




Syllabus

Second Semester Courses in Zoology

2023-2024

Contents:

- Syllabus for Core Course (CR):
 - **USZOO4502CR1 - ANIMAL DIVERSITY**
- Syllabus for Vocational Course (VSC):
 - **USZOO4501VS1 – BIOTECHNIQUES**
- Evaluation and Assessment guidelines


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APPROVED SYLLABUS


08 APR 2023

F.Y. B.Sc. ZOOLOGY

Course Title: Animal Diversity

Course Code: USZOO4502CR1

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

Prerequisite: None

(Conditions for completion of the course: Two out of three prescribed field trips are mandatory)

Course Objectives:

1. Diversity in animals ranges from diversity in their distribution on the planet to the variety in their structure and function right down to the molecular level. Evolution has shaped the patterns in this diversity at all these levels. In the current course we introduce the students to classification and zoogeography, two ways one can look at the patterns in animal diversity.
2. To introduce students to classification of animals by giving a brief idea of the need for classification, history of classification and logic for classification i.e. evolutionary history.
3. To make students know characteristics of the different invertebrates and vertebrates from the animal kingdom and how to use classification keys.
4. To get the students familiarized with the patterns in diversity of animals on the planet i.e zoogeography.

Course Outcomes:

CO	On completion of the course the learner should be able to:	Bloom's Taxonomy Level
1.	Identify and classify various animal specimens in their respective phyla and other taxonomic classes based on morphological characteristics.	Remembering
2.	Understand the connection between classification and evolution.	Understanding
3.	Develop an understanding of zoogeography (the patterns of diversity of animals on the planet) and its applications.	Applying

UNIT 1: Introduction of patterns in animal diversity

(15 lectures)

- Levels of diversity and branches of biology that study these levels
- Zoogeography:
 - Zoogeographical realms, laws of distribution, factors inducing expansion, dispersal, migration and repression.
 - Faunal distribution types (continuous, disjunct, endemic) and abiotic and biotic factors affecting them.
 - Change in landmasses on the planet over time and its effect on zoogeography: theory of land bridges (include Palk strait), mass extinction and re-establishment of biodiversity.
 - Applications of zoogeography: Applications in species reintroduction, ecology and conservation (introduce them to conservation status), understanding lessepsian migration.
- Introduction to classification - History of animal classification, use of knowledge of classification, different types of classification systems, Current trends in classification (including Molecular Phylogeny)

UNIT 2: Invertebrate Classification

(15 lectures)

- Salient features of the different Phyla: (with example of one animal each based on teacher's discretion)
 - Phylum Protozoa
 - Phylum Porifera
 - Phylum Coelenterata / Cnidaria
 - Phylum Platyhelminthes
 - Phylum Nematoda
 - Phylum Annelida
 - Phylum Arthropoda
 - Phylum Mollusca
 - Phylum Echinodermata

UNIT 3: Vertebrate Classification

(15 lectures)

Salient features of vertebrates:

- Phylum Hemichordata
- Phylum Chordata
 - Subphylum Urochordata
 - Subphylum Cephalochordata
 - Subphylum Vertebrata
- ❖ Superclass: Agnatha
 - Class Cyclostomata
- ❖ Superclass: Gnathostomata
 - Class Pisces
 - Class Amphibia
 - Class Reptilia
 - Class Aves
 - Class Mammalia – Prototheria, Metatheria, Eutheria and Marine Mammals

Recommended References:

1. Mader, S. and Windelspecht, M. (2021). Biology (14th ed.). McGraw Hill.
2. Kotpal, R.L. (2020). Modern Textbook of Zoology: Vertebrates (4th ed.). Rastogi Publications
3. Cox, C.B., Ladle, R.J. and Moore, P.D. (2020). Biogeography: An Ecological and Evolutionary approach (10th ed.). John Wiley and Sons Ltd.
4. Urry, L., Cain, M., Wasserman, S., Minorsky, P. and Reece, J. (2017). Campbell Biology (11th ed). Pearson Publication
5. Darlington, P.J. (2017). Zoogeography: The geographical distribution of animals. Academic Publishers.
6. Jordan, E.L. and Verma, P.S. (2013). Chordate Zoology (14th ed.). S. Chand and Company Ltd.
7. Miller, J. and Levine, J. (2010). Miller and Levine Biology. Pearson Prentice Hall
8. Jordan, E.L. and Verma, P.S. (2009). Invertebrate Zoology (15th ed.). S. Chand and Company Ltd.
9. Dhama, J.K. and Dhama, P.S. (1979). Invertebrate Zoology. R. Chand & Company.
10. Kotpal, R.L. (2020). Modern Textbook of Zoology: Invertebrates (12th ed.). Rastogi Publications.
11. Dhama, J.K. and Dhama, P.S. (1979). Chordate Zoology
12. Huxley, J. (1974). The Atlas of World Wildlife. Mitchell Beazley Publishers Limited.

Practical Course:

1. Study of distinctive fauna of the zoogeographical realm.
2. Study of change in land masses over time.
3. Study of chronostratigraphic charts.
4. **Invertebrate classification (using a simple identification key)**

Protozoa:	Amoeba, Euglena, Paramecium,
Porifera:	Leucosolenia, bath sponge, hyalonema (glass rope sponge)
Coelenterata:	Hydra, Obelia colony, Aurelia, Funaria
Platyhelminthes:	Planaria, Liver fluke, Tapeworm
Nematoda:	Ascaris (male and female)
Annelida:	Earthworm, Leech, Nereis
Arthropoda:	Crab, lobster, Lepisma, beetle, dragonfly, butterfly, spider, centipede, millipede
Mollusca:	Chiton, Dentalium, Pila, bivalve, Sepia, Nautilus
Echinodermata:	Starfish, brittle star, sea urchin, sea cucumber, feather star

5. Mounting of Setae of earthworm and spicules from Sponge
6. Study of types of shells and foot in Mollusca
7. Identification of foraminifera shells

8. **Vertebrate classification: (using a simple identification key)**

Hemichordata:	Balanoglossus
Urochordata:	Ascidia, Herdmania
Cephalochordata:	Amphioxus
Cyclostomata:	Petromyzon, Myxine
Pisces:	Chondrichthyes – Shark, electric ray Osteichthyes – Flying fish, Puffer fish and Sea horse
Amphibia:	Frog, toad, Caecilian, salamander, Siren
Reptilia:	Chameleon, Calotes/Gecko, turtle, tortoise, snake, crocodile, Phrynosoma
Aves:	Kite, duck, Owl
Mammalia:	Hedgehog, Bat, Guinea pig and Marine Mammals (Dugong, Blue Whale, Dolphin)

Field Trip: Students attend two out of three field trips:

- One of the two Sea shore walks: two shore walks of different habitats will be conducted, and the students must attend AT LEAST one of the two and submit a field report.
- One walk for terrestrial animals in parks/zoos/wildlife sanctuaries/ in and around Mumbai: this is a COMPULSORY field trip and students submit a field report.

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 / Short Answers / Assignments / 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 or more.

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

- End Semester Practical Examination (Identification, performance of experiments), submission of field reports / additional identification or experiment and submission of certified Journal – 50 marks.

Template for the Core course End Semester examination in Semester II for the Core course in Animal Diversity

UNITS	REMEMBERING	UNDERSTANDING	APPLYING	TOTAL MARKS Per unit
1	10	6	4	20
2	12	6	2	20
3	12	6	2	20
TOTAL	34	18	8	60
% WEIGHTAGE	56.7	30	13.3	100%

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F.Y.B.Sc. ZOOLOGY

Course Title: Biotechniques**Course Code: USZOO4501VS1**Credits 3: **Theory (1) = Total 15 hr and Practical (1) = Total 30 hr**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 (BT 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 1: 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.




Syllabus

Second 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


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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

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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.

