75 Marks

## **NOTE:**

1. Minimum marks for passing the examination in each semester shall be 33% in each paper as well as aggregate in each semester.
2. If a candidate fails to obtained minimum credit he/she will be consider as back paper examination. The back paper exam will be held with junior batch of the same semester.
3. A candidate can be allowed 2 times back paper exam only in all the papers.
4. If candidate fails to clear his/her semester after 2 attempt of back paper, his/her earlier registration will be cancelled and the candidate will only be allowed for examination after re-registration.

**Semester I**  
**Paper I: Lower Non-chordate (BOZ101)**

**Unit - I**

General Classification of Phylum Protozoa upto classes  
Protozoa: *Trypanosoma*: Structure, Nutrition, Life cycle  
*Paramecium*: Structure, Nutrition, Excretion, Reproduction

**Unit - II**

General Classification of Phylum Porifera & Cnidaria upto classes  
Porifera: *Sycon (Scypha)*: Structure, nutrition & Reproduction  
Canal system in sponges: cell types, spicules

**Unit - III**

General Classification of Phylum Cnidaria upto classes  
Cnidaria: *Obelia*: Structure, Obelia colony, Nutrition, Reproduction, Life Cycle, Polymorphism

**Unit – IV**

General Classification of Phylum Platyhelminthes  
Platyhelminthes: *Echinococcus*, & *Taenia Solium*: Structure, Nutrition & Life Cycle

**Unit - V**

General Classification of Phylum Aschelminthes upto classes  
Aschelminthes: *Wuchereria bancrofti* & *Ascaris*: Structure, Nutrition & Life Cycle  
Parasitic adaptations in helminthes

***Recommended Books***

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

## **Paper II- Higher Non-chordate (BOZ 102)**

### **Unit - I**

General Classification of Phylum Annelida upto classes

Annelida: *Nereis* : Structure, Nutrition, Excretion,

Nervous system, Reproduction

### **Unit - II**

General Classification of Phylum Arthropoda upto classes

Arthropoda: *Palaemon* Structure, Nutrition, Excretion,

Nervous system, Reproduction

Insect Metmorphosis

### **Unit - III**

General Classification of Phylum Mollusca upto classes

Mollusca: *Unio, Pila*: Structure, Nutrition, Excretion, Nervous system, Reproduction

Torsion and detorsion in Gastropods

### **Unit - IV**

General Classification of Phylum Echinodermata upto classes

Echinodermata: *Asterias*: Structure, Nutrition,

Excretion, Reproduction

### **Unit - V**

General Classification of Hemichordata upto classes

Hemichordata: *Balanoglossus* and its affinities.

Affinities of Ctenophora

### ***Recommended Books***

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



## Paper III- Taxonomy & Evolution (BOZ 103)

### Unit - 1

Principles of taxonomy and hierarchy  
International code of Zoological Nomenclature  
Numerical taxonomy  
Chemical taxonomy

### Unit - II

Origin of Life  
Evidences of organic evolution: Vestigial organ  
Connecting link, Homologous & Analogous

### Unit –III

Theories of evolution: Lamarckism, Neo-Lamarckism,  
Darwinism, Neo- Darwinism  
Natural selection

### Unit –IV

Mutation: Definition and types  
Isolation Definition and Types

### Unit-IV

Speciation Definition and types  
Mimicry Definition & role in evolution

### ***Recommended Books***

1. Moody : Introduction to Evolution (Indian Edition).
2. Strickberger : Evolution
3. Ashok Verma : Principal of Animal taxonomy

## **Practicals**

Models	10
Permanent slide preparation	05
Comments on spots from 1-10	20
Evolution	05
Viva-voce	05
Practical record & Attendance	05
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### **Contents of Practical:**

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

### **Museum Specimens:**

**Porifera** : *Leucosolenia, Sycon, Grantia, Cliona, Spongilla, Euspongia, Hylonem*  
**Cnidaria** : *Physalia, Millipora, Aurelia, Rhizostoma, Alcyonium, Tubipora Gorgonia, Pteroids, Adamsia, Madrepora, Fungia, Metridium, Fungia, Rhizostoma, Proropita*

<b>Platyhelminthes</b>	: <i>Planaria, Fasciola, Taenia solium</i> .
<b>Aschelminthes</b>	: <i>Ascaris</i> , (Male & Female).
<b>Annelida</b>	: <i>Nereis, Heteroneries, Aphrodite, Chaetopterus, Pontobdella</i> .
<b>Mollusca</b>	: <i>Chiton, Dentalium, Patella, Aplysia, Doris, Pecten, Pinctada, Teredo, Loligo, Sepia, Octopus, Nautilus</i> .
<b>Arthropoda</b>	: <i>Lepus, Balanus, Sacculina, Mysis, Eupagurus, Limulus, Julus, Scolopendra, Lepisma</i> .
<b>Echinodermata</b>	: <i>Astropecten, Clypeaster, Holothuria, Antidon</i> .

**Permanent Slides:**

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

**Taxonomy & Evolution:** Photo Sheet exercise

## Semester II

### Paper I- Chordates (BOZ 201)

#### Unit -I

General classification of chordates upto orders  
Functional morphology of type forms  
Protochordata: *Herdmania*, *Branchiostoma*  
Retrogressive metamorphosis

#### Unit -II

Pisces: *Scoliodon*: Structure, Nutrition, Blood vascular system,  
Nervous system, Urino-genital System  
Type of scales

#### Unit -III

Amphibia: Neoteny, parental care  
Reptilia: Poisonous & non poisonous snakes  
Snake biting mechanism.

#### Unit -IV

Birds (Aves): Characteristics features  
Flight adaptations  
Bird migration

#### Unit -V

Mammals: Characteristics features  
Egg laying mammals  
Marsupiales

#### ***Recommended Books***

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)

## **Paper II- Animal Physiology (BOZ 202)**

### **Unit I**

Digestion System: Structure, Function & regulation  
Digestive glands and its functions

### **Unit II**

Circulatory system: Structure of heart, artery & veins  
Mechanism of Blood circulation  
Blood: Types, functions

### **Unit III**

Respiratory System: structure of reparatory organ  
Breathing Mechanism, Lung capacity  
Gaseous transport & control

### **Unit IV**

Excretory system: Structure and function of Nephron  
Urine formation, Micturation  
Skeleton system, bones, cartilages

### **Unit V**

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

### ***Recommended Books***

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

## **Paper III- Endocrinology & Comparative Anatomy (BOZ 203)**

### **Unit I**

Origin of Pituitary, Structure and function

Types of Hormones from Pituitary Gland

### **Unit II**

Thyroid Gland: Structure, Types of Hormones & Functions

Adrenal Gland: Structure, Types of Hormones & Functions

### **Unit III**

Hormones from Pancreas

Hormones from Sex organ

Penal gland

### **Unit IV**

Circulatory system

Integumentary system

### **Unit V**

Urino-genital system

Nervous system with special reference to brain

### **Recommended Books**

1. Gorbamn, A & Burn H.A. : A text book of comparative endocrinology (Willey Eastern)
2. Yadav J.S. :Endocrinology
3. Guyton A.C. : Medical Physiology
4. Srivastava, Agrawal and Kumar : Animal Physiology
5. Baynara & Turner : General Endocrinology (W.B. Saunder's)
6. Yong J.Z. : Life of Vertebrates, ELBS
7. Nigam H.C. : Zoology of Chordates, Vishal Publications, Jalandhar.
8. Kotpal R.L. :Text book of vertebrates, Rastogi Publications

## **Practicals**

Models	10
Permanent slide Preparation	05
Physiological Exercise	10
Endocrinology	05
Comments on spots from 1-10	10
Viva-voce test	05
Practical record	05
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### **Contents of Practical:**

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

#### **1. Museum Speciation**

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

#### **2. Permanent Slides**

<b>Protochordata</b>	:	W.M. <i>Salpa, Doliolum</i> , T.S. of <i>Amphioxus</i> , Spicules of <i>Herdmania</i> .
<b>Amphibia</b>	:	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.
<b>Aves</b>	:	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. Physiology** : Estimation of Haemoglobin, Counting of RBC and WBC in Human  
Blood, Preparation of Hemin Crystals, Preparation of blood film of  
frog.
- 5. Endocrinology:** Photo sheet of various disease caused by Endocrine gland: Exophthalmic  
Goiter, Acromegly, Graves Disease, Midget

## Semester III

### Paper I- Cell Biology & Immunology (BOZ 301)

#### Unit I

Introduction of Cell  
Prokaryotic and Eukaryotic  
Cell theory, Cell organelles

#### Unit II

Ultra structure & Functions: Mitochondria  
Ultra structure & Functions: Golgi bodies  
Ultra structure & Functions: Endoplasmic Reticulum

#### Unit III

Ultra structure: Endoplasmic Reticulum  
Cell cycle  
Cell division: Mitosis and Meiosis

#### Unit IV

An Introduction to cellular basis of Immunity  
Active & Passive immunity

#### Unit V

Characteristics of antigen and antibody  
Antigen -Antibody reaction, MHC Molecules  
Immune disorder: AIDS.

#### *Recommended Books*

1. Lewis C.D. and Levin, R. : Biology of gene, Mc. Grew Hill - Toppan Co. Ltd.
2. Robertes & Robertes : Cell & Molecular Biology.
3. Verma P.S. & Agarwal : Cell Biology.
4. Gupta P.K. : Cytology.
5. Lodish, H.et.al. : Molecular cell biology.
6. Karp G. : Molecular Cell Biology.
7. Kuby : Immunology



## **Paper II- Genetics (BOZ 302)**

### **Unit I**

Elements of Heredity and Variation  
Mendel's Laws of inheritance

### **Unit II**

Linkage & type  
Crossing over  
Sex linked inheritance: Hemophilia, Colour blindness,

### **Unit III**

Sex determination: Human beings and Drosophila  
Blood Groups  
Dosage compensation

### **Unit IV**

Nucleic acids: as genetic material  
Hershey - Chase & Fraenkel - Conrat experiment

### **Unit V**

Gene mutation  
Molecular basis of gene mutation  
Cytoplasmic inheritance

### ***Recommended Books***

1. Strickberger : Genetics, Macmillan Publications.
2. Enderson : Genetics.
3. Verma P.S. and J.K. Agarwal : Genetics, S. Chand and Co.
4. Gupta P.K. : Genetics, Rastogi Publication

## **Paper III- Biochemistry (BOZ 303)**

### **Unit I**

Biomolecules  
Structure & Classification: Proteins  
Structure & Classification: Carbohydrates and fats

### **Unit II**

Glycolysis  
Kreb's Cycle  
Oxidative phosphorylation,  
Electron transport system

### **Unit III**

Gluconeogenesis  
Cori's cycle  
Fatty acid synthesis  
Urea cycle

## **Unit IV**

Enzymes: Nature, Properties

Classification action

Co-enzyme; isozyme;

apzyme; ribozyme; co-factors.

## Unit V

Vitamins: Classification  
Chemical nature of Vitamins  
Importance and Sources

### *Recommended Books*

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 : Lehninger's Biochemistry CBS

## Practicals

Cytological Exercise	10
Immunology	10
Genetic Exercise	10
Biochemical test	10
Viva-voce	05
Practical record	05
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### **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

### **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

### **Genetics:**

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

### **Biochemical tests:**

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

**Semester IV**  
**Paper I Ecology (BOZ 401)**

**Unit 1**

Ecology: Definition, aim & scope

Ecological factors

Adaptation: Definition, types with adaptive features and examples

**Unit II**

Definition and types

Terrestrial Ecosystem

Aquatic Ecosystem

**Unit III**

Energy flow in ecosystem

Food chain, food web

Biogeochemical cycles

**Unit IV**

Ecological pyramids

Ecological succession

**Unit V**

Population interactions: Intra and inter specific

Community- Definition and characteristics

**Recommended Books**

1. Odum : Fundamental of Ecology (W.B. Saunders)
2. Ricklefy : Ecology (W.H. Freeman)
3. Willimer & Stone: Environmental Physiology (Blackwell Sci. Oxford 4K)
4. Singh H.R. : Ecology & Environmental Science.

**Paper II Wild Life Management (BOZ 402)**

**Unit I**

Wild Life in India

Endangered flora

Endangered fauna of India

**Unit II**

Wild life management

Wild life conservation (*in-situ* and *ex-situ*): Zoos

**Unit III**

Rules and regulations of Wild life

Modern concept (IUCN categories)

Different projects for animal preservation

## **Unit IV**

National Parks in India  
Sanctuaries  
Biosphere reserves

## **Unit IV**

Important movements: Chipko movement  
Narmada Bachavo Aandholan, Pani Panchayat  
Seed Movement

### ***Recommended Books***

1. S.K. Singh : Text Book of Wildlife Management, Ibdc, Publisher
2. Sulphey & Safeer : Introduction to Environment Management, PHI, Publisher
3. Singh H.R. : Ecology & Environmental Science.
4. P.D. Sharma : Ecology & Environmental Science, Rastogi Publication

## **Paper III Instrumentation (BOZ 403)**

### **Unit I**

Principles and applications of pH meter  
Principles and applications centrifuge

### **Unit II**

Principal and application of Electrophoresis  
Chromatography: Paper and TLC

### **Unit III**

Microscopy and type  
Compound microscopy

### **Unit IV**

Phase-Contrast microscope  
Electron Microscopy

### **Unit V**

Microtomy: Paraffin embedding of tissues  
Cutting of sections & processing

### ***Recommended Books***

1. Introduction to Instrumentation in Life Sciences Plastic Comb by Prakash Singh Bisen , Anjana Sharma
2. Biological Instrumentation and Methodology (Tools & Techniques) S Chand & Co Ltd

## Practicals

Ecological Models	10
Ecological Exercise	10
Adaptation	05
Wild life exercise	05
Instrumentations	10
Viva-voce test	05
Practical record	05
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### **Ecological Exercise**

Study of Physio-chemical factors (temperature, pH, salinity and light)  
Properties of water (turbidity, hardness, CO<sub>2</sub>, acidity, alkalinity),  
Ecological apparatus

### **Adaptation**

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

### **Wild Life Exercise:**

Photosheet of different wild life fauna: Elephant, Lion, Tiger

### **Instrumentation**

Centrifugation and types, Chromatography  
Agarose Gel Electrophoresis, SDS PAGE,  
Spectrophotometry, Fractionation of rat liver/Fish,  
Distribution of enzymes in the cell

**Semester V**  
**Paper I Economic Zoology (BOZ 501)**

**Unit I**

Pest, types, characteristic features  
Integrated Pest Management (IPM)

**Unit II**

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

**Unit III**

Protozoa and human diseases  
Diseases caused by ticks and mites

**Unit IV**

Apiculture  
Sericulture  
Lac culture

**Unit III**

Pearl culture  
Pisciculture  
Prawn culture

***Recommended Books***

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

**Paper II Animal Behaviour (BOZ 502)**

**Unit I**

Ethology: Definition and scope  
Patterns of Behaviour

**Unit II**

Methods used in ethological studies  
Courtship Behaviour

### **Unit III**

Migratory behaviour in fish  
Socialism in animals

### **Unit IV**

Motivation  
Imprinting

### **Unit V**

Learning  
Role of hormones in behaviour

### ***Recommended Books***

1. Mathur Reena - Animal Behaviour, S.Chand & Co.
2. Mannings - Ethology
3. Gundevia H.S. and Hargovind - Animal Behaviour.
4. Lucas J. R. and Simmons L. W. - Essays in Animal Behaviour

## **Paper III Environmental Biology (BOZ 503)**

### **Unit I**

Environmental Pollution - Water, air, soil and noise pollution  
Greenhouse effect & global warming  
Acid rain, ozone layer depletion

### **Unit II**

Conventional and non-conventional sources of energy  
Environment & human health  
Water quality & water borne diseases

### **Unit III**

Environmental hazards of radiations and safety measures  
Environmental Impact Assessment  
Bio-indicators

### **Unit IV**

Biodiversity: Concept, types and values  
Hotspots; Threats to biodiversity

### **Unit V**

Biodegradation  
Biomagnifications and Bioremediation  
Solid waste management: Causes, effects and control

### ***Recommended Books***

1. Willimer, Stone & 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



## Practicals

Economic Zoology (Life cycle)	20
Stored grain pests	10
Environmental Biology Exercise	15
Animal Behaviour Project	20
Viva-voce test	05
Practical record	05
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### **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

### **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

### **Environmental biology**

Pond water analysis, Estimation of water quality & DO,

comments upon the Apparatus related with environmental assessment

## **Semester VI**

### **Paper I Molecular Biology (BOZ 601)**

#### **Unit I**

Structure & function of DNA  
DNA Types  
Double helical model

#### **Unit II**

Nucleosome organization, Transposons  
RNA: Types  
Clover leaf model of t-RNA

#### **Unit II**

Central dogma  
Concept of gene expression  
Reverse transcription

#### **Unit IV**

Split gene, Replication of DNA  
Transcription  
Post-transcriptional modifications

#### **Unit V**

Translation  
Protein sorting, packaging and transport  
Regulation of gene expression in prokaryotes (Operon model)

#### ***Recommended Books***

1. Singh B.D.: Biotechnology (Kalyani Pub.)
2. Mayers R.A.: Molecular Biology and Biotechnology.
3. Lodish et al - Molecular Cell Biology 5th ed
4. Watson, J.D - Molecular Biology of the Gene

### **Paper II Genetic Engineering (BOZ 602)**

#### **Unit I**

Genetic engineering- Aims and scope  
Restriction enzymes

#### **Unit II**

Gene Cloning  
Cloning vectors

## **Unit II**

Gene Library  
Applications of Genetic engineering

## **Unit IV**

DNA finger  
DNA foot printing

## **Unit V**

Edible vaccines  
Gene therapy

### ***Recommendations***

1. Genetic Engineering - Principles and Methods (Vol 27) - J. Setlow, ed., (Springer, 2006)
2. Alfred Pingoud – Restriction Endonucleases, Springer Verlag Berlin Heidelberg New York
3. Lodish et al - Molecular Cell Biology 5th ed
4. Watson, J.D - Molecular Biology of the Gene

## **Paper III Biostatistics (BOZ 603)**

### **Unit I**

Introduction of Biostatistics  
Data and its type,  
Data presentation, Table, Graphs

### **Unit II**

Range  
Variety  
Coefficient of correlation

### **Unit III**

Levels of significance  
Regression

### **Unit IV**

Student's t – test  
Chi-square

### **Unit IV**

Null hypothesis  
Alternate Hypothesis  
ANOVA,

### ***Recommended Books***

1. W.W. Daniel : Biostatistics, Wiley India, Publication
2. Arora P.N., P.K. Malhan : Biostatistics, Himalaya Publishing House.
3. Prasad S.G. : Biostatistics.

## Practicals

Molecular Biology (Models)	20
Molecular Biology	15
Genetic Engineering	10
Biostatistics	10
Seminar	10
Viva and record	10
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	75

### **Molecular Biology**

Molecular Worksheet, Model preparation of DNA, RNA and Proteins, Isolation of bacterial DNA, Bacterial growth curve, Demonstration of cloning

### **Genetic Engineering**

Cloning, Recombinant DNA Technology worksheets

### **Biostatistics**

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