



Syllabus

First Semester Course in **Zoology**

2023 – 2024

Contents:

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



GENETICSCredits 3: Theory = **45 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:

On completion of the course the learner should be able to:

Sr. No	Course Outcomes	Bloom's Taxonomy Level
1	Define and explain basic concepts in genetics.	Remember
2	Understand gene expression and subsequent phenotypic expression for concerned traits.	Understand
3	Explain concepts in linkage, linkage analysis, population genetics and quantitative genetics.	Understand
4	Draw and/or map pedigrees and interpret pedigree data and problems in genetics	Apply
5	Analyse and interpret data from quantitative genetics and pedigree analysis.	Analyse

UNIT 1

(15 lectures)

FUNDAMENTAL CONCEPTS

- 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

(15 lectures)

HUMAN GENETICS

- 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

(15 lectures)

APPLIED GENETICS

- 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.

Recommended References:

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

Evaluation (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 / Assignments / Presentations / Short answers 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.

F.Y.B.Sc.

Course Code: **USZOO4501CR1PR****PRACTICALS IN GENETICS**Credits 1: **Practical = 30 hrs**Prerequisite: **None****Course Objectives:**

1. Be able to perform the goodness of fit test.
2. To be able to isolate genomic material
3. Ability to evaluate and analyse pedigree charts and genetic conditions

Course Outcomes:

On completion of the course the learner should be able to:

Sr. No	Course Outcomes	Bloom's Taxonomy Level
1	Ability to perform the goodness of fit test to analyse given/available data	Remember
2	Isolate genomic DNA and RNA from liver tissue	Remember
3	Understand methodologies to study quantitative genetics data	Understand
4	Draw and/or map pedigrees and interpret pedigree data and problems in genetics	Apply

Practical Course:

1. Goodness of fit: Chi square test
2. Problems of H-W law with field data collection.
3. Problems on Gene Mapping (linkage analysis)
4. Problems on Pedigree Analysis
5. Problems on Balancer Lethals
6. Human Chromosomal Karyotype analysis (image based)
7. Isolation of DNA and RNA from tissue samples.
8. Quantitative trait loci - Is the trait controlled by a single gene or multiple genes.

BIOTECHNIQUES

Credits 3: Theory = 15 hrs and Practical = 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:

On completion of the course the learner should be able to:

Sr. No.	Course Outcomes	Bloom's Taxonomy Level
1	Know and remember good laboratory practices.	Remember
2	Know the working principles, functions and uses of commonly used instruments and techniques in biology laboratories.	Understand
3	Handle/Use these instruments and techniques.	Apply
4	Perform experiments and data analysis	Analyse

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.
- 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

(30 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. Hofmann, A. and Clockie, S. (2018). *Wilson And Walker's Principles and Techniques Of Biochemistry And Molecular Biology (8th ed)*. Cambridge University Press
2. Irwin, S. (2012). *Biochemical Calculations (2nd ed)*. Wiley student edition
3. Mettler Toledo Manual (2021). *Essential Laboratory Skills: A guide for measurement quality in the lab*. Mettler Toledo
4. Mettler Toledo Manual (2021). *A guide to pH measurements: Theory and practice of laboratory pH analysis*. Mettler Toledo.
5. Roy, D. (2010). *Biotechnology*. Narosa Publishing House
6. Sadasivam, S. and Manickam, A. (2022). *Biochemical Methods*. (4th ed.) New Age International.
7. Sharma, K. (2007). *Manual of Microbiology (2nd ed)*. Ane Books India



Syllabus

First Semester Course in **Zoology**

2023 – 2024

Contents:

- Syllabus for Open Elective (OE)
 - **USZOO4501OE1 - WONDERS OF THE ANIMAL KINGDOM**
 - **USZOO4502OE1 – SOCIAL LIFE OF ANIMALS**
- Evaluation and Assessment guidelines



FYBA, FYBMS, FYMCJ, FYBAF, FYBCom

Course Title: Wonders of the Animal Kingdom Course Code: USZOO4501OE1

Credits 2: **Theory 2 (Total 30 hrs)**

Prerequisite: **None**

Course Objectives:

1. Get a flavour and basic understanding of the way animals are in their ecosystem.
2. Understand special traits/features of animals and the interaction with their environment.
3. Develop a holistic approach to animals and appreciate the diversity and complexity of nature.
4. Get a flavour and basic understanding of the way animals are in their ecosystem.
5. Understand special traits/features of animals and the interaction with their environment.
6. Develop a holistic approach to animals and appreciate the diversity and complexity of nature.

Course Outcomes:

CO	On completion of the course the learner should be able to	Bloom's Taxonomy Level
1	Know how animals interact and behave	Remembering
2	Understand animal interactions with other animals and with their habitat	Understanding
3	Explain animal behaviour and special modifications developed by them	Remembering
4	Use of special features exhibited by animals that help them in hunts and survival	Understanding

UNIT 1: NOVEL ANIMAL CHARACTERISTICS & BIO ENGINEERING

(15 lectures)

- Arctic Fish and the antifreeze protein
- Parental care – Seahorse, Midwife Toad, Kangaroo and Joey relationship
- Fast and the Furious - Cheetah and Peregrine falcon (adaptations for speed)
- Strategizing a hunt (Anatomy of a hunt) – Lions and Orcas
- Biomimicry - Shinkansen bullet train (design inspired by an Owl, an Adele Penguin and a Kingfisher) and Shark skin patterned inspired paint and denticles patterns.
- Communal nesting in sociable weaver birds in Africa (Concept and advantages)

UNIT 2: ANIMAL LEARNING AND MIMICRY

(15 lectures)

- Parasitoid wasp and the zombie Lady bug
- Toxoplasma and the zombified fearless Rat
- Rabies and the human Zombie
- Chimps and use of tools for food
- Learning behaviour in Dolphins
- Mimicry: Butterflies and Coral snakes (Advantages and disadvantages)

List Of Recommended Reference Books:

1. National Geographic Education. (n.d.). Cheetahs on the brink of extinction again. [<https://education.nationalgeographic.org/resource/cheetahs-brink-extinction-again/>]
2. O'Brien, S. J. (1985). A role for molecular genetics in biological conservation. Retrieved from <https://repository.si.edu/bitstream/handle/10088/4265/OBrien1985.pdf?sequence=1>
3. Stanford University School of Medicine. (2012, September). How the cheetah got its stripes: A genetic tale by Stanford researchers. Retrieved from <https://med.stanford.edu/news/all-news/2012/09/how-the-cheetah-got-its-stripes-a-genetic-tale-by-stanford-researchers.html>
4. Unknown. (Unknown). Who knew? 5 charming cheetah facts. Retrieved from <https://www.lionworldtravel.com/news/who-knew-5-charming-cheetah-facts>
5. Unknown. (2016, June 24). Specimen of the Week 245: The peregrine falcon skull. Retrieved from <https://blogs.ucl.ac.uk/museums/2016/06/24/specimen-of-the-week-245-the-peregrine-falcon-skull/>

6. Unknown. (Unknown). The peregrine falcon: Powerful evidence of amazing design. Retrieved from <https://reasonandscience.catsboard.com/t1754-the-peregrine-falcon-powerful-evidence-of-amazing-design>
7. Unknown. (Unknown). Discover how killer whales squeeze out great white livers like toothpaste. Retrieved from <https://a-z-animals.com/blog/discover-how-killer-whales-squeeze-out-great-white-livers-like-toothpaste/>

Evaluation (Theory): Total marks per course - 50

- I. Formative Assessment ‘for’ Learning (continuous internal assessment - CIA to improve learning).**
 - CIA: Written Test – 20 marks
- II. Summative Assessment ‘of’ Learning**
 - End Semester Examination – 30 marks
 - One question from each unit for 15 marks, with internal choice. Total marks per question with choice -20

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

UNITS	REMEMBERING	UNDERSTANDING	TOTAL MARKS Per unit
1	8	7	15
2	8	7	15
TOTAL	16	14	30
% WEIGHTAGE	53.33	46.67	100

\$

FYBA, FYBMS, FYMCJ, FYBAF, FYBCom

Course Title: Social Life of Animals

Course Code: USZOO4502OE1

Credits 2: **Theory 2 (Total 30 hrs)**

Prerequisite: **None**

Course Objectives:

1. To understand why animals live in groups and societies.
2. To know the benefits and costs of living in groups and societies.
3. To understand the basic structures of organization of animal groups and societies.
4. To understand special features evolved by animals living in groups and societies.

Course Outcomes:

CO	On completion of the course the learner should be able to:	Bloom's Taxonomy Level (BT level)
1.	Know the reasons behind why animals form groups and societies.	Knowing
2.	Understand the benefits and costs of living in groups and societies.	Understanding
3.	Know the different structures of organization of animal groups and societies.	Knowing
4.	Appreciate evolution of specific features animals living in groups and societies.	Understanding
5	Know how researchers' study and understand the above-mentioned features.	Understanding

UNIT 1: Formation of groups and societies in animals (15 lectures)

- Why do animals form groups? For better shelter, protection, and food collection.
- Benefits that animals get by grouping:
 - Shelter from harsh environment: Penguins
 - Protection from predators by: diluting predation risk, confusing the predators, employing communal defence and having improved vigilance
 - Foraging: better food finding and better food capture
- Costs of living in groups: reduced share of resources, reduced chances of reproduction, increased chances of spread of diseases.
- Rules and decisions whilst living in groups.
- Social behaviour: Darwin's insuperable difficulty, kin selection, Inclusive fitness,

UNIT 2: Special Features Social Animals and their societies (15 lectures)

- Honeybee dance language
- Special features of ants: anyone – choosing smallest distance, fungal culture, brood theft
- Nest architecture of termites
- Functions of aggressive behaviour in wasps
- Societies of naked mole rats
- Reciprocal altruism in vampire bats
- Evolution of special features of animal societies: cooperation, conflict, ethics and morality

List Of Recommended Reference Books:

1. Davies, NB, Krebs, JR, West, SA (2012). An Introduction to Behavioural Ecology (4th edition). Wiley-Blackwell Publication
2. Gadagkar, R (2001). Survival Strategies – Cooperation & Conflict in Animal Societies: Cooperation and Conflict in Animal Societies. Harvard University Press
3. Various easy to read articles published on social animals in journals.

