



Syllabus

Fourth Semester Courses in Zoology

2024 – 2025

Contents:

- Syllabus for Core Courses Course (CR)
USZOO5003CR1 – EVOLUTION
USZOO5004CR1 – ANIMAL BEHAVIOUR
- Syllabus for Minor Courses Course (MN)
USZOO5002MN1 – PARASITOLOGY



S.Y.B.Sc. ZOOLOGY

Course Code: USZOO5003CR1

EVOLUTIONCredits 4: **Theory 3 = 45 hrs and Practical 1 = 30 hrs**Prerequisite: **The student should have done two core courses in Zoology in Semesters I and II****Course Objectives:**

1. To present before the students an overview of modern evolutionary understanding of the concepts they come across in everyday life.
2. To equip them with skill sets to better understand fundamental evolutionary processors in depth to be able to understand modern biology better.

Course Outcomes:

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

CO	Course Outcomes	Bloom's Taxonomy Level
1	Recapitulate fundamental evolutionary concepts.	Remembering
2	Learners can understand complex evolutionary mechanisms and forces that shape species diversity.	Understanding
3	Generate scientific explanations for complex/puzzling phenomenon when presented.	Applying
4	Analyse and interpret data, figures and tables from literature and draw sound conclusions.	Analysing

UNIT 1

(15 lectures)

- Evolution: Defined and Explained
- Why Study Evolution? Understanding Evolutionary Thought process
- Critical concepts in Evolution: (Use majorly Evolutionary Analysis by Herron and Freeman)
 - Natural Selection – What does it mean? Natural selection and chance, Selfish genes and Unselfish behaviour, what not to expect of Natural selection.
 - Fitness: The currency of selection. How fitness drives selection? - Looking at Evolution of Beak shape on the island of Daphne major.
 - Mutation – The ultimate source of variations, Point and structural mutations, Is mutation random? - Richard Lensky's experiment to giving an overview of selective mutations driving evolution
 - Genetic Drift – Concept, relation to population size, aging in humans and diet. How does it affects DNA repair and longevity? How strong is Genetic Drift? Random mating – Concept, contribution to evolution.

UNIT 2

(15 lectures)

- Modern Synthesis of Evolution
- Sexual Selection: why Sex and how does evolution drive it
- Types of Selection and Mechanisms of Speciation
- Precambrian Evolution and Cambrian Explosion
- Evolution and the Fossil record:
 - Nature of the fossil record and the story of evolution in it
 - Mass extinction events on Earth
 - Comparing Fossil and molecular divergence data

UNIT 3

(15 lectures)

- Evolutionary story of Homo Sapiens
 - Concept of a common ancestor
 - Where did we come from – the story leading to the hominid line
- Uses and implications of Evolutionary Biology
 - Practical applications of evolutionary science
 - Health and medicine

List of Recommended Reference Books:

1. Shubin, N. (2020). Some assembly required. Oneworld Publications
2. Zimmer, C., & Emlen, D. (2019). Evolution: Making sense of Life (3rd ed). W. H. Freeman Macmillan Learning.
3. Futuyama, D., & Kirkpatrick, M. (2017). (Evolution 4th ed). Sinauer Publications
4. Herron, J. C., & Scott, F. (2013). Evolutionary Analysis (5th ed). Pearson Education Limited
5. Ridley, M. (2003). Evolution (3rd ed.). Blackwell Publishing.

Practical Course:

1. Identification of feet and beak in birds
2. Identification of fossils - Trilobite, Ammonite, Fish fossil, Molluscan fossil, wood fossil
3. Construction of a Phylogenetic tree
 - ✓ Downloading sequencing from primary databases
 - ✓ Multiple Sequence Alignment
 - ✓ Construction of phylogenetic trees using open-source tree generation software
4. Dating a common ancestor using the concept of divergence from common ancestor
5. Radiometric dating: Understanding Carbon 14 dating, Rubidium - strontium dating, Uranium - lead dating, Potassium Argon dating.
6. Calculating the likelihood of an evolutionary tree : the concept of an outgroup, Rooted vs unrooted tree and tree building algorithms
7. Studying the combined effects of selection and migration in organism - Lake Erie Island water snakes
8. Random genetic drift, bottleneck effect and founder effect - a study using virtual labs
9. Use of allele frequencies and linkage disequilibrium to date modern human expansion from Africa - use of Alu repeats

Evaluation (Theory): Total marks per course - 100

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

CIA Exam – 40 marks

- CIA 1: Written Test – 20 marks
- CIA 2: Multiple choice questions / Field report /Assignment / Presentation - 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 Journal – 50 marks.

Template for End Semester examination in Semester IV for the Core course in Evolution.

UNITS	REMEMBERING	UNDERSTANDING	APPLICATION and ANALYSES	TOTAL MARKS Per unit
1	7	5	8	20
2	6	4	10	20
3	6	4	10	20
TOTAL	19	13	28	60
% WEIGHTAGE	31.6	21.6	46.6	100

ANIMAL BEHAVIOURCredits 4: **Theory 3 = 45 hrs and Practical 1 = 30 hrs**Prerequisite: **The student should have done two core courses in Zoology in Semesters I and II****Course Objectives:**

1. The students will be introduced the field of animal behaviour.
2. The students will learn how animal behaviour is shaped by development, genetics, physiology, ecology and evolution.
3. The students will also be introduced to some examples of classical experiments and observations in animal behaviour.
4. The students will learn the basic techniques used to record and analyze animal behaviour.

Course Outcomes:

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

CO	Course Outcomes	Bloom's Taxonomy Level
1	Understand how behaviour of animals is shaped by development, genetics, physiology, ecology and evolution	Understanding
2	Understand how researchers have set up experiments to elucidate and interpret behaviour of animals.	Analysing
3	Perform basic techniques used to record and analyze animal behaviour	Applying

UNIT 1

(15 lectures)

Basics of Animal Behaviour

- Historical review of ethology
- Scope of the field of ethology
- Approaches to study animal behaviour – ethological and behaviourist approaches
- Tinbergen's four questions
- Animal personalities

UNIT 2

(15 lectures)

Expression of behaviour

- Bases of behaviour: Genetic, Developmental, Neurological, Physiological
- Communication
- Instinct, learning and cultural transmission
- Play behaviour
- Aggression

UNIT 3

(15 lectures)

Behavioural Ecology

- Habitat selection, territoriality and migration
- Prey-predator interactions, foraging
- Sexual selection and mating systems
- Parental care
- Sociobiology

Recommended References:

1. Dugatkin, L. A. (2020). Principles of Animal Behavior (4th ed). University of Chicago Press
2. Alcock, J. (2009). Animal Behaviour: An Evolutionary Approach (9th ed). Sinauer Associates Inc., U.S.
3. Martin, P. and Bateson, P. (2007). Measuring Behaviour: An Introductory Guide (3rd ed). Cambridge University Press
4. Gadagkar, R. (1997). Survival Strategies. Universities Press

5. Selected research papers about classical animal behaviour studies and developing methods to study animal behaviour.
6. Selected films, videos about animal behaviour

Practical Course:

1. Constructing Ethogram for lab organisms, pets or animals seen in the surrounding, learning basic techniques such as ad libitum sampling, instantaneous scans, all occurrence sessions, focal animal and behaviour sampling.
2. Simulation models to study – such as flock formation, ant foraging and trail formation, Hawk – Dove game
3. Analyzing sound spectra

Evaluation: Practicals will be assessed continuously. There will be no end semester exam. But there will be a viva. The marks will be distributed as follows: Ethogram and sampling techniques: 20 marks, simulation studies: 20 marks, Viva: 10 marks

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/Descriptive/assignments/presentations - 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 or more.

Template for End Semester examination in Semester IV for the Core course in Animal Behaviour

UNITS	REMEMBERING	UNDERSTANDING	APPLICATION and ANALYSES	TOTAL MARKS Per unit
1	8	6	6	20
2	10	6	4	20
3	10	6	4	20
TOTAL	28	18	14	60
% WEIGHTAGE	46.7	30	23.3	100

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PARASITOLOGYCredits 4: **Theory 3 = 45 hrs and Practical 1 = 30 hrs**Prerequisite: **The student should have done two core courses in Zoology in Semesters I and II****Course Objectives:**

1. To help students gain an in depth understanding of some disease-causing protozoan, helminth parasites.
2. Students should be able to understand the molecular aspect of certain parasites.

Course Outcomes:

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

CO	Course Outcomes	Bloom's Taxonomy Level
1	Students can understand the molecular aspect of certain parasites.	Understanding
2	Students will be able to diagnose the causative agents, vectors, describe pathogenesis, treatment and prophylaxis for the parasites studied.	Applying
3	Know the Molecular mechanisms that are at play in host parasite infections	Remembering
4	Students will be able to analyse at a molecular level how vectors and hosts are compatible for an infection	Analysing

UNIT 1

(15 lectures)

INTRODUCTION TO PARASITOLOGY AND PROTOZOAN PARASITES

- Parasites (Ectoparasites, Endoparasites, Digenetic, temporary, Permanent, Facultative)
- Hosts (Definitive, Intermediate, paratenic, reservoir)
- Morphology , mode of infection, life cycle, pathogenicity, prophylaxis and treatment of Protozoan parasites
- Protozoan parasites – *Entamoeba histolytica*, *Leishmania donovani*, *Plasmodium vivax*, *Giardia intestinalis*.

UNIT 2

(15 lectures)

HELMINTH PARASITES

- Morphology , mode of infection, life cycle, pathogenicity, prophylaxis and treatment of Helminth parasites
- Helminth Parasites – *Taenia solium*, *Fasciola hepatica*, *Wuchereria bancrofti*, *Ascaris lumbricoides*

UNIT 3

(15 lectures)

MOLECLAR PARASITOLOGY

- Host-parasite interactions.
 - Molecular Mechanisms that are at play in host parasite interactions in Plasmodium, Trypanosoma, Entamoeba, Leishmania
 - Immune invasion strategies in Plasmodium and Leishmania.
 - Molecular interactions between parasites and their vectors: Plasmodium and Anopheles, Trypanosoma and Tse Tse fly, Leishmania and sandfly (phlebotomus)

List of Recommended Reference Books:

1. Symth, J. D. (1994). Introduction to Animal Parasitology. Cambridge University Press.
2. Chatterjee, K. D. (2019). Parasitology - Protozoology and Helminthology (13th ed). S.Chand Publications.
3. Heelan, J. S., Ingersoll, F. W. (2002). Essentials of Human Parasitology. Delmar Thomson Learning
4. Gillespie, S. H., & Hawkey, P. M (1995). Medical Parasitology - A Practical approach. Oxford Univ Press.
5. Farrar, J. (2023). Manson's Tropical Diseases. Elsevier Health Sciences

6. Elridge, B. F., & Edman, J. D. (2003). Medical Entomology: A Textbook on Public Health and Veterinary Problems Caused by Arthropods (revised edition). Kluwer academic publisher
7. Dhama, P.S., & Dhama, J.K. (2021). Invertebrate Zoology (5th ed.). R. Chand & Co
8. Burleigh, B. A., & Soldati-Favre, D (eds). (2008). Molecular Mechanisms of Parasite Invasion. Springer link
9. Soldati, D., Froth, B., & Cowman, A. (2004). Molecular and functional aspects of parasite invasion. Springer link

Practical Course:

1. Identification of Protozoan parasites – Entamoeba, Leishmania,, Plasmodium, Giardia
2. Identification of Helminth parasites – Taenia, Liverfluke, Ancylostoma, Wuchereria, Ascaris, Dracunculus
3. Parasitic adaptations – Taenia (scolex, proglottid), Trypanosoma, Entamoeba, Ascaris, Giardia
4. Mounting of mouthparts of mosquito/bed bug

Evaluation (Theory): Total marks per course - 100

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

CIA Exam – 40 marks

- CIA 1: Written Test – 20 marks
- CIA 2: Multiple choice questions - 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 marks

- End Semester Practical Examination (Identification and performance of experiments) and Journal – 50 marks

Template for End Semester examination in Semester IV for the Minor course in Parasitology.

UNITS	REMEMBERING	UNDERSTANDING	APPLICATION and ANALYSES	TOTAL MARKS Per unit
1	7	8	5	20
2	7	8	5	20
3	7	8	5	20
TOTAL	21	24	15	60
% WEIGHTAGE	35	40	25	100



Syllabus

Fourth Semester Course in **Zoology**

2024 – 2025

Contents:

- Syllabus for Open Elective/s (OE):

USZOO5002OE1 – LIFE IN THE EXTREME


PRINCIPAL
ST. XAVIER'S COLLEGE
AUTONOMOUS
MUMBAI - 400 001.



APPROVED SYLLABUS

20 JAN 2024



LIFE IN THE EXTREMECredits: **Theory 2 (Total 30 hrs)**Prerequisite: **None****Course Objectives:**

1. To know different types of habitats present on the planet earth and in short outside. Understand various types of extreme habitats are such as those with extreme temperatures, extreme pressures, high salt concentrations, high acidic and alkaline, and arid environment. Some of these regions also have prolonged brightness or darkness.
2. To understand how animals manage to live in varieties of extreme habitats that are present on the planet earth - what kind of structural, functional and behavioural features the animals have evolved.
3. To know the application of such studies.

Course Outcomes:

CO	Course Outcomes	Bloom's Taxonomy Level
1.	know about the different types of habitats	Knowing
2.	understand how animals manage to live in habitats with extreme physical features.	Understanding
3.	Understand where such studies are applied	Understanding

UNIT 1

(15 lectures)

Animals in extreme pressure and chemical conditions

- Introduction to different types of habitats on earth
- Animals living in extreme high pressure conditions – oceanic trenches
- Animals living in high salt, high acidic and high alkaline conditions

UNIT 2

(15 lectures)

Animals in extreme temperature and dryness

- Animals living in extreme cold conditions – polar regions, high altitudes.
- Animals living in extreme hot conditions – hot deserts, hydrothermal vents
- Application of study of extremophiles – such as in early earth environment and extraterrestrial environments

List of Recommended Reference Books:

1. Wharton, D. A. (2007). Life at the Limits (Reissue edition). Cambridge University Press
2. Various educational documentaries

Evaluation (Theory): Total marks per course – 50

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

CIA - 20 marks

- 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 -22 to 23.

Template for the End Semester examination in Semester III for the Open Elective course in Life in the Extreme.

UNITS	REMEMBERING	UNDERSTANDING	TOTAL MARKS Per unit
1	8	7	15
2	7	8	15
TOTAL	15	15	30
% WEIGHTAGE	50	50	100



Syllabus

Fourth Semester Course in **Zoology**

2024 – 2025

Contents:

- Syllabus for Skill Enhancement Course (SE):
USZOO5001SE1 – PHILOSOPHY OF SCIENCE



PHILOSOPHY OF SCIENCECredits: **Theory 2 (Total 30 hrs)**Prerequisite: **None****Course Objectives:**

- To introduce the idea of philosophy and its relevance in science
- Introduce them to key concepts in philosophy that shape the scientific method and thus inquiry and inculcate critical thinking.

Course Outcomes:

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

CO	Course Outcomes	Bloom's Taxonomy Level
1	Know the historical development of scientific thought	Remembering
2	Understand logic and what is a valid and sound logical construction	Understanding
3	Be able to critically analyse data being presented and be able to pick out logical fallacies if any	Analysing
4	Be well versed with concepts like empiricism, epistemology and falsifiability	Understanding
5	Be able to contextualize philosophical issues in the study of organisms	Application

UNIT 1

(15 lectures)

➤ **Introduction to Philosophy of Science**

- What does it mean?
- Historical perspectives on Philosophy - Eastern and Western (Ancient, Medieval, Modern and Postmodern thought)

➤ **Logic**

- What is Logic?
- Constructing a logical argument - Structure of logical premises
- Validity and Soundness in logical arguments
- Deductive, Inductive and Abductive reasoning

➤ **Logical fallacies**

- What is a fallacy?
- Common logical fallacies - Strawman argument, non sequitur, correlation to causation inference, argument from personal incredulity and a few others

➤ **The Scientific Method**

- Overview and critique.
- Hypothesis testing and falsification principle.
- Do scientific principles give us the true picture of reality?

UNIT 2

(15 hours)

➤ **Some Philosophical thoughts**

- David Hume - Problem of induction
- Carl Popper - The concept of falsifiability of scientific hypothesis
- Thomas Kuhn - Structure of Scientific revolutions: why does science always keep changing?
- Nancy Cartwright - Scientific explanations and causal reasoning

➤ **Philosophy of Biology**

- Reductionism vs Holism
- Teleology in Biology - Pros and cons
- Scientific Epistemology
- Intelligent design vs Evolution

- Science, Technology, and Ethics: Examining the ethical implications of scientific advancements.
- Case Studies: Applying philosophical concepts to real-world scientific controversies - Mind Body problem, Anti vax movement.

List Of Recommended Reference Books:

1. Philosophy of Science: A Very Short Introduction. Samir Osaka
2. Indian Philosophy and Philosophy of Science. John N Crossley. University of Hawaii press
3. Stanford Encyclopedia of Philosophy. <https://plato.stanford.edu>
4. Theory and Reality: An Introduction to the Philosophy of Science. Peter Godfrey-Smith
5. Science and Social Knowledge. Helen Longino
6. Philosophy of Science Association. <https://www.philsci.org/>

Evaluation (Theory): Total marks per course - 50

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

- The course will have 2 assignments to be handed in by the students for 20 Marks.

II. Summative Assessment ‘of’ Learning

- A group discussion/debate on topics pertaining to philosophical issues in a specific scientific discipline worth 15 Marks.
- Final discussion and Viva with the Course instructor on philosophical concepts taught (mainly focusing on the assignments submitted) worth 15 marks.

Template for End Semester examination in Semester IV for the Skill Enhancement course in Philosophy of Science.

UNITS	REMEMBERING	UNDERSTANDING	APPLICATION and ANALYSES	TOTAL MARKS Per unit
1	12	7	6	25
2	10	6	9	25
TOTAL	22	13	15	50
% WEIGHTAGE	44	26	30	100

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