

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 2×1=2 practical, Total=08 credit) and V to VI has 12 credits (3X3=9 theory and 3×1=3 practical, Total 12 credits or 2×4=8 theory and 4×1=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)

Sr. No.	Code	Paper	Title	IA	ESE	Total Marks	Credits
Semester I							
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
Semester II							
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
Semester III							
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
Semester IV							
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
Semester V							
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
Semester VI							
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, Proripita*

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

Permanent Slides:

Protozoa :	<i>Paramecium, W.M. Binary Fission, Conjugation in Paramecium, Monocystis, Opalina, Balantidium, Entamoeba, Leishmania.</i>
Porifera :	Spongin fibres, gemmule, spicules, L.S. & T.S. of <i>Sycon.</i>
Coelenterate : (Cnidaria)	T.S. of <i>Hydra</i> through gonads, <i>Obelia</i> W.M., <i>Obelia</i> medusae, Ephydra Larva.
Helminthes :	<i>Fasciola</i> through testes; Scolex, mature and gravid proglottid of <i>Taenia solium</i> , Miracidium, Redia, Cercaria, Metacercaria, Cysticercus larva.
Annelida :	T.S. <i>Nereis</i> , 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 <i>Culex</i> and <i>Anopheles</i> , <i>Pediculus</i> W.M., <i>Cimex</i> W.M.
Echinodermata :	T.S. of arm of starfish, pedicellaria, bipinnaria larva.
Hemichordata :	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

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

2. Permanent Slides

Protochordata	:	W.M. <i>Salpa, Doliolum</i> , T.S. of <i>Amphioxus</i> , Spicules of <i>Herdmania</i> .
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. 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;

abzyme; 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. Sulphery & Safer : 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, CO₂, 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 III

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, median, and test of significance