



Syllabus

First Semester Course in **Zoology**

2023 – 2024

Contents:

- Syllabus for Core Course (CR):
 - **USZOO4501CR1 – GENETICS**
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 - **USZOO4501VS1 – BIOTECHNIQUES**
- Evaluation and Assessment guidelines



F.Y. B.Sc. ZOOLOGY

Course Title: Genetics

Course Code: USZOO4501CR1

Credits 4: Theory (3) = Total 45 hrs and Practical (1) = Total 30 hrs

Prerequisite: **None**

Course Objectives:

1. To understand the fundamentals of Mendelian genetics and its application
2. To understand the basic molecular mechanisms in Mendelian genetics
3. Ability to apply concepts of classical genetics in human genetics and understand the interplay between genes and phenotypes.
4. This course aims at a comprehensive understanding of genetics and its varied applications whilst shedding light on more fundamental concepts of sex determination and mutations.

Course Outcomes:

CO	On completion of the course the learner should be able to	Bloom's Taxonomy Level
1	Able to define and explain basic concepts in genetics.	Remembering
2	Understand gene expression and subsequent phenotypic expression for concerned traits.	Understanding
3	Be able to draw and map pedigree and analyse the data.	Application
4	Able to explain concepts in linkage, linkage analysis and population genetics and solve sums based on the same	Understanding
5	Analyse and interpret genetic data	Application

UNIT 1: FUNDAMENTAL CONCEPTS

(15 lectures)

- Concepts of allele and gene in genetics,
- Mendelian Monohybrid Inheritance - Concepts of dominance and segregation
- Exceptions to Mendelian Monohybrid inheritance - Lethal genes, Co-dominance and incomplete Dominance, Haploinsufficiency.
- Mendelian Dihybrid Inheritance - concept of independent assortment
- Variations of Dihybrid Inheritance - Recessive and Dominant Epistasis, Inhibitory gene.
- Multiple Alleles: Concept and case study of the Human blood group system wrt formation of blood groups, understanding the interaction between major and minor blood group genes (dominance, co-dominance and epistatic interactions)
- Cytoplasmic Inheritance: Kappa particles in Paramecia, Shell coiling in Limnea (maternal inheritance).

UNIT 2: HUMAN GENETICS

(15 lectures)

- Mendelian Genetics in Humans:
 - Autosomal Dominant inheritance: Huntington's chorea disorder / Marfan's syndrome
 - Autosomal recessive inheritance: Harlequin-type Ichthyosis / PKU
 - X-linked recessive inheritance: Duchenne muscular dystrophy / Haemophilia
 - X-linked Dominant inheritance: Rett Syndrome / Fragile X syndrome
- DNA mutations: Deletion, Insertion, Frame Shift, Transition and Transversion
- Chromosomal Aberrations: Structural - Deletion, Duplication, translocation, Inversion, nondisjunction. Numerical - Trisomy and Monosomy.

UNIT 3: APPLIED GENETICS

(15 lectures)

- Population Genetics: Overview of Hardy-Weinberg law, Assumptions and predictions of the H-W law, Derivation of H-W law, calculating allele and genotype frequencies in a population using the H-W equilibrium.
- Linkage Mapping: Two-point cross, Three-point cross, Use of linkage analysis in gene mapping
- Quantitative Genetics: Introduction, concept of continuous traits and polygenic inheritance
- Sex Determination: Sry/Dax story in humans, Sxl/Msl story in Drosophila
- Balancer lethal in Drosophila: maintaining recessive lethal mutants.

List Of Recommended Reference Books:

1. Hartl, D. L. (2020). Essential Genetics and Genomics (7th ed.). Jones and Bartlett Learning
2. Taneri, B., Asilmaz, E., Delikurt, T., Savas, P., Targen, S., & Esemem, Y. (2020). Human Genetics and Genomics: A Practical Guide. Wiley-VCH Publisher
3. Klug, W. S., Cummings, M. R., Spencer, C. A., Palladino, M. A. & Killian, D. J. (2019). Concepts of Genetics (12th ed.). Pearson Publication
4. Strachan, T. & Read, A. (2019). Human Molecular Genetics (5th ed.). Routledge Taylor & Francis Group.
5. Sunstad, D. P., & Simmons, M. J. (2016). Principles of Genetics (7th ed.). Wiley
6. Russel, P. J. (2015). iGenetics (3rd ed.). Pearson Publication
7. Crow, J. F. & Kimura, M. (2009). An Introduction to Population Genetics Theory (2009 Reprint). The Blackburn Press.
8. Fairbanks, D & Anderson. (1999) Genetics the continuity of Life
9. Strickberger, M. W. (1995). Genetics (3rd ed.). Prentice Hall of India

Practical Course:

1. Goodness of fit: Chi square test
2. Validation of Mendel's Monohybrid Cross
3. Study of Sex-linked Inheritance using Drosophila (Red eye vs White eye)
4. Problems of H-W law with field data collection.
5. Problems on Gene Mapping (linkage analysis)
6. Problems on Pedigree Analysis
7. Problems on Balancer Lethals
8. Chromosomal Aberrations in Onion root tip and Karyotyping
9. Paper and TLC Analysis of Drosophila eye pigments
10. Isolation of DNA and RNA from tissue samples.
11. Quantitative trait loci - Is the trait controlled by a single gene or multiple genes.

F.Y. B.Sc. ZOOLOGY

Course Title: Biotechniques

Course Code: USZOO4501VS1

Credits 3: Theory (1) = 15 hrs and Practical (1) = 30 hrs

Prerequisite: **None**

Course Objectives:

1. To introduce the students to good laboratory practices.
2. To introduce the students to commonly used instruments and techniques in biology.
3. To teach the students the working principles, functioning and uses of these instruments and techniques.
4. To give the students hands-on training in handling these instruments and techniques.

Course Outcomes:

CO	On completion of the course the learner should be able to	Bloom's Taxonomy Level
1	Know and remember good laboratory practices.	Remembering
2	Know the working principles, functions and uses of commonly used instruments and techniques in biology laboratories.	Understanding
3	Handle/Use these instruments and techniques.	Applying
4	Perform experiments and data analysis	Analysing

UNIT: Biotechniques - Theory

(15 Lectures)

- Pipetting techniques - Principle, functioning and use: of Pipettes (regular and Micropipettes),
- Weighing Balance, Autoclaves (Dry heat & Steam Sterilization) and Biosafety Cabinet. (1 hours)
- Usage and tips on Water Bath, Incubator
- Concept of Molarity, Normality, Serial Dilution, ppm, ppb. Concept of stock solution and working solutions
- pH meter - pH theory, Electrode types and handling, Calibration of pH electrode
- Spectrophotometry - Introduction to Spectrophotometry and BL law, Colorimeter and Spectrophotometer Design,
- Microscopy - Working, Principle and Introduction to Dissection microscope, Light microscope, Stereomicroscope, Darkfield and Phase contrast microscope.
- Good laboratory practices and Globally Harmonized Systems.

Basic biotechniques - Laboratory Skills

(15 lectures)

1. Use of Pipettes - Micropipettes and glass pipetting. Measuring Pipetting Accuracy.
2. Use of Weighing Balance - Operational use and basic weighing technique
3. Application of Autoclave and Dry heat Sterilization methods in Sterilization of plasticware, Glassware and biological materials.
4. Operation of a Biosafety Type II A Cabinet
5. Making laboratory solutions of a given Molarity, Normality. Performing serial dilutions. Diluting a given solution to a fixed part per (thousand, million, billion). Preparing a Stock solution and a working Solution for the same.
6. pH measurement of daily use household chemicals, Acid base Titrations
7. Spectrophotometry - Finding Lambda max for coloured solutions, Protein/glucose concentration estimation assay.
8. Microscope - preparation of slide, dry and wet mounts, Microscope handling techniques.
9. Use of Haematology analyser to assess blood samples.

