

**V SEMESTER B.Sc ZOOLOGY**  
**PAPER – V:ENVIRONMENTAL BIOLOGY & ETHOLOGY**

**40 hrs**

**UNIT: I**  
**ENVIRONMENTAL BIOLOGY**

**15 hrs**

- 1.1** Fundamentals of Ecology: 04hrs
- a. Sub-divisions and Scope of Ecology.
  - b. Concept of habitat: Micro-habitat and Macro-habitat.
  - c. Concept of Ecological Niche: Spatial, Trophic and Multidimensional.
  - d. Abiotic factors: Light, Temperature and Soil.
- 1.2** Energy Flow in the Ecosystem: First and Second law of thermodynamics. 01hr
- 1.3** Primary and Secondary productivity in an ecosystem. 01hr
- 1.4** **Population Ecology:** Density, Natality, Mortality, Age distribution, Growth, Dispersion and Biotic Potential. 02hrs
- 1.5** **Community Ecology:** Interspecific interactions – Negative (Antibiosis, Competition, Parasitism and Predatism) and Positive (Commensalism, Proto 02hrs Co-operation and Mutualism).
- 1.6** **Ecological succession:**
- a. Definition, Causes, Types, Examples – Hydrosere and Xerosere. 02hrs
  - b. Concept of climax – Monoclimax theory, Polyclimax theory and Climax pattern hypothesis.
- 1.7** **Current Environmental Issues:** 03hrs
- a. Greenhouse effect and Global warming:
    - Introduction.
    - Greenhouse gases and their main anthropogenic sources.
    - Global warming and its impact on climate change (sea level change, crop yield, water balance) and human health.
    - Mitigation/control measures.
  - b. Acid rain:
    - Introduction.
    - Nature of acid rain.
    - Impact of acid rain on human health, aquatic environment, terrestrial environment, and the built environment.
    - Mitigation/control measures.
  - c. Ozone layer depletion:
    - Introduction.
    - Ozone layer depletion process.
    - Consequence of Ozone layer depletion– human health, animals, terrestrial plants, aquatic ecosystems and climate.
    - Mitigation/control measures.

**UNIT II**

**12hrs**

- 2.1** **Toxicology:**
- a. Definition. 02hrs
  - b. Toxins–Types: Insecticides (Chlorinated hydrocarbons, Organophosphates and Carbamate), Rodenticides, Herbicides, Fungicides and Heavy metals (Lead, Mercury, Cadmium & Arsenic)

	c. Concept of Biomagnification and Biotransformation	
<b>2.2</b>	<b>Integrated pest management (IPM):</b> Definition and types.	01 hr
<b>2.3</b>	<b>Energy Resources:</b>	03 hrs
	a. Types: renewable and non-renewable.	
	b. Non-Conventional renewable sources of energy: Solar, Tidal, Wind, Geothermal, Biogas, Biodiesel, Hydrogen –the fuel of future.	
	c. Nuclear energy and Nuclear reactions: Definition, risk of nuclear accidents, advantages and disadvantages of nuclear power plants.	
<b>2.4</b>	<b>Solid waste management:</b> Disposal and recovery (Collection centres, Land filling, Incinerations, Recycling of Wastes and construction of Sanitary Latrines).	01hr
<b>2.5</b>	<b>Wild life conservation and its management:</b>	03 hrs
	a. Red data book.	
	b. In situ conservation: Wild life sanctuaries, National parks and Biosphere reserves.	
	c. Ex situ conservation: Zoological gardens, Botanical gardens, Seed banks, Pollen storage and Tissue culture.	
<b>2.6</b>	<b>a. Remote sensing:</b> Definition, types (Satellite remote sensing and Microwave remote sensing) and applications.	02 hrs
	<b>b. Geographic information system (GIS):</b> Definition, components and applications.	

### UNIT III - ETHOLOGY (ANIMAL BEHAVIOUR)

**3hrs**

<b>3.1</b>	Introduction to animal behaviour, historical perception, aims and objectives.	01hr
<b>3.2</b>	<b>Stereotyped and Acquired behaviour:</b>	02 hrs
	a. Stereotyped behaviour: Kinesis, Taxes, Reflexes, Instincts and Motivation with suitable examples.	
	b. Acquired behaviour (Learnt behaviour): Imprinting, Habituation, Trial and Error learning.	
<b>3.3</b>	<b>Pheromones (Chemical communication):</b> Definition and types, Pheromones in insects and vertebrates.	01hr
<b>3.4</b>	<b>Social behaviour:</b>	02 hrs
	a. Social behaviour in Insects – Honey Bees and Termites.	
	b. Social system in Primates: Monkeys and Apes.	
<b>3.5</b>	<b>Biological rhythms:</b> Definition, Circadian rhythm and Biological clock.	01hr
<b>3.6</b>	<b>Communication in Animals:</b> Dances of Honey Bees, Alarm calls, Eco-location or Sonar in Bat, Aggression and Bioluminescence.	02 hrs
<b>3.7</b>	<b>Parental care:</b> Fishes and Amphibians (two examples each)	01hr
<b>3.8</b>	<b>Special/ unique behaviour:</b>	03 hrs
	• Courtship behaviour	
	• Altruism	
	• Kin selection	
	• Mimicry	

#### References:-

1. Animal behaviour by Alock(2013)
2. Survival strategies by R. Gadakar(1997)
3. Introducton to Animal behaviour by Manning A. & M.S.Dawkins(2012)
4. Animal Behaviour by Robert A(1966)

5. Learning and instinct in animals by Thorpe(1956)
6. Ethology bu Reena Matur(1998)
7. Ecology by Charles J. Krebs(2009)
8. Fundamentals of Ecology by Eugene P. Odum(1953)
9. Elements of Ecology by Clarke(2015).

**V SEMESTER B.Sc., ZOOLOGY PRACTICAL  
PAPER- V ENVIRONMENTAL BIOLOGY AND ETHOLOGY**

**15 Units**

**I. Limnological studies:**

**06 units**

1. Examination of water samples from near by ponds and tanks for the identification of phytoplankton and zooplankton.
2. Estimation of dissolved oxygen by Winkler's method.
3. Estimation of dissolved salt by Mohr's method.
4. Estimation of dissolved organic matter.
5. Estimation of total hardness.
6. Estimation of pH using pH meter/ pH paper/ Titrimetry.

**II. Ecological Adaptations:**

**03 units**

1. Tubicolous worms: Arenicola and Chaetopterus.
2. Fossorial (Burrowing) forms: Dentalium.
3. Sedentary forms: Sea anemone and Lepas.
4. a. Passive fliers: Exocoetus and Draco.  
b. Active fliers: Insects and Bat
5. Animal associations:
  - a. Polymorphic forms: Physalia
  - b. Facultative mutualism: Hermit crab and Sea anemone
6. Desert forms: Phrynosoma
7. Arboreal for: Hyla

**III. Ethology:**

**03 units**

1. Demonstration of Drosophila behaviour: Response of Drosophila flies to different culture media. (ripe banana, rava, curds)
2. Social behaviour in termites: Study of different castes.
3. Mimicry/Camouflage: Stick insect and Chameleon.

**IV. Project report submission:**

**03 units**

- a. Toxicology- Analysis of water (polluted), Solid waste management, Air pollution (Tie up with Pollution control Board, BWSSB, PG dept of Environmental Science, DST and NGOs is recommended)
- b. Rain water harvesting
- c. Visit to Wild Life Sanctuary, National Park, Bio-reserve and Sacred Grove.
- d. Social organisation in Termites and Primates (monkeys and apes).  
*(Field/ industrial visits for the topics related to project report, is recommended)*

**SCHEME OF PRACTICAL EXAMINATION,  
V SEMESTER : B.Sc ZOOLOGY  
ENVIRONMENTAL BIOLOGY AND ETHOLOGY: PRACTICAL - V**

<b>Duration: 3 hrs.</b>		<b>Max.Marks: 35</b>
<b>01</b>	<b>Limnology:</b> Identify and comment on the observed Plankton/s in the given water sample.	08 marks
<b>OR</b>		
	Estimate            in the given water sample and discuss the result. (experiment from serial number 2 to serial number 6 of Unit I)	
<b>02</b>	<b>Ecological adaptations:</b> Identify, draw a neat labelled diagram and comment on the ecological adaptations of A, B, & C.	12 marks (4x3)
<b>03</b>	<b>Ethology:</b> Identify and discuss on the behaviour of D & E	5 marks (2 <sub>1/2</sub> +2 <sub>1/2</sub> )
<b>04</b>	<b>Project Report submission</b>	05 marks
<b>05</b>	<b>Class Records</b>	05 marks
		<b>Total 35 marks</b>

Note: Question 3- Ethology- **D** from 2 of unit-III;  
**E** from 3 of unit-III

**V SEMESTER B.Sc ZOOLOGY**  
**PAPER VI: – GENETICS AND BIOTECHNOLOGY**

		<b>40hours</b>
<b>UNIT I</b>		<b>13 hrs</b>
<b>GENETICS</b>		
<b>1.1</b>	<b>Heredity and Environment:</b> Concept of genotype, phenotype, phenocopy, Norm of reactions (Experiments on <i>Potentilla glandulosa</i> , Fur colour in Himalayan Rabbit, studies of Human twins).	02 hrs
<b>1.2</b>	<b>Introduction to Mendelism:</b> Mendelian principles- Law of segregation and Law of independent assortment.	02 hrs
<b>1.3</b>	<b>Deviation from Mendelism:</b>	08 hrs
	<b>a.</b> Multiple allelism (Ex: Inheritance of ABO blood groups), Rh factor and its inheritance, significance of Rh factor: Erythroblastosis foetalis. <b>b.</b> Interaction of genes: Inheritance of comb shape in poultry. <b>c.</b> Multiple factor inheritance: Inheritance of skin colour in man. <b>d.</b> Sex linkage: <ul style="list-style-type: none"> <li>• X – linked inheritance, Eye colour in <i>Drosophila</i>, Colour blindness and Haemophilia.</li> <li>• Construction of pedigree charts for colour blindness and haemophilia.</li> <li>• Y – linked inheritance: Hypertrichosis in man.</li> </ul>	
<b>1.4</b>	<b>Cytoplasmic inheritance:</b> Kappa particles in <i>Paramecium</i> , Coiling of shells in snail.	01 hr
<b>UNIT II</b>		<b>13 hrs</b>
<b>2.1</b>	<b>Giant chromosomes:</b> Polytene and Lampbrush chromosomes.	02 hrs
<b>2.2</b>	<b>a.</b> Chromosomal basis of sex determination: Types with examples. <b>b.</b> Genic balance theory. <b>c.</b> Gynandromorphs and Free Martins.	02 hrs
<b>2.3</b>	<b>a.</b> Numerical aneuploidy– Down’s syndrome, Cri du Chat syndrome, Turner’s syndrome and Klinefelter’s syndrome. <b>b.</b> Genetic diseases: Alcaptonuria, Albinism, Thalassaemia, Galactosemia and Cystic fibrosis.	03 hrs
<b>2.4</b>	<b>Concept of gene:</b> Fine structure of gene: Cistron, Recon and Muton, Operon concept: Inducible Operon (E.g. Lac Operon)	01 hr
<b>2.5</b>	<b>Gene mutations:</b> Spontaneous and induced mutations, CIB method of detection of mutations, Physical, Chemical and Biological mutagens.	03 hrs
<b>2.6</b>	<b>a. Eugenics:</b> Definition, aspects of positive eugenics and negative eugenics. <b>b.</b> Euthenics and Euphenics.	02 hrs
<b>UNIT III</b>		<b>14 hrs</b>
<b>BIOTECHNOLOGY</b>		
<b>3.1</b>	<b>Genetic Engineering / Recombinant DNA (rDNA)Technology</b>	04 hrs
	<b>a.</b> Molecular tools: Restriction enzymes, DNA ligases, Alkaline phosphatase. <b>b.</b> Vectors: Plasmids, Bacteriophages and Cosmids. <b>c.</b> Host cells: Prokaryotic hosts and Eukaryotic hosts. <b>d.</b> Bioreactors: Definition, types (mention) and applications. <b>e.</b> Methods of gene transfer: Microinjection, electroporation, of DNA,	

	lipofection and direct transfer of DNA.	
<b>3.2</b>	<b>Applications of Biotechnology:</b>	
	<b>a. Transgenesis:</b>	01 hr
	i. Introduction – Meaning and significance.	
	ii. Transgenesis in mice, Knock out and Knock in technology.	
	<b>b. Animal improvement:</b>	02 hrs
	i. Super ovulation and embryo transfer: Steps, benefits and limitations of embryo transfer.	
	ii. Artificial insemination	02 hrs
	<b>c. Gene therapy:</b>	
	i. Somatic cell gene therapy, Embryo cell gene therapy and Germ cell gene therapy.	01 hr
	ii. In vivo and ex-vivo gene therapy.	01 hr
	<b>d. Stem cells:</b> Introduction, features, types, sources and applications	01 hr
	<b>e. Hybridoma technology:</b> Monoclonal antibodies and their applications.	
	<b>f. DNA fingerprinting:</b> Definition, steps involved and applications.	
<b>3.3</b>	<b>PCR technique:</b> Definition, steps involved and applications.	02 hrs
	<b>RFLP, RAPD and AFLP:</b> Definition and applications.	

**References:-**

1. Genetic Engineering by Sandhya Mitra(2015)
2. Gene cloning by Brown(2016)
3. Molecular biotechnology by Sathyanarayana U(2008)
4. Biotechnology by S.S. Purohith(2012)|
5. Transgenic animals by M.M.Ranga(2006)
6. Animal Biotechnology by M.M. Ranga(2007)
7. Molecular Biotechnology by Chennarayappa(2007)
8. Human Genetics by Mange and Mange(1993)
9. Principles of Genetics by Robert H Tamarin Ta Ta McGraw- Hill pub(2004).
10. Genetics by Monroe W. Strickberger , Mac Millan Pub(2008)

**V SEMESTER B.Sc., ZOOLOGY PRACTICAL - VI  
PAPER – VI - GENETICS AND BIOTECHNOLOGY**

	<b>15 Units</b>
1. Drosophila Genetics:	04 Units
a. Sexual dimorphism and Mutant forms – Vestigial wing, White eye, Bar eye, Sepia eye, Yellow body and Ebony body.	
b. Mounting of Polytene chromosome (Salivary gland chromosome)	
c. Mounting of Sex comb and Genital plate.	
d. Genetic problems: Monohybrid cross, Dihybrid cross, multiple alleles, gene interaction	
e. Sex linkage (Construction of pedigree charts for colour blindness and haemophilia)	
2. Human Genetics:	04 Units
d. Blood typing	
e. Preparation of Buccal smear for sex chromatin	
f. Preparations of Blood smear for identification of cell types and comment on the types of leucocytes.	
3. Biotechnology:	03 Units
g. Staining and identification of Bacteria (Gram staining)	
h. Biochemical analysis to determine the interaction of bacteria with different substrates.	
i. Isolation of plasmid DNA	
4. Isolation of DNA from animal tissue.	01 Unit
5. Qualitative detection of acetic acid in Yeast culture (Student is required to prepare the culture)	01 Unit
6. Study of polyploidy in Onion root tip using Colchicine	01 Unit
7. Translocation in Rheo.	01 Unit

**SCHEME OF PRACTICAL EXAMINATION  
V SEMESTER B.Sc ZOOLOGY  
GENETICS AND BIOTECHNOLOGY: PRACTICAL - VI**

**Duration: 3 hrs.**

**Max.Marks: 35**

<b>01.</b>	Drosophila Genetics:	05 marks
	a) Identify and comment on A and B with neat labelled diagram: (Drosophila male/female/mutants- any two)	(2 <sub>1/2</sub> +2 <sub>1/2</sub> )
	b) Mounting: Polytene Chromosome (Salivary Gland Chromosome) or Sex comb or Genital Plate.	07 marks
	or	
	Genetic problems (any two) (4+3 marks)	
<b>02.</b>	Human Genetics : from d to f (any one)	06 marks
<b>03.</b>	Biotechnology:	06 marks
	c) From g, h and i (any one)	06 marks
	d) From 5, 6, 7 and 8 (any one)	
<b>04.</b>	Class Records	05 marks
	<b>Total</b>	<b>35 marks</b>

