

Syllabus First Semester Course in **Zoology** 2023 - 2024

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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:

СО	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., & Esemen, 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.

Evaluation (Core Theory): Total marks per course - 100

I. Formative Assessment 'for' Learning (continuous internal assessment - CIA to improve learning).

CIA – 40 Marks

- CIA 1: Written Test 20 marks
- CIA 2: Multiple choice questions/Lab visit/Assignment 20 marks

II. Summative Assessment 'of' Learning

End Semester Examination – 60 marks.

• One question from each unit for 20 marks, with internal choice. Total marks per question with choice -30 to 32.

Evaluation of (Practical:) Total marks Practical course - 50

• End Semester Practical Examination (Identification and performance of experiments) and submission of Certified Journal – 50 marks.

Template for the End Semester examination in Semester I for the Core Course in Genetics.

UNITS	REMEMBERING	UNDERSTANDING	APPLICATION and ANALYSES	TOTAL MARKS Per unit
1	13	5	2	20
2	10	5	5	20
3	8	6	6	20
TOTAL	31	16	13	60
% WEIGHTAGE	51.66	26.67	21.67	100%

Course Code: USZOO4501VS1

F.Y. B.Sc. ZOOLOGY

Course Title: Biotechniques

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:

СО	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.

List Of Recommended Reference Books:

- 1. Sadasivam, S. and Manickam, A. (2022). *Biochemical Methods*. (4th ed.) New Age International.
- 2. Mettler Toledo Manual (2021). Essential Laboratory Skills: A guide for measurement quality in the lab. Mettler Toledo
- 3. Mettler Toledo Manual (2021). *A guide to pH measurements: Theory and practice of laboratory pH analysis*. Mettler Toledo
- 4. Hofmann, A. and Clockie, S. (2018). Wilson And Walker's Principles and Techniques Of Biochemistry And Molecular Biology (8th ed). Cambridge University Press
- 5. Irwin, S. (2012). *Biochemical Calculations* (2nd ed). Wiley student edition
- 6. Roy, D. (2010). Biotechnology. Narosa Publishing House
- 7. Sharma, K. (2007). Manual of Microbiology (2nd ed). Ane Books India
- 8. Skoog, D. A., Holler, F. J., Nieman, T. A. (2006). *Principles of Instrumental Analysis* (5th ed). Thomson Books

Evaluation (Vocational Skill Theory): Total marks per course - 50

I. Formative Assessment 'for' Learning (continuous internal assessment - CIA to improve learning).

CIA - 20 Marks

CIA 1: Assessment of student's use of instruments as per the problem given – 20
 Marks

II. Summative Assessment 'of' Learning

End Semester Examination – 30 marks.

• Theory and experimental components will be there with the Theory comprising 15 marks and the experimental component for 15 marks.

Template for the End Semester examination in Semester I for the Vocational Skill course in Biotechniques.

UNITS	REMEMBERING	UNDERSTANDING	APPLICATION and ANALYSES	TOTAL MARKS Per unit
1	5	5	5	15
2	5	5	5	15
TOTAL	10	10	10	30
% WEIGHTAGE	33.33	33.33	33.33	100%

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