

B. Sc. Zoology Semester IV

Name of the Programme: B.Sc. II

Class: Part 3S

Semester: IV DSC-4-04S

Subject: Zoology

Name of the course (Paper): Genetics and Ecology

Course Outcomes Code: COs-04

About the course

The course is a walk for the Bachelor's degree through the amazing diversity of living organisms from simple to complex. The course makes a detailed knowledge of genetics and ecology. It explains the inheritance of traits in animals, mechanism of linkage, crossing over and different genetic disorders. It also deals with effect of abiotic and biotic factors on organisms and structure and functioning of ecosystems.

COs:

Upon completion of this course successfully, students would be able to

1. Describe Mendel's Laws of Inheritance.
2. Differentiate between a monohybrid and a dihybrid cross.
3. Deduce the type of gene interaction from ratio of offspring.
4. Describe linkage and crossing over.
5. Describe various modes of sex determination.
6. Identify the type of syndrome from karyotype.
7. Describe various prenatal diagnostic techniques.
8. Describe effects of water, temperature and light as ecological factors.
9. Identify the type of biotic interaction from given example.
10. Describe components of ecosystem and structure of terrestrial and marine ecosystem.

UNIT I:

1. Law of dominance.
2. Law of segregation.
3. Law of independent assortment.
4. Interactions of genes: Supplementary factor, complementary factor, duplicate factor.
5. Inhibitory factors and lethal factors – dominant and recessive.

UNIT II:

1. Types of linkage, arrangement of linked genes and significance of linkage.
2. Crossing over –Mechanism of crossing over, theories of crossing over (Darlington's theory, breakage and exchange theory and copy choice theory).
3. Types of crossing over – Single, double and multiple crossing overs.
4. Factors affecting crossing over, Significance of crossing over.

5. Multiple alleles in relation to Blood group in man.

UNIT III:

1. Sex determination: Autosomes and sex chromosomes, Sex determination in animals, Chromosomal Theory, Genic Balance Theory. Environmental and hormonal control of sex determination, Gynandromorphs.
2. Human karyotype.
3. Non-disjunction and Disorders: Turner's syndrome, Klinefelter's syndrome, Down's syndrome, Edward's Syndrome,
4. Autosomal recessive disorders: Cystic fibrosis, Albinism, Phenylketonuria, Alkaptonuria,
5. Sex linked genetic disorders and their inheritance in man: Hemophilia and color blindness.

UNIT IV:

1. Genetic Screening and prenatal diagnosis: CVS (Chorionic Villus Sampling), Amniocentesis.
2. Human Heredity: - Inheritance of eye color, Skin color.
3. Recessive genes and consanguineous marriages.
4. Pedigree Analysis, Symbols used in pedigree analysis.
5. Kinds of twins: Identical, Fraternal, Siamese twins, Significance of twin study.

UNIT V:

1. Water as an abiotic ecological factor.
2. Temperature: Temperature tolerance, Effects of temperature on animals. Homeotherms, poikilotherms. hibernation, aestivation.
3. Light: Biological effects of light on aquatic and terrestrial animals: Reproduction, Metamorphosis, pigmentation, vision, photokinesis, phototropism, photoperiodism,
4. Biotic factors: Intraspecific and interspecific associations: Predation, parasitism, Antagonism, commensalism, mutualism, competition (Gauze's Principle).

UNIT VI:

1. Autotrophs and heterotrophs.
2. Food chain, food web, ecological pyramids (number, energy and biomass).
3. Terrestrial ecosystem: Characteristics, types of Biomes.
4. Aquatic ecosystem: Characteristics, Fresh water ecosystems (Lentic and Lotic) and Marine Ecosystem.
5. Ecotone and Edge Effect.

LIST OF PRACTICAL BASED ON GENETICS AND ECOLOGY

A) Genetics Experiments:

1. Recording of Mendelian traits in man.
2. Detection of monohybrid cross with the help of plastic beads.

3. Detection of dihybrid cross with the help of plastic beads.
4. Culturing *Drosophila* using standard methods.
5. *Drosophila* – male and female identification, Mutant forms of *Drosophila* (from pictures)
6. Demonstration of Barr body from buccal epithelium or leucocyte.
7. Preparation of human karyotypes with the help of ICT/suitable tools.
8. Study of syndromes with the help of ICT tools/Photo slides- Turner's syndrome, Klinefelter's syndrome, Down's syndrome
9. Detection of syndrome from karyotype (Turner's syndrome, Klinefelter's syndrome, Down's syndrome).
10. Study of human genetic traits and application of Hardy-Weinberg Principle to them – Baldness, length of index and ring Finger, attached and free earlobes, rolling of tongue, Widow's peak.

B) Ecology-

1. Estimation of pH in water.
2. Estimation of Dissolved oxygen, salinity, free CO₂, total hardness in water sample.
3. Adaptations of aquatic and terrestrial animals based on study of museum specimens such as rocky, sandy, muddy-shore, flying and burrowing animals.
4. Preparation of checklist of producers and consumers of local ecosystems and construction of a food web diagram based on field visit.
5. Mounting and identification of zooplankton.

General:-

Study of a natural ecosystem and field report of the visit.

DISTRIBUTION OF MARKS DURING PRACTICAL EXAMINATION

EXTERNAL MARKS

- | | |
|---|----------|
| 1. Genetics Experiment: | 08 Marks |
| 2. Ecological Estimation/Analysis: | 04 Marks |
| 3. Spotting: | 08 Marks |
| (2 spots each from section A and B of two marks each) | |
| 4. Viva-voce: | 05 Marks |

Total:- 25 Marks

INTERNAL MARKS

1. Attendance:	05 Marks
2. Performance:	05 Marks
3. Certified class record:	05 Marks
4. Field visit report	05 Marks
5. Submission of photographic collection as per syllabus:	05 Marks

Total:- 25 marks

SKILL ENHANCEMENT MODULE (SEM)

1. Study of a Natural Aquatic Ecosystem

- Select of local natural aquatic ecosystem
- Study various abiotic factors of the ecosystem and collect data on their annual variation.
- Study various biotic components of the ecosystem and their interrelationships.
- Submit a report.

2. Study of a Natural Terrestrial Ecosystem

- Select of local natural aquatic ecosystem
- Study various abiotic factors of the ecosystem and collect data on their annual variation.
- Study various biotic components of the ecosystem and their interrelationships.
- Submit a report.

3. Study of Adaptations in Local Aquatic Animals

- Select aquatic animals showing different adaptations
- Study the behaviour of selected animals / birds/ insects
- Prepare a report on morphological and anatomical adaptations in these animals

4. Studying the laws of Mendel's in a new and effective way

- Working Model/ Colorful charts / Slides Shows any effective way can be used to study and demonstrate the Mendelian laws.
- Comparative study can be done by using any effective method.
- Try to collect plant material to prove Mendel's principle.

5. Survey of Mendelian traits in local population

- Conduct a survey of about 100 people among the local population.
- Note down the occurrence of different traits (dominant/recessive).
- Apply Hardy-Weinberg principle to the data

6. Counting of twins at local level through survey

- Collect the data of the percentage of twins.
- Comparative analysis of kinds of twins.

7. Study the food chain found in the around your town/village

- Prepare a flow chart with photographs (Mobile or camera click) of food chains in terrestrial, aquatic ecosystems.
- Prepare a flow chart with photographs (Mobile or camera click) of food chains in terrestrial , aquatic ecosystems.
- During local visits you can observe food web in the area and collect photographic evidence.