ORDINANCES, TEST OUTLINES,
SYLLABI and READING COURSES
For
B.Sc. (Honours) Multidisciplinary PART I
(SEMESTER I & II)

Academic Sessions
2025–26 ,2026-27

Under
Choice-Based Credit System (CBCS)
Scheme of

NEP 2020

PROGRAMME CODE: B.Sc. (Honours) Multidisciplinary

DEPARTMENT OF SCIENCE
GURU NANAK COLLEGE
BUDHALADA
(An Autonomous College)
NAACAccredited'A++'Grade
CollegewithPotentialforExcellenceStatusby
UGC, Star College Status-DBT
E-mail:gncbudhlada@yahoo.co.in
Website:www.https://www.gncbudhlada.org
Under Punjabi University, Patiala

SYLLABI, OUTLINES OF PAPERS AND TESTS FOR

B.Sc. (HONOURS) MULTIDISCIPLINARY Part-I

(SEMESTER I & II)

SESSIONS 2025-26, 2026-27

Semester-I							
Paper Code	**Title of Paper**	**Credits**	**Hours (Per Week)**	**Max Marks**	**External Exam**	**Internal Assessment**	**Time allowed**
BZOL1101T	**MAJ**:Animal Diversity (Protozoa to Chordata)	03	03	100	70	30	03 hrs.
BZOL1102P	**MAJ-LAB**: Animal Diversity (Protozoa to Chordata)	01	02	50	35	15	03 hrs.
BZOL1103T/ BZOL1104P	**MIN**:*Animal Diversity (Protozoa to Chordata)/LAB	4 [3+1]	03/02	100/50	70/35	30/15	03/03 hrs.
BZOL1105T/ BZOL1106P BZOL1107T/ BZOL1108P	**IDC/MDC**: Human Diseases/LAB or Environmental Science-1/LAB	3 [2+1]	02	50/50	35/35	15/15	1.5/03hrs
BZOL1109T/ BZOL1110P	**SEC**: Vermiculture and Vermicomposting Technology/LAB	3 [2+1]	02	50/50	35/35	15/15	1.5/03hrs
Semester-II							
BZOL1201T	**MAJ**: Comparative Anatomy and Developmental Biology of Vertebrates	03	03	100	70	30	03 hrs.
BZOL1202P	**MAJ-LAB**: Comparative Anatomy and Developmental Biology of Vertebrates	01	02	50	35	15	03 hrs.
BZOL1203T/ BZOL1204P	**MIN**: *Comparative Anatomy and Developmental Biology of Vertebrates/LAB	4 [3+1]	03/02	100/50	70/35	30/15	03/03 hrs.
BZOL1205T/ BZOL1206P BZOL1207T/ BZOL1208P	**IDC/MDC**: Economic Zoology/LAB or Environmental Science-II/ Lab	3 [2+1]	02	50/50	35/35	15/15	1.5/03hrs
BZOL1209T/ BZOL1210P	**SEC**: Apiculture/ LAB	3 [2+1]	02	50/50	35/35	15/15	1.5/03hrs

Note:

1. MAJ: Discipline Specific Core Course; **MAJ-LAB**: Discipline Specific Core Practical Course; **MIN**: Minor Core Courses; **IDC/MDC:** Inter Disciplinary Courses; **AEC**: Ability Enhancement Course; **VAC**: Value Added Course; **SEC**: Skill Enhancement Course.

2. *The credit of the minor will be 04 (03 credit for theory and 01 credit for Practicals).The contact hours of the minor will be 05 hours (03 hours Theory and 02 hours Practical).

3. Weightage of different components in internal assessment of theory papers is as: Attendance-20%, Assignment/Project/Seminar/Lab Work-40% and Internal Examination (Mid Semester Written Exam)-40%.

4. Students who wish to exit after First year will have to complete their summer internship/vocational course of 04 credits before the exit in order to be eligible for a UG Certificate Course.

UG (HONOURS) MULTIDISCIPLINARY
Part-I (SEMESTER-I)
SESSIONS 2025-26,2026-27

Paper Code	Title of Paper	Credits	Hours (Per Week)	Max Marks	External Exam	Internal Assessment	Time allowed in hrs
ERSUG1101T	**VAC:** Environment and Road Safety	02	02	50	35	15	2 hrs

Part: 1 Semester: I
PAPER: ZOOLOGY MAJOR
ANIMAL DIVERSITY (PROTOZOA TO CHORDATA)
PAPER CODE: BZOL1101T

Max. Marks:100 **Credit: 3**
Theory: 70 **Total Lectures: 45 hours**
Internal Assessment: 30 **(3 hours/week)**
Pass Marks: 35%

COURSE OBJECTIVES:
To provide students with comprehensive understanding of animal kingdom.
To understand the structural and functional organization of various animal groups.
To understand general characteristics and evolutionary relationships of various animals.

COURSE OUTCOMES:
Students will come to learn about basic characteristics of chordates and non chordates.
To equip the Students with the ability to understand,classify and identify various animal species, understand the principle of animal classification and appreciate the importance of biodiversity.

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and will carry 12 marks each. Section C will consist of 11 short-answer type questions of 2 marks each which will cover the entire syllabus uniformly.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from section A and two questions from section B .Section C is compulsory.

SECTION -A **(23hours)**

Phylum Protozoa: General characters; Reproduction in Protozoa.
Phylum Porifera: General characters; Canal System in Sycon.
Phylum Coelenterata: General characters; Polymorphism in Obelia.
Phylum Platyhelminthes: General characters; Life history of *Taenia solium*.
Phylum Nemathelminthes:General characters; Life history of *Ascaris lumbricoids* and its parasitic adaptations
PhylumAnnelida: General characters; Excretion in Annelida
Phylum Arthropoda: General characters; Respiration in Prawn and Cockroach, Metamorphosis in Insects
Phylum Mollusca: General characters
Phylum Echinodermata: General characters; Water-vascular system in Asteroidea

SECTION- B **(22hours)**

Protochordates: General features
Agnatha: General features of Agnatha (Cyclostomata)
Pisces: General features, Migration and Osmoregulation in Fishes.
Amphibia: General features; Parental Care, Neoteny and Paedogenesis
Reptilia: General features; venomous and non-venomous snakes, Biting mechanismin snakes and Poison apparatus
Aves: General features; Flight adaptations in birds
Mammalia: General features, Origin of mammal.

Recommended Books

- Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunder International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.L. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
- Young, J. Z. (2004).The Life of Vertebrates.III Edition. Oxford university press.
- Pough H. Vertebrate life, VIII Edition, Pearson International.
- Hall B.K. and Hallgrimsson B. (2008).Strickberger'sEvolution.IV Edition Jones and Bartlett Publishers Inc.

PRACTICAL: ANIMAL DIVERSITY (PROTOZOA TO CHORDATA)
PAPER CODE: BZOL1102P

Max. Marks: 50 **Credits: 1**
Practical examination: 35 **Pass marks: 35%**
Internal Assessment: 15 **Time Allowed: 3 hours**
(2hours/week)

COURSE OBJECTIVES:

Study specific phyla such as protozoa, porifera, mollusca etc. with suitable examples.
Learn to identify animal specimens based on their characteristics and classification.

COURSE OUTCOMES

Students may be introduced to basic research methods and learn how to communicate scientific information effectively.
To provide students with the comprehensive understanding of the animal kingdom
To identify animals understand their evolutionary relationships and appreciate their importance in ecosystem.
Students should also be able to apply their knowledge to practical scenarios and engage and critical thinking about animal science.

LABORATORY EXERCISES

Classification upto orders with ecological notes and economic importance of the following:

Protozoa: Slides*: Amoeba, Trypansoma,Paramecium, Vorticella*
Porifera: Specimens: *Sycon, Euplectella, Hyalonema, Spongilla and Euspongia.*
Coelenterata: Specimens: *Physalia,Madrepora,Aurelia, HydraObelia.*
Platyhelminthes: Specimens*: Taenia. Scolex* and Proglottids of *Taenia* (mature and gravid)
Aschelminthes:*Ascaris* (male and female).
Annelida: Specimens: *Pheretima, Nereis, Tubifex* and *Pontobdella*.
Arthropoda:*Cancer* (Crab),*Periplaneta* (Cockroach),Dragonfly, termite queen, *Apis*(Honey bee), *Bombyx,Palamnaeus* (Scorpion*),Limulus* (King crab).
Mollusca:*Ostrea, Solen* (Razor fish), *Limax, Loligo, Octopus,Chiton and Dentalium*.
Echinodermata: *Asterias*
Hemichordata: *Balanoglossus.*
Urochordata: *Herdmania*
Cephalochordata*: Amphioxus,*
Cyclostomata: *Petromyzon, Myxine*
Chondrichthyes*:Zygaena* (Hammer headed shark*), Pristis* (saw fish**),** *Trygon*
Actinopterygii: *Muraena, Mystus, Catla, Hippocampus, Exocoetus*
Dipneusti (Dipnoi): *Protopterus* (African lung fish).
Amphibia:*Amblystoma* and *its Axolotl* Larva, *Salamandra, Hyla*and *Rhacophorus.*
Reptilia: *Chamaeleon, Python, Naja,Viper ,Crocodilus, Chelone*(Turtle)and*Testudo (*Tortoise).
Aves*: Pavo, Tyto, Alcedo* and*Casuarius.*
Mammalia*: Ornithorhynchus, Echidna, Macropus, Loris, Manis.*

Study of the following permanent stained preparations/Photomicrographs:

A. L.S. and T.S. Sycon, Gemmules, Spicules and Sponginfibres of a sponge.
B. Spicules, pharynx of *Herdmania* and pharynx of *Amphioxus,* Scales of fishes

Preparation of the following slides:

Preparation of permanent whole mount stained in borax carmine: *Obelia*

Field visit to Museum.

INSTRUCTIONS FOR PRACTICAL PAPER

Max. Marks: 50 **Credit:01**
External paper: 35 **Pass Marks: 35%**
Internal Assessment: 15 **Time Allowed: 3 hours**

1. 5 Museum specimens/slides from Protozoa to Echinodermata for identification, classification and short morphological note.	10
2. 5 Museum specimens/slides from Hemichordata to Mammalia for identification, classification and short morphological note.	10
3. Identification of 2 permanent slides	4
4. Preparation of Permanent stained slide	3
5. Viva-Voce	2
6.Field visit report	2
7.Practical note book.	4

PAPER: ZOOLOGY MINOR
ANIMAL DIVERSITY (PROTOZOA TO CHORDATA)
PAPER CODE: BZOL1103T

Max. Marks:100 **Credit: 3**
Theory: 70 **Total Lectures: 45 hours**
Internal Assessment: 30 **(3 hours/week)**
Pass Marks: 35%

COURSE OBJECTIVES:

To provide students with comprehensive understanding of animal kingdom.
Understanding the structural and functional organization of various animal groups.
To understand general characteristics and evolutionary relationships of various animals.

COURSE OUTCOMES:

Students will come to learn about basic characteristics of chordates and non chordates.
To equip the Students with the ability to understand, classify and identify various animal species, understand the principle of animal classification and appreciate the importance of biodiversity.

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and will carry 12 marks each. Section C will consist of 11 short-answer type questions of 2 marks each which will cover the entire syllabus uniformly.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from section A and two questions from section B. Section C is compulsory.

SECTION-A **(23hours)**

Phylum Protozoa: General characters; Reproduction in Protozoa.
Phylum Porifera: General characters; Canal System in Sycon.
Phylum Coelenterata: General characters; Polymorphism in Obelia.
Phylum Platyhelminthes: General characters; Life history of Taeniasolium.
Phylum Nemathelminthes: General characters; Life history of Ascarislonbricoides and its parasitic adaptations
PhylumAnnelida: General characters; Excretion in Annelida
Phylum Arthropoda: General characters; Respiration in Prawn and Cockroach, Metamorphosis in Insects
Phylum Mollusca: General characters
Phylum Echinodermata: General characters; Water-vascular system in Asteroidea

SECTION-B **(22hours)**

Protochordates: General features
Agnatha: General features of Agnatha (Cyclostomata)
Pisces: General features, Migration and Osmoregulation in Fishes.
Amphibia: General features; Parental Care, Neoteny and Paedogenesis
Reptilia: General features; venomous and non-venomous snakes, Biting mechanism
In snakes and Poison apparatus
Aves: General features; Flight adaptations in birds
Mammalia: General features, Origin of mammals

Recommended Books

- Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunder International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.L. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
- Young, J. Z. (2004).The Life of Vertebrates.III Edition. Oxford university press.
- Pough H. Vertebrate life, VIII Edition, Pearson International.
- Hall B.K. and Hallgrimsson B. (2008).Strickberger'sEvolution.IVEdition.Jones and Bartlett Publishers Inc.

PRACTICAL: ANIMAL DIVERSITY (PROTOZOA TO CHORDATA)
PAPER CODE:BZOL1104P

Max. Marks: 50 **Credits: 1**
Practical examination: 35 **Pass marks: 35%**
Internal Assessment: 15 **Time Allowed: 3 hours**
(2hours/week)

COURSE OBJECTIVES:

Study specific phyla such as protozoa, porifera, mollusca etc. with suitable examples.
Learn to identify animal specimens based on their characteristics and classification.

COURSE OUTCOMES

Students may be introduced to basic research methods and learn how to communicate scientific information effectively.
To provide students with the comprehensive understanding of the animal kingdom.
To identify animals understand their evolutionary relationships and appreciate their importance in ecosystem.
Students should also be able to apply their knowledge to practical scenarios and engage and critical thinking about animal science.

LABORATORY EXERCISES

Classification upto orders with ecological notes and economic importance of the following:

Protozoa: Slides*: Amoeba, Trypansoma,Paramecium, Vorticella*
Porifera: Specimens: *Sycon, Euplectella, Hyalonema, Spongilla and Euspongia.*
Coelenterata: Specimens: *Physalia,Madrepora,Aurelia, HydraObelia.*
Platyhelminthes: Specimens*: Taenia. Scolex* and Proglottids of *Taenia* (mature and gravid)
Aschelminthes:*Ascaris* (male and female).
Annelida: Specimens: *Pheretima, Nereis, Tubifex* and *Pontobdella*.
Arthropoda:*Cancer* (Crab),*Periplaneta* (Cockroach),Dragonfly, termite queen, *Apis*(Honey bee), *Bombyx,Palamnaeus* (Scorpion)*,Limulus* (King crab).
Mollusca:*Ostrea, Solen* (Razor fish), *Limax, Loligo, Octopus,Chiton and Dentalium*.
Echinodermata: *Asterias*
Hemichordata: *Balanoglossus.*
Urochordata: *Herdmania*
Cephalochordata*: Amphioxus,*
Cyclostomata: *Petromyzon, Myxine*
Chondrichthyes:*Zygaena* (Hammer headed shark*), Pristis* (saw fish**),** *Trygon*
Actinopterygii: *Muraena, Mystus, Catla, Hippocampus, Exocoetus*
Dipneusti (Dipnoi): *Protopterus* (African lung fish).
Amphibia:*Amblystoma* and *its Axolotl* Larva, *Salamandra, Hyla*and *Rhacophorus.*
Reptilia: *Chamaeleon, Python, Naja,Viper ,Crocodilus, Chelone*(Turtle)and*Testudo (*Tortoise).
Aves*: Pavo, Tyto, Alcedo* and*Casuarius.*
Mammalia*: Ornithorhynchus, Echidna, Macropus, Loris, Manis.*

Study of the following permanent stained preparations/Photomicrographs:

A. L.S. and T.S. Sycon, Gemmules, Spicules and Sponginfibres of a sponge.
B. Spicules, pharynx of *Herdmania* and pharynx of *Amphioxus,* Scales of fishes

Preparation of the following slides:

Preparation of permanent whole mount stained in borax carmine: *Obelia*

Field visit to Museum.

INSTRUCTIONS FOR PRACTICAL PAPER

Max. Marks: 50 **Credit : 01**
External paper: 35 **Pass Marks: 35%**
Internal Assessment: 15 **Time Allowed: 3 hours**

1. 5 Museum specimens/slides from Protozoa to Echinodermata for identification, classification and short morphological note.	10
2. 5 Museum specimens/slides from Hemichordata to Mammalia for identification, classification and short morphological note.	10
3. Identification of 2 permanent slides	4
4. Preparation of Permanent stained slide	3
5. Viva-Voce	2
6. Field visit report	2
7. Practical note book.	4

ZOOLOGY: IDC/MDC
HUMAN DISEASES
PAPER CODE:BZOL1105T

Max. Marks: 50 **Credits: 2**
Theory: 35 **Pass Marks: 35%**
Internal Assessment: 15 **Total Lectures: 30 hours**
(2 hours/ week)

COURSE OBJECTIVES:

Understanding the normal functioning of human body and recognizing how diseases disrupt these functions.
To learn about the causative agents,symptoms,prevention and treatment methods of various diseases.

COURSE OUTCOMES:

Two equip students with the knowledge and skills to understand, diagnose and manage human health problems.
Students gain and understanding of how diseases manifest at the molecular level including genetic mutation, protein dysfunction and cellular responses to injury.

INSTRUCTIONS FOR PAPER SETTER

The End Semester examination will be of 1 hour 30 minutes duration. The question paper will consist of three sections, Section A, B and C. Section A and B will have four questions each from the respective sections of the syllabus out of which the candidate will be required to attempt two questions each. Each question will carry 06 marks. Section C will be compulsory with 11 objective/short-answer type questions of 01 mark each which will cover the entire syllabus.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt any two questions from section A and two questions from section B. Section C is compulsory

SECTION- A **(15hours)**

Introduction- Health - WHO definition, importance of individual health. Lifestyle choice for healthier life: Diet, exercise, alcohol, tobacco and drugs, computers and health, mobile phone and health, psychological health

Viral Infections: Brief account of chickenpox, poliomyelitis, rabies, dengue fever, mumps, influenza, measles, hepatitis, HIV infection and AIDS- causes,symptoms,prevention and cure.

Bacterial Infections: Brief account of dysentery, cholera, Tuberculosis, tetanus, typhoid, plague; STD and leprosy causes, symptoms, prevention and cure.

Protozoan Infections: Brief account of protozoan infections *leishmaniasis*, malaria causes, symptoms, prevention and cure.

SECTION -B **(15hours)**

Worm Infections: Brief account of Platyhelminthes and nematode infections: *taeniasis, ascariasis, ancylostomiasis* causes, symptoms, prevention and cure.

Vector borne diseases: Vector identification of vectors Filaria,kalaazar,chikungunya-causes, symptoms, prevention and cure.

Mental health: Meaning, definition, history, characteristics of a mentally healthy person. Types of mental illness causes, symptoms and prevention major mental illness (schizophrenia, paranoia), minor mental illnesses (anxiety, phobia, obsessive compulsive neuroses)

Recommended Books

- Abraham Verghese. (1996). Introduction to Psychiatry. 131 Publications Pvt. Ltd.
- Anderson, G. M. Communicable Disease Control. Macmillan, New York.
- Chauhan, S. S. Mental Hygiene. - A Science of Adjustment. Allied Publishers.
- Carol. D. Tamparo. Diseases of Human body
- Deepak Kumar. (2001). Diseases and Medicines in India: A historical Overview.
- Mangal, S., K. (2004). Introduction to Abnormal Psychology .Sterling Publishers.
- Mary L. M. Mark Zelman. Paul Holdway: Human Diseases - A Systematic Approach.
- Park. K (2005). Textbook of Prevention and Social Medicine.
- Park. J. E .and Park. K. Textbook of Preventive and Social Media

PRACTICAL: HUMAN DISEASES
PAPER CODE: BZOL1106P

Max. Marks: 50 **Credits: 1**
Practical examination: 35 **Pass Marks: 35%**
Internal Assessment: 15 **Time Allowed: 3 hours**

COURSE OBJECTIVES:

Learn about various diagnostic techniques .
Develop critical thinking skills to interpret laboratory results and clinical data.

COURSE OUTCOMES:

This includes learning about normal anatomy and physiology, recognizing pathological changes and understanding how diseases affect the human body.
Students will also develop skills in clinical examination diagnostic techniques and potential even basic research methods related to disease investigation.

LABORATORY EXERCISES

1. Study of permanent stained slides/specimens/diagrams of parasitic protozoans and bacteria mentioned in the theory syllabus.
2. Study of *Ascaris, Taenia solium* and their life stages through permanent slides/photomicrographs or specimens.
3. Study of arthropod vectors associated with human diseases*: Pediculus, Culex, Anopheles, Aedes* through specimens/charts.
4. Study of symptoms and therapy for major and minor mental health illnesses mentioned in theory syllabus.

INSTRUCTIONS FOR PRACTICAL PAPER

Max. Marks: 50 **Credits: 1**
Practical examination: 35 **Pass Marks: 35%**
Internal Assessment: 15 **Time Allowed: 3 hours**

1. 2 Museum specimens/slides/photographs for identification, classification and short morphological note on parasitic protozoa or bacteria. 8
2. 2 Museum specimens/slides/photographs for identification, classification and short morphological note on parasitic worms 8
3. Identification, classification and morphological note on 2 arthropod vectors 6
4. Write-up about one major/minor mental health disease 5
5. Viva-Voce 4
6. Practical. 4

ZOOLOGY: IDC/MDC
ENVIRONMENT SCIENCE-I
PAPER CODE:BZOL1107T

Max. Marks: 50 **Credit : 2**
Theory: 35 **Pass Marks: 35%**
Internal Assessment: 15 **Total Lectures: 30 hours**
(2 hours/ week)

COURSE OBJECTIVES:

To understand the environmental concepts.

Encourage critical thinking, problems solving and effective communication skills to tackle environmental problems and develop sustainable solutions.

COURSE OUTCOMES:

Students gain a solid understanding of environmental principles including quality conservation by biology and environmental policy.

Learners developed skills to mitigate environment issues and promote sustainability.

INSTRUCTIONS FOR PAPER SETTER

The End Semester examination will be of 1 hour 30 minutes duration. The question paper will consist of three sections. Section A, B and C. Section A and B will have four questions each from the respective sections of the syllabus out of which the candidate will be required to attempt two questions each. Each question will carry 06 marks. Section C will be compulsory with 11 objective/short-answer type questions of 01 mark each which will cover the entire syllabus.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt any two questions from section A and two questions from section B. Section C is compulsory

Section-A (15hours)

Fundamentals of Environmental Sciences: Definition and Scope of Environmental Science.Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere .Concept of sustainable development. Environmental education and awareness.

Environmental Chemistry:Composition of air.Photochemical smog.Water as a universal solvent.Concept of BOD.Toxic chemicals: Pesticides and effects .Heavy metal pollution.Carcinogens in the air.

Environmental Biology: Ecology as an inter-disciplinary science.Biotic and Abiotic components.Brief account of food chain and food web.Species diversity, Concept of Ecotone, edge effects.Ecosystem stability and factors affecting stability.Ecosystem services.

Types of Ecosystems: Desert (hot and cold), forest,wetlands, lotic, lentic,Oceanic.Concept of biomes.

SECTION-B (15hours)

Biodiversity and its conservation: Definition, types, importance of biodiversity and threats to biodiversity.Concept and basis of identification of "Hotspots'; hotspots in India.Strategies for biodiversity conservation: in situ, ex situ and in vitro conservation.National parks, Sanctuaries, Protected areas and Sacred groves in India .Brief idea about Extinct ,Rare, Endangered and Threatened flora and fauna of India.

Environmental Biotechnology: Bioremediation definition and types.Bioindicators, Biofertilizers, Biofuels and Biosensors.

Natural Hazards: Catastrophic geological hazards floods, landslides, earthquakes, volcanism, avalanche, tsunami and cloud burst. Prediction of hazards and mitigation of their impacts

Environmental Disasters: Bhopal Gas Tragedy, 1984, Chernobyl Disaster, 1986

Energy and Environment: Solar energy, Fossil fuels, hydro-power, wind power, geothermal energy.Natural resources and their assessment by Remote Sensing and GIS.

Recommended Books

- Rajagopalan, R. (2016) Environmental Studies Oxford University Press, New Delhi
- Rana, S.V.S. (2010) Essentials of Ecology and Environmental Science, PHI Learning Pvt. New Delhi
- Sulphey, M.M. (2012) Introduction to Environment Management, PHI Learning Pvt. New Delhi
- Sharma, S.K. (2015). Environmental Law, Wisdom Press. New Dehli
- Sharma, P.D. (2018) Ecology and Environment Rastogi Publishers, New Delhi
- Santra, S.C. (2016) Environmental Sciences. New Central Book Agency, Kolkata

PRACTICAL:ENVIRONMENT SCIENCE
PAPER CODE:BZOL1108P

Max. Marks:50 **Credit:1**
Practical examination: 35 **Pass Marks: 35%**
Internal Assessment:15 **Time Allowed: 3hours**

COURSE OBJECTIVES:

Conduct biodiversity assessments to understand ecosystem health and conservation.
Students learn the skills and knowledge necessary to address environmental challenges.

COURSE OUTCOMES:

Students develop skills in analyzing and interpreting data including statistical analysis and data visualization.
Students learn to apply scientific methods and practices including numeracy and mathematical concepts and practical contexts.

LABORATORY EXERCISES

1. Determination of minimum size of the Quadrant by 'Species-Area-Curve' method.
2. Determination of frequency of species by Line Transect Method and Point Frame Method.
3. Determination of Standing Crop and Biomass in Terrestrial Ecosystem.
4. Study of the abiotic and biotic components of an Aquatic/Terrestrial Ecosystem
5. Estimation of Net Primary Productivity by Harvest Method in Grassland Ecosystem.
6. Study of historical environmental disasters.

INSTRUCTIONS FOR PRACTICAL PAPER

Max. Marks:50 **Credit: 1**
External paper: 35 **Pass Marks: 35%**
Internal Assessment: 15 **Time Allowed: 3 hours**

1. Performance and write up of any one (Exp 1-2)	8
2. Performance and write up of any one (Exp 3-5)	8
3. Study of Biotic/Abiotic components of Aquatic/Terrestrial ecosystem	6
4. Write-up about one historical environmental disaster.	5
5. Viva-Voce	4
6. Practical note book	

ZOOLOGY: SKILL ENHANCEMENT COURSE (SEC)
VERMICULTURE AND VERMICOMPOSTING TECHNOLOGY
PAPER CODE: BZOL1109T

Max. Marks:50 **Credit: 2**
Theory: 35 **Total Lectures: 30 hours**
Internal Assessment: 15. **(2hours/week)**
Pass Marks: 35%

COURSE OBJECTIVES:

To teach a students about importance of recycling of garbage in order to sustain our health and environment students will understand four R's of recycling, reduce, reuse recycle, restore by the certificate course in vermicompost technology .

To teach students to compost in a limited space.

COURSE OUTCOMES:

They can generate employments.

They will also turn towards organic farming and help to maintain the environment pollution free and will get the knowledge of biodiversity of local earthworms.

INSTRUCTIONS FOR PAPER SETTER

The End Semester examination will be of 1 hour 30 minutes duration. The question paper will consist of three sections. Section A, B and C. Section A and B will have four questions each from the respective sections of the syllabus out of which the candidate will be required to attempt two questions each. Each question will carry 06 marks. Section C will be compulsory with 11 objective/short-answer type questions of 01 mark each which will cover the entire syllabus.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt any two questions from section A and two questions from section B .Section C is compulsory.

SECTION-A (15hours)

Introduction to Vermiculture: Definition, its value in maintenance of soil structure and role as four R's of recycling, reduce, reuse, restore.

Classification,habits,habitat,morphology of *Pheretima posthuma*-Useful, local and exotic species of earthworm.

SECTION-B (15hours)

Process of Vermicomposting: Material required, bed preparation, inoculation of earthworms, precautions and best practices, harvesting, processing, vermiwash, benefits and uses of compost. Different Methods of Vermicomposting: small- and large-scale bed method, pit method, vermicompost pots, earthworm farming for home gardens conventional commercial composting at larger scale.

Problems in vermicomposting: Pest and diseases of earthworms, frequent problems and preventive methods.Vermiculture and vermicompost Economy and entrepreneurship.

Books Recommended

- Bhatnagar&Patla, 2007. Earthworm vermiculture and vermin-composting, KalyaniPress, Goa, India.Publishers, New Delhi
- Mary Violet Christy, 2008. Vermitechnology, MJP Publishers, Chennai.
- Chaudhuri, P.S. (2005). Vermiculture and vermicomposting as biotechnology for conversion of organic wastes into animal protein and organic fertilizer. Asian Jr. of Microbiol. Biotech. Env. Sc., 7(3):359-37A.
- Das, M.C. 2012. Charles Darwin's Plough.Tools for Vermitechnology. I K International Publishing House, ISBN: 978-93-81 141-27, 182 pages.

PRACTICAL: VERMICULTURE AND VERMICOMPOSTING TECHNOLOGY
PAPER CODE: BZOL1110P

Max. Marks:50 **Credit:1**
Practical examination: 35 **Pass Marks: 35%**
Internal Assessment: 15 **TimeAllowed:3hours**

COURSE OBJECTIVES:

Students will understand the importance of vermicomposting in managing organic wastage.
Students will design a basic vermicomposting practices.

COURSE OUTCOMES:

Hands on experience in vermiculture and vermicomposting techniques including setting up and maintaining vermicomposting system.
Increased understanding of the environment benefits of vermicomposting, including waste reduction ,greenhouse gas mitigation and sustainable agriculture practices.

LABORATORY EXERCISES

1. Study of Vermiculture, Vermiwash&Vermicompost equipment and devices.
2. Identification of useful species of earthworms.
3. Study of Life stages & development of *Eisenia fetida*.
4. Morphological and anatomical description of an Earthworm
5. Preparation of vermicompost- methods: Bed Method and Pit Method.
6. Process of Earthworm Farming (Vermiculture), Extraction (harvest), vermicomposting harvest and processing.
7. Field trip/project report.

INSTRUCTIONS FOR PRACTICAL

Max. Marks:50 **Credit: 1**
Practical examination: 35 **Pass Marks: 35%**
Internal Assessment: 15 **Time Allowed: 3 hours**

1. Performance and write up of preparation of Vermicompost/Vermiwash 8
2. Identification of Earthworm and its Morphological and Anatomical description 8
3. Study of life stages of *Eisenia fetida* 6
4. Write-up about Vermicompost harvesting/post-harvest processing 5
5. Viva-Voce 4
6. Practical notebook and Field report 4

ERSUG1101T: ENVIRONMENT AND ROAD SAFETY (VAC)
Session 2025-26, 2026-27

Total Marks: 50 Max **Lectures per week:03**
Theory: 35 marks **Credits: 02**
Internal assessment: 15 **Maximum Time: 02 hr**

COURSE OBJECTIVES:

To reduce accidents, injuries, and fatalities, promote responsible driving, and minimize the environmental impact of vehicles and transportation.

To enhance road safety knowledge among all road users, enforce traffic laws, and foster eco-friendly driving practices.

COURSE OUTCOMES:

Students will gain knowledge about environmental problems like pollution, climate change, and biodiversity loss.
Students will learn about environmental laws and regulations aimed at protecting the environment.
Students will understand the link between human actions and environmental degradation.

INSTRUCTIONS FOR PAPER SETTER

The examination will be of 35 marks and of 2 hours duration. The question paper will consist of three sections, SECTION A, B and C. SECTION A and B will have four questions each from respective sections of the syllabus. Each question will carry 6 marks, which may be segregated into sub-parts. Section C will be compulsory with 11 short-answer type questions of 1 mark each and will cover the entire syllabus.

INSTRUCTIONS FOR STUDENTS

Students should attempt four questions from Section A and B by selecting at least 2 questions from each Section. The section C will be compulsory.

SECTION-A

1. **Introduction to environmental studies**: The multidisciplinary nature of environmental studies.Definition, scope and importance Concept of Biosphere-Lithosphere, Hydrosphere, Atmosphere.

2**. Ecosystem & biodiversity conservation**: Ecosystem and its components. Biodiversity Definition, Values, Threats and its conservation in India as Mega-biodiversity nation; Endangered and endemic species of India.

3. **Natural resources-renewable and non-renewable resources**: Deforestation, Desertification causes and impacts due to mining. Land use changes.

3.1 **Water:** Use and over-exploitation of surface and ground water Floods, droughts, conflicts over water (international &interstate)

3.2 **Energy resources**: renewable and non-renewable energy sources.Use of alternate energy sources.

4. **Environmental Pollution:** types, causes and controls: air, water, soil and noise.Nuclear hazards and their risks. Solid waste management, Source measures of urban and Segregations: Control Industrial waste.

SECTION-B

5. **Environmental protection laws in India**: Environmental protection act for Air(Prevention and control of pollution) Water Control of (Prevention and pollution) Wildlife, Forest conservation.Climate change & global warming.

6**. Human Communities and the Environment**

6.1 **Human population growth**: Impacts on environment human health and welfare Sanitation & Hygiene.
Environment movements: Chipko, Silent valley, Bishnoi's of Rajasthan, Resettlement and rehabilitation of project

affected persons: case studies Environmental communication and public awareness case studies for a Clean green pollution free state (e g CNG vehicles in Delhi)

7. **Road safety awareness**: Concept and significance of Road safety, Traffic signs, Traffic rules, Traffic Offences and penalties. How to obtain license,Role of first aid in road Safety.

8**. Stubble Burning**: Meaning of Stubble burning, Impact on health & environment. Management and alternative uses of crop stubble.Environmental Legislations and Policies for restriction of agriculture residue burning in Punjab.

9. **Field Work**
Visit to an area to document environmental assets: river and impact of pollution on it. Study of common Plants, Insects, Birds and basic principles of identification.

Recommended readings
1. Odum, E.P. T. & Andrews, J. 1971. Fundamentals of Ecology Philadelphia: Saunders
2. Pepper, I. L., Gerba, C.P. & Brusseau, M.L. 2011 Environmental and Pollution Sciences. Academic Press
3. Rao. M.N.& Dutta. A.K.1987.Waste water treatment .Oxford and IBH Publishing Co.Pvt.Ltd.
4. Raven, P.H., Hassenzahl, D.M. & Berg,R.2012. Environment 8th edition, John Wiley & Sons
5. Rosencranz A Divan, S. & Nobie, M.L. 2001. Environmental law and policy in India, Tripathi 1992
6. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP
7. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology,Environmental Science and Conservation.S. Chand Publishing. New Delhi.
8. Thapar V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent
9. Warren C.E. 1971 Biology and Water Pollution Control WB Saunders
10. Wilson, E. O. 2006. The Creation: An appeal to save life on earth New York: Norton.
11. World commission on Environment and Development 1987 Our Common Future Oxford University Press.

Part: 1 Semester: II
PAPER: ZOOLOGY MAJOR
COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES
PAPER CODE: BZOL1201T

Max. Marks: 100 **Credits: 03**
Theory: 70 **Total Lectures: 45 hours**
Internal Assessment: 30 **(3hours/week)**

COURSE OBJECTIVES:

To understand the structural and functional similarities and differences among vertebrate groups.
To provide students with the deep understanding of vertebrate diversity evolution and development.
To understand various development processes including gametogenesis and fertilization.

COURSE OUTCOMES:

Students will learn about the correlation of comparative development to evolutionary biology and phylogeny and how development processes contribute to the evolution of vertebrate structure.
Students will understand how the structures and functions of vertebrate organs related to their adaptation in ecological niches.

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and will carry 12 marks each. Section C will consist of 11 short-answer type questions of 2 marks each which will cover the entire syllabus uniformly.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from section A and two questions from section B. Section C is compulsory.

SECTION- A **(22hours)**

Integumentary System Derivatives of integument w.r.t. glands and digital tips
Skeletal System Evolution of visceral arches
Digestive System Brief account of alimentary canal and digestive glands
Respiratory System Brief account of Gills, lungs, air sacs and swim bladder
Circulatory System Evolution of heart and aortic arches
Urinogenital System Succession of kidney, Evolution of urinogenital ducts
Nervous System Comparative account of brain
Sense Organs Types of receptors

SECTION -B **(23hours)**

Early Embryonic Development Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals, vitellogenesis in birds, Fertilization: external (amphibians), internal (mammals), blocks to polyspermy, Early development of frog and hurmans (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula); Fate of germ layers.

Late EmbryonicDevelopment: Extraembryonic membranes, Implantation of embryo in humans, Formation of human placenta and functions, other types of placenta on the basis of histology; Metamorphic events in frog life cycle and its hormonal regulation.

Control of Development Fundamental processes in development (brief idea) -Gene activation, determination, induction, Differentiation, morphogenesis and types of morphogenetic movements, intercellular communication and cell death.

Recommended Books

- Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. I Edition. McGraw-Hill Higher Education.
- Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies
- Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts, USA.
- Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons.
- Walter, H.E. and Sayles, LP; Biology of Vertebrates, Khosla Publishing House.
- Balinsky, B.L. (2008). An introduction to Embryology, International Thomson Computer Press.
- Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Inc.

PRACTICAL:COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES
PAPER CODE: BZOL1202P

Max. Marks: 50 **Credit : 1**
Practical examination: 35 **Time Allowed: 3hours**
Internal Assessment: 15 **Pass Marks:35%**
(2hours/week)

COURSE OBJECTIVES:

Examine development processes in various organisms to understand embryological development and tissue formation.

Study the comparative anatomy of different organisms for understanding evolutionary relationship and adaptations.

COURSE OUTCOMES:

Identifying anatomical structures, comparing different vertebrate groups and gaining knowledge of development stages including early embryonic development and placenta formation.

Through practical sessions students will develop skills,observation and analysis of slides and vertebrates specimens.

LABORATORY EXERCISES

1. Osteology: a) Disarticulated skeleton of Frog, and Rabbit b) Carapace and plastron of turtle/tortoise
2. Frog Study of developmental stages-whole mounts and sections through permanent slides-cleavage stages, blastula, gastrula, tadpole external and internal gill stages.
3. Examination of gametes frog/rat sperm and ova through permanent slides or photomicrographs.
4. Study of the different types of placenta histological sections through permanent slides or photomicrographs.
5. Comparatives study of Heart and Brain in Vertebrates through Models/Charts
6. Study of Mammalian Eye and Ear through Models/Charts
7. Study of histological slides of Mammalian tissues

INSTRUCTIONS FOR PRACTICAL PAPER

Max. Marks:50 **Credit: 1**
Practical examination: 35 **Time Allowed: 3hours**
Internal Assessment: 15 **(2hours/week)**

1. Identification and description of two bone specimens	6
2. Identify and write short note on any two-Model/Chart of Heart/Brain/Eye	10
3. Identification of permanent stained slides pertaining to Expt. 2, 3 & 7	6
4. Identification of Photomicrographs pertaining to Expt. 4	5
5. Viva-Voce	4
6. Practical note book	4

PAPER: ZOOLOGY MINOR
COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES
PAPER CODE: BZOL1203T

Max. Marks: 100 **Credits: 03**
Theory: 70 **Total Lectures: 45 hours**
Internal Assessment: 30 **(3hours/week)**

COURSE OBJECTIVES:

To understand the structural and functional similarities and differences among vertebrate groups.
To provide students with deep understanding of vertebrate diversity,evolution and development.
To understand various development processes including gametogenesis and fertilization.

COURSE OUTCOMES:

Students will learn about the correlation of comparative development to evolutionary biology and phylogeny and how development processes contribute to the evolution of vertebrate structure.
Students will understand how the structures and functions of vertebrate organs related to their adaptation in ecological niches.

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and will carry 12 marks each. Section C will consist of 11 short-answer type questions of 2 marks each which will cover the entire syllabus uniformly.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from section A and two questions from section B. Section C is compulsory.

SECTION- A **(22hours)**

Integumentary System Derivatives of integument w.r.t. glands and digital tips
Skeletal System Evolution of visceral arches
Digestive System Brief account of alimentary canal and digestive glands
Respiratory System Brief account of Gills, lungs, air sacs and swim bladder
Circulatory System Evolution of heart and aortic arches
Urinogenital System Succession of kidney, Evolution of urinogenital ducts
Nervous System Comparative account of brain
Sense Organs Types of receptors

SECTION- B **(23hours)**

Early Embryonic Development Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals, vitellogenesis in birds, Fertilization: external (amphibians), internal (mammals), blocks to polyspermy, Early development of frog and hurmans (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula); Fate of germ layers.
Late Embryonic Development: Extraembryonic membranes, Implantation of embryo in humans, Formation of human placenta and functions, other types of placenta on the basis of histology; Metamorphic events in frog life cycle and its hormonal regulation.
Control of Development Fundamental processes in development (brief idea) -Gene activation, determination, induction, Differentiation, morphogenesis and types of morphogenetic movements, intercellular communication and cell death.

Recommended Books

- Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. I Edition. McGraw-Hill Higher Education.
- Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies
- Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts, USA.
- Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons.
- Walter, H.E. and Sayles, LP; Biology of Vertebrates, Khosla Publishing House.
- Balinsky, B.L. (2008). An introduction to Embryology, International Thomson Computer Press.
- Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Inc.

PRACTICAL: COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES
PAPER CODE: BZOL1204P

Max. Marks: 50 **Credit : 1**
Practical examination: 35 **Time Allowed: 3hours**
Internal Assessment: 15 **(2hours/week)**

COURSE OBJECTIVES:

Examine development processes in various organisms to understand embryological development and tissue formation.

Study the comparative anatomy of different organisms for understanding evolutionary relationship and adaptations.

COURSE OUTCOMES:

Identifying anatomical structures, comparing different vertebrate groups and gaining knowledge of developmental stages including early embryonic development and placenta formation.

Through practical sessions students will develop skills, observation and analysis of slides and vertebrates specimens.

LABORATORY EXERCISES

1. Osteology: a) Disarticulated skeleton of Frog,and Rabbit b) Carapace and plastron of turtle/tortoise
2. Frog Study of developmental stages-whole mounts and sections through permanent slides-cleavage stages, blastula, gastrula, tadpole external and internal gill stages.
3. Examination of gametes frog/rat sperm and ova through permanent slides or photomicrographs.
4. Study of the different types of placenta histological sections through permanent
5. slides or photomicrographs.
6. Comparatives study of Heart and Brain in Vertebrates through Models/Charts
7. Study of Mammalian Eye and Ear through Models/Charts
8. Study of histological slides of Mammalian tissues

INSTRUCTIONS FOR PRACTICAL PAPER

Max. Marks:50 **Credit: 1**
Practical examination: 35 **Time Allowed: 3hours**
Internal Assessment: 15 **(2hours/week)**

1. Identification and description of two bone specimens	6
2. Identify and write short note on any two-Model/Chart of Heart/Brain/Eye	10
3. Identification of permanent stained slides pertaining to Expt. 2, 3 & 7	6
4. Identification of Photomicrographs pertaining to Expt. 4	5
5. Viva-Voce	4
6. Practical note book	4

ZOOLOGY: IDC/MDC
ECONOMIC ZOOLOGY
PAPER CODE:BZOL1205T

Max. Marks: 50. **Credit: 2**
Theory: 35 **Total Lectures: 30hours**
Internal Assessment: 15 **(2hours/week)**

COURSE OBJECTIVES:

Economics zoology aims to apply zoological knowledge for human benefit, focusing on the economic importance of animals both beneficial and harmful.

Students learn about various animal husbandry practices including sericulture apiculture poultry and fisheries with the focus on sustainable practices and ethical considerations.

COURSE OUTCOMES:

It aims to foster an understanding of sustainable resource management and conservation. Students will develop skills in animal breeding feeding and disease management.

Understanding the economic importance of various management techniques in animal husbandry and developing various skills in related fields.

INSTRUCTIONS FOR PAPER SETTER

The End Semester examination will be of 1 hour 30 minutes duration. The question paper will consist of three sections. Section A, B and C. Section A and B will have four questions each from the respective sections of the syllabus out of which the candidate will be required to attempt two questions each. Each question will carry 06 marks. Section C will be compulsory with 11 objective/short-answer type questions of 01 mark each which will cover the entire syllabus.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt any two questions from section A and two questions from section B. Section C is compulsory.

SECTION- A **(15hours)**

Sericulture: Mulberry and non-mulberry species in India, Morphology and life cycle of *Bambyx mori*, Silkworm rearing techniques: Processing of cocoon, reeling, Silkworm diseases and pest control

Apiculture: Species of honey bees in India, life cycle of *Apis indica* , Colony organization, division of labor and communication, Bee keeping methods and equipment's: indigenous methods, extraction appliances, extraction of honey from the comb and processing, Bee pasturage, honey and bees wax and their uses, Pests and diseases of bees and their management

Live Stock Management: Dairy: Introduction to common dairy animals and techniques of dairy management, Types of housing, loose housing system and conventional barn system; advantages and limitations of dairy farming, milk and milk products. Cattle diseases

Poultry: Types of breeds and their rearing methods, Feed formulations for chicks, Nutritive value of egg and meat.Diseases of poultry and control measures.

SECTION- B **(15hours)**

Aquaculture: Types of aquaculture: Pond culture: Construction, maintenance and management; carp culture, shrimp culture, shellfish culture, composite fish culture and pearl culture

Aquarium Fish keeping: Common fishes used for culture.Fishing crafts and gears. Ornamental fish culture: Fresh water ornamental fish biology, Breeding Techniques .Construction and maintenance of aquarium: Construction of home aquarium, materials used, setting up of freshwater aquaria, aquarium plants, ornamental objects, cleaning the aquarium, maintenance of water quality.control of snail and algal growth. Modern techniques of fish seed production

Lac Culture: Lac production in India. Life cycle, host plants and strains of Lac insect. Lac cultivation: Local practice, improved practice, propagation of Lac insect, inoculation period, harvesting of Lac .Lac composition, processing, products, uses and their pests.

Recommended Books

- Eikichi, H. (1999), Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Ganga, G. (2003). Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Mahadevappa, D., Halliyal, V.G., Shankar, D.G. and Bhandiwad, R., (2000). Mulberry Silk Reeling Technology Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Roger, M (1990). The ABC and Xyz of Bee Culture: An Encyclopedia of Beekeeping,Kindle Edition.
- Shukla and Upadhyaya (2002). Economic Zoology, Rastogi Publishers
- ManjuYadav (2003). Economic Zoology, Discovery Publishing House.
- P.V. Jabde (2005). Textbook of applied Zoology, Discovery Publishing House, New Delhi
- Cherian&Ramachandran Bee keeping in-South Indian Govt. Press, Madras.
- Bard. J (1986). Handbook of Tropical Aquaculture.
- Santanam, R. A. Manual of Aquaculture.
- Zuka. R.I and Hamiyn(1971). Aquarium fishes and plants

PRACTICAL: ECONOMIC ZOOLOGY
PAPER CODE:BZOL1206P

Max. Marks:50 **Credit: 1**
Practical examination: 35 **Time Allowed: 3hours**
Internal Assessment: 15

COURSE OBJECTIVES:

Applying zoological knowledge to solve real world problems, such as pest management, disease control, and conservation.
Learning to identify and classify animals of economic importance, including insects, fish, and other aquatic species.

COURSE OUTCOMES:

Students learn about fishery Biology, aquaculture practices and the management of aquatic resources
Students learn to identify different animal species including insect fishes and livestock

LABORATORY EXERCISES

1. Identification and study of important cultivable edible and ornamental fishes
2. Identification and study of various varieties of milk producing cows/buffaloes-indigenous and exotic breeds
3. Identification and study of important varieties of poultry indigenous and exotic breeds
4. Identification of mulberry and non-mulberry silkworms and their larvae
5. Study of Beekeeping/Silkworm rearing/Aquarium/Aquaculture equipment and methods
6. Estimation of quality of milk from different dairy farm unit specific gravity, fat content, pH, viscosity.
7. Identification of purity of Honey in different samples.
8. Field visits to a Sericulture/fisheries/apiculture/poultry/dairy farm-submission of Field Report

INSTRUCTIONS FOR PRACTICAL PAPER

Max. Marks:50 **Credit: 1**
Practical examination: 35 **Time Allowed: 3hours**
Internal Assessment: 15 **(2hours/week)**

1. Identification of economically important fishes, cattle, poultry, insects from specimens/photographs and write a short note on them 8
2. Note on Beekeeping/Silkworm rearing/Aquarium/Aquaculture equipment or methods 8
3. Investigate quality/purity of milk/honey 6
4. Write-up about lifecycle of Honey bee/Lac insect/ Silkworm 5
5. Viva-Voce 4
6. Practical note book 4

ZOOLOGY: IDC/MDC
ENVIRONMENTAL SCIENCE-II
PAPER CODE: BZOL1207T

Max. Marks: 50. **Credit: 2**
Theory: 35 **Total Lectures: 30hours**
Internal Assessment: 15 **(2hours/week)**

COURSE OBJECTIVES:

Impart knowledge on causes affects and control measures of environmental pollution and natural disaster promoting sustainable development goals

Develop a broader understanding of green materials energy cycles and sustainable urbanization, highlighting the role of a renewable energy sources and eco friendly practices

COURSE OUTCOMES:

Students learn about sustainable practices and renewable energy sources and eco friendly technology to promote environmentally responsible lifestyles.

Students gain a deeper understanding of ecosystem biodiversity and the impact of human activities on the environment

INSTRUCTIONS FOR PAPER SETTER

The End Semester examination will be of 1 hour 30 minutes duration. The question paper will consist of three sections. Section A, B and C. Section A and B will have four questions each from the respective sections of the syllabus out of which the candidate will be required to attempt two questions each. Each question will carry 06 marks. Section C will be compulsory with 11 objective/short-answer type questions of 01 mark each which will cover the entire syllabus.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt any two questions from section A and two questions from section B. Section C is compulsory.

SECTION-A (15hours)

Environmental Pollution and Control: Air Pollution- Sources and types of Pollutants .Indian National Ambient Air Quality Standards.Impact of air pollutant on human health, plants and materials.Acid rain,Indoor air pollution .NoisePollution- Sources, Impact of noise and vibrations on human health. Water Pollution-Types and sources of water pollution, Impact on humans, plants and animals.Soil Pollution- sources, impact and mitigation measures.

Solid and Hazardous Waste Management: Solid Waste types and sources. Solid wasteprocessing-Recycling, composting and vermicomposting.Disposalof solid wastes-sanitary land filling,incineration of solid waste.Hazardous wasteTypes, characteristics and health impacts, management. E-waste and Plastic waste.

SECTION-B (15hours)

Environmental Assessment, Management and Legislation: Aims and objectives of Environmental Impact Assessment (EIA).Overview of Environmental Laws in India: Wildlife Protection Act, 1972, Environmental (Protection) Act, (1986) TheHazardous and Other Waste (Management and Transboundary Movement) Rules, 2016, The Bio-Medical Waste Management Rules, 2016

Environmental Conventions and Agreements: Stockholm Conference on Human Environment 1972, Montreal Protocol, 1987, Ramsar Convention on Wetlands (1971), Earth Summit at Rio de Janeiro, 1992, Kyoto Protocol, 1997.

Contemporary Environmental Issues: Biodiversity loss,Climate change,Ozone layer depletion.Sea level rise.National Action Plan on Climate Change. Environmental issues related to water resource projects Narmada dam, Tehri dam.National river conservation plan Namami Gange and Yamuna Action Plan (brief account). Conservation of wetlands, Ramsar sites in India.Forest Conservation Chipko movement, Silent Valley movement. Wild life conservation project: Project tiger, introduction -Swachh Bharat Abhiyan.

Recommended Books:

- Rajagopalan, R. (2016) Environmental Studies Oxford University Press, New Delhi
- Rana, S.V.S. (2010) Essentials of Ecology and Environmental Science, PHI Learning Pvt. New Delhi
- Sulphey, M.M. (2012) Introduction to Environment Management, PHI Learning Pvt. New Delhi
- Sharma, S.K. (2015). Environmental Law, Wisdom Press. New Delhi
- Sharma, P.D. (2018) Ecology and Environment. Rastogi Publishers, New Delhi
- Santra, S.C. (2016) Environmental Sciences. New Central Book Agency, Kolkata

PRACTICAL: ENVIRONMENTAL SCIENCE-II
PAPER CODE: BZOL1208P

Max. Marks:50 **Credit: 1**
Practical examination: 35 **Time Allowed: 3hours**
Internal Assessment: 15 **(2hours/week)**

COURSE OBJECTIVES:

Apply theoretical knowledge of environmental science to practical situations.
Collect, analyze, and interpret environmental data to understand environmental issues.

COURSE OUTCOMES:

Students learn to monitor and assess environmental parameters including water quality,air quality and soil quality.
Practical activities encourage critical thinking and problem solving skills to address environmental challenges.

LABORATORY EXERCISES

1. Study of soil profile and Physical characteristics of soil- bulk density, particle density and porosity
2. Determination of soil moisture content and Determination of soil pH
3. Determination of pH of a water sample.
4. Determination of Dissolved Oxygen in Water and Biological Oxygen Demand
5. Determination of Turbidity in Water
6. Study of Wildlife Projects/Forest Conservation movements/National Plans

INSTRUCTIONS FOR PRACTICAL PAPER

Max. Marks:50 **Credit: 1**
Practical examination: 35 **Time Allowed: 3hours**
Internal Assessment: 15 **(2hours/week)**

1. Practical related to soil testing (Exp 1-2)	8
2. Practical related to water quality testing (Exp 3-5)	8
3. Write-up about any one Environmental Law in India	6
4. Write-up about Wildlife Projects/Forest Conservation movements/National Plans	5
5. Viva-Voce	4
6. Practical note book	4

ZOOLOGY: SKILL ENHANCEMENT COURSE (SEC) APICULTURE
PAPER CODE: BZOL1209T

Max. Marks: 50. **Credit: 2**
Theory: 35 **Total Lectures: 30hours**
Internal Assessment: 15 **(2hours/week)**

COURSE OUTCOMES:

Apiculture, or beekeeping, courses aim to equip individuals with the knowledge and skills to manage honeybee colonies, produce honey and other bee products, and to understand the vital role of bees in pollination.
The overarching goal is to foster sustainable income generation and contribute to ecological balance.

COURSE OUTCOMES:

Students will learn about the life cycle, social behavior, and different species and castes of honeybees.
They will gain practical skills in setting up, maintaining, and managing beehives, including different types of hives (e.g., Langstroth and Newton hives).
The course will cover the economic significance of apiculture, including its role in pollination and the potential for self-employment and entrepreneurship.

INSTRUCTIONS FOR PAPER SETTER

The End Semester examination will be of 1 hour 30 minutes duration. The question paper will consist of three sections. Section A, B and C. Section A and B will have four questions each from the respective sections of the syllabus out of which the candidate will be required to attempt two questions each. Each question will carry 06 marks. Section C will be compulsory with 11 objective/short-answer type questions of 01 mark each which will cover the entire syllabus.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt any two questions from section A and two questions from section B and the section C is compulsory.

SECTION- A **(15hours)**

Biology of Bees: Classification and Biology of Honey Bees, Social Organization of Bee Colony, behavioural patterns (bee dance, swarming).
Rearing of Bees: Artificial Bee rearing (Apiary), Beehives - Newton and Langstroth, Bee Pasturage, Selection of Bee Species for Apiculture, Bee Keeping Equipment, Methods of Extraction of Honey (Indigenous and Modern) and processing.Apiary management-Honey flow period and lean period, effects of pollutants on honeybees

SECTION- B **(15hours)**

Diseases and Enemies: Bee Diseases and Enemies Control and Preventive measures
Bee Economy: Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis, Royal jelly), Pollen. Modern methods in employing artificial Beehives for cross pollination in horticultural gardens-stationary and migratory bee keeping
Entrepreneurship in Apiculture: Bee Keeping Industry -Recent advancements employment opportunities, economics in small and large-scale beekeeping, scope for women entrepreneurs in beekeeping sector, study of development programs and organizations involved in beekeeping in India.

Recommended Books

- Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
- Bisht D.S., Apiculture, ICAR Publication.
- Singh S., Beekeeping in India, Indian council of Agricultural Research, New Delhi
- Mishra, R.C. (1995).Honeybees and their management in India. Indian Council of Agricultural Research, New Delhi.
- Rahman, A. (2017).Beekeeping in India. Indian Council of Agricultural Research, New Delhi.
- Gupta, J.K. (2016). Apiculture, Indian Council of Agricultural Research, New Delhi

PRACTICAL: APICULTURE
PAPER CODE:BZOL1210P

Max. Marks:50 **Credit: 1**
Practical examination: 35 **Time Allowed: 3hours**
Internal Assessment: 15 **(2hours/week)**

COURSE OBJECTIVES:

Students gain hands-on experience in beekeeping practices, including handling bees, inspecting colonies, and harvesting honey.
Students learn to handle bees safely and inspect colonies for signs of disease or pests.

COURSE OUTCOMES:

Students understand the importance of be health and learn to identify and manage disease and pest affecting the colonies.
Students learn to keep accurate records of apiary activities including colony health, and pest management.

LABORATORY TECHNIQUES

1. Identification of Castes of honey bees or Queen cellDrone cells & Brood Cell.
2. Identification of Different species of Honey Bees used in commercial Apiculture industry
3. To identify and to understand usage of Bee keeping equipment.
4. To set up an artificial bee hive.
5. To study the products of Apiculture industry: Beeswax, Honey, Propolis, Pollen, Royal jelly, Bee venom
6. Extraction of Honey using Honey extractor, processing, packing and storing of Honey.
7. Study of Bee diseases.
8. Field visit/Project Report

INSTRUCTIONS FOR PRACTICAL PAPER

Max. Marks:50 **Credit: 1**
Practical examination: 35 **Time Allowed: 3hours**
Internal Assessment: 15 **(2hours/week)**

1. To identify different species/castes of Honey bees/cells of beehive from specimens/photographs 8
2. Identify and write a short note on Beekeeping equipment/Honey extractor 8
3. Description Note on product of Apiculture industry 6
4. Identification of Bee diseases from photographs 5
5. Viva-Voce 4
6. Practical note book 4