

Govt. College For Women Parade Ground Jammu
An Autonomous College
NAAC Accredited “A” Grade



B.Sc Semester-I

Course No. UZOTC-101
CREDITS: 4

Course Title: **ANIMAL DIVERSITY**

**Learning Outcome-Based Curriculum Framework (LOCF) Syllabus for the Examination to be held in
December, 2020; December, 2021 and December, 2022
UNDER CHOICE BASED CREDIT SYSTEM**

Course Learning Objective:

Zoology is the scientific study of animal life. Animals are the most diverse creatures on this planet. This course gives a framework for understanding the diversity within different groups, and interrelationship among different species and genera within each group. The aim of this course is to understand the importance of animal kingdom in context to hierarchy, body plan and their role in ecological development. This course provides an overview of the invertebrate and vertebrate animals, including sponges, cnidarians, flatworms, nematodes, annelids, molluscs, arthropods, echinoderms, invertebrate chordates, fishes, amphibians, reptiles, birds, and mammals. This paper comprises of 15 units. First nine units provide knowledge of coelom formation, different level of organization, different modes of living, evolutionary changes of Non-chordates and their salient features. Whereas, remaining units will impart knowledge on different classes of chordates. After completion of this course, the learners will have a framework for understanding all of the different types of animals, and the characteristics of each.

Course Learning Outcome:

Upon completion of the course, students will be able to:

- Distinguish between major phyla of animals through a demonstrated understanding of their taxonomic classification and diversity.
- Describe the distinguishing characteristics of all major phyla.
- Understand the fundamental differences among animal body plans and relate them to function, taxonomic classification, and evolutionary relationships among phyla.
- Illustrate lifecycles, structure, function and reasons for importance of few representative organisms from different groups of animals.
- Identify anatomical structures from prepared tissues.
- Observe living animals in the environment and relate observations to theory from the course.
- Recognize major animal phyla and animals on the basis of their external characteristics.

1. Course /Paper Title	:	Animal Diversity (Theory)
2. Maximum Marks	:	100
i) External (Univ. Exam.)	:	80
ii) Internal Assessment	:	20
4. Minimum Pass Marks	:	
i) External	:	29
ii) Internal	:	07
5. Duration of Univ. Exam.	:	3 Hrs.

Unit 1:**Protista, Porifera and Cnidaria****13 Hrs**

- 1.1 Introduction to kingdoms of organisms (Five kingdom system -a brief overview viz. Monera, Protista, Fungi, Plantae & Animalia).
- 1.2 Protista
 - 1.2.1 General characters and classification up to class level
 - 1.2.2 Locomotory Organelles and locomotion in Protozoa
- 1.3 Porifera
 - 1.3.1 General characters and classification up to class level.
 - 1.3.2 Canal System in Sponges
- 1.4 Cnidaria
 - 1.4.1 General characters and classification up to class level.
 - 1.4.2 Polymorphism in Cnidaria: Hydrozoa, Siphonophora
 - 1.4.3 Corals & Coral reefs

Unit 2:**Helminthes and Annelida****13 Hrs**

- 2.1 Helminthes
 - 2.1.1 Platyhelminthes
 - 2.1.1.1 General characters and classification up to class level.
 - 2.1.1.2 Structure, reproduction, life cycle and pathogenesis of *Taeniasolium*
 - 2.1.2 Nematelminthes
 - 2.1.2.1 General characters and classification up to class level.
 - 2.1.2.2 Structure, reproduction, life cycle, parasitic adaptations and pathogenesis of *Ancylostomaduodenales*
- 2.2 Annelida
 - 2.2.1 General characters and classification up to class level.
 - 2.2.2 Metamerism in Annelida

Unit 3: Arthropoda, Mollusca and Echinodermata

- 3.1 Arthropoda
 - 3.1.1 General characters and classification up to class level.
 - 3.1.2 Eye structure and Vision in Arthropoda
 - 3.1.3 Metamorphosis in Insects
- 3.2 Mollusca
 - 3.2.1 General characters and classification up to class level.
 - 3.2.2 Torsion in gastropods
 - 3.2.3 Shell in mollusca
- 3.3 Echinodermata
 - 3.3.1 General characters and classification up to class level.
 - 3.3.2 Water-vascular system in Asteroidea
 - 3.3.3 Trochophore larval: Structure and Significance

Unit 4: Protochordates, Agnatha, Pisces and Ambhibia **13 Hrs**

- 4.1 Origin of Chordates
- 4.2 Protochordates: General features and Phylogeny.
- 4.3 Agnatha
 - 4.3.1 General features of Agnatha and classification of cyclostomes up to class level.
- 4.4 Pisces
 - 4.4.1 General features and Classification up to order level.
 - 4.4.2 Osmoregulation in Fishes
- 4.5 Amphibia
 - 4.5.1 General features and Classification up to order level.
 - 4.5.2 Parental care in Amphibians

Unit 5: Reptiles, Aves and Mammals **13 Hrs**

- 5.1 Reptiles
 - 5.1.1 General features and Classification up to order level.
 - 5.1.2 Poisonous and non-poisonous snakes.
 - 5.1.3 Biting mechanism in snakes
- 5.2 Aves
 - 5.2.1 General features and Classification up to order level.
 - 5.2.2 Flight adaptations in birds
- 5.3 Mammals
 - 5.3.1 Classification up to order level.
 - 5.3.2 Origin of mammals

Note: 1 There shall be one written theory paper of 100 marks and one practical paper of 100 marks. 20% (20 marks) of the marks shall be reserved for internal assessment in theory paper and 50 % (50 marks) in the practical paper. Theory paper will be set for 80 marks and the practical paper for 50 (40 marks for paper and 10 for viva - voce). Daily evaluation of practical records/viva voce/attendance etc. will be of 50 marks (including 20% (10 marks) for attendance, 20% (10 marks) for viva voce and 60% for the internal test and day to day performance (15 marks each) In case of the regular students internal assessment received from the college will be added to the marks obtained by them in the university examination and in case of private candidates marks obtained by them in the University examination shall be increased proportionately in accordance with the statues / regulation.

Internal Assessment Test

One long answer type question of 10 marks and five short answer type questions of 2 marks each

Note 2: For paper setters:

External End Semester University Exam

Section A: 10 very short answer type questions are to be set. The maximum length of answer shall be 50 words. All the questions are compulsory. Each question will carry 2 marks, total weightage being 20 marks.

Section B: This section will comprise of ten long answer type questions, with two questions from each unit. Candidate will have to attempt 5 questions selecting one question from each unit. Each question will, carry 12 marks and the total weightage being 60 marks.

Teaching and Learning Process:

Teaching-Learning process will include delivery of lectures using boards, Multimedia presentation, short documentaries on animal diversity, imparting practical based knowledge through specimens, live demonstration of diversity in surroundings.

Assessment Methods:

Assessment methods are:

- Course examination
- Multiple choice questions quiz at the end of each lecture
- Case studies
- Oral presentation by students
- Report or essay writing
- Project based to assess the skills of scientific enquiry and problem-solving

Online Tools and Web Resources:

- <http://vle.du.ac.in>
- Animal Diversity Web (ADW); an online database of animal natural history, distribution, classification, and conservation biology. Web resource <https://animaldiversity.org/>
- Online Zoo; <https://www.activewild.com/online-zoo/>

Books Recommended

1. Text book of Zoology-Hymen series McGraw Hills.
2. Protozoology-Kudo, Books & Periodicals Corporation (India).
3. Text-book of Zoology-Sedwick series. Central Book Depot.
4. Text-book of Zoology-Parker and Haswell Vol. I. Mac Millan & Co. 1986, New York.
5. Protozoology-Mackinen and Hawez, Canb University.
6. Treatise in Zoology-Lankester series.
7. Parasitic protozoa-Baker. Allen & Unwin, Inc. USA.
8. Human Helminthology-Faust, E.C, Lee and Febiger, Philadelphia.
9. Medical Parasitology- K. D. Charterjee
10. Helminthology- Kotpal
11. Arthropod Anatomy-Snod,Grass. Principles of insect morphology (1935) Snodgrass, R.E. McGraw Hill London, New York.
12. Invertebrale-Bordale and Potts. C.L.
13. Integrated principles of Zoology by Hickman, C.P. Jr., F.M. Hickman &L.S. Roberts. (Mosby College Publ. St. Louis.).
14. Manual of Zoology Vol. I (invertibrata) part I and II. Ayyar, E.K. &T.N. Ananlha-Krishnan (S. Vishwanathan, Printers & Publ. Pvt. Ltd. Madras).
15. Invertebrate Zoology-Jordan,E.L. & P.S. Vemla (S. Chand & Co. Ltd. Madras).
16. Chordate Zoology- N. Arumugam, Vol. 2. SarasPublication
17. Chordate Zoology-E.L.Jordan& P.S. Verma. S. Chand Limited
18. Chordate zoology- P.S. Dhami&J.K. Dhami (1981) (R. Chand & Co.)
19. Principles of anatomy and physiology-G.J.Tortora&N.P. Anagnostakos (1984) (Harper & Row Publ., N.Y.).
20. Textbook of zoology, Vertebrates-A.J. Marshall (1995) (The McMillan Press Ltd., UK).
21. Modern textbook of Zoology (Vertebrates) -R.L.Kotpal (2000). (Rastogi Publ., Meerut).
22. Functional Anatomy of the Vertebrates: An Evolutionary Perspective- Liem, Karel F., William E. Bemis, Warren F. Walker, Lance Grande (2001). Brooks Cole.
23. Advanced Chordate Zoology-Gurdarshan Singh & H. Bhaskar (2002). Campus Books.

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B.SC. SEMESTER-I

(PRACTICAL)

Core Course No. : **UZOPC 101**

Core Course Title: **ANIMAL DIVERSITY**

CREDITS: **2**

1. Study of external features of the following:

- 1.1 *Nereis*: External features with special emphasis on Head & Parapodia and Heteronereis phase.
- 1.2 Prawn: External morphology & Appendages
- 1.3 Cockroach: Mouthparts
- 1.4 *Pila*, *Unio*: External morphology of Shell.
- 1.5 Amphioxus: With special reference to oral hood, Velum, branchial wall, section through various regions.

2. Distinguishing characters & classifications of the following animals:

- 2.1 *Euglena*, *Plasmodium*, *Paramecium*
- 2.2 *Sycon*, *Hyalonema*, and *Euplectella*.
- 2.3 *Hydra*, *Obelia*, *Millipora*, *Sertularia*, *Physalia*, *Verella*, *Porpita*, *Aurelia*, *Tubipora*, *Metridium*.
- 2.4 *Planaria*, *Fasciola*, *Echinococcus*, *Taeniasolium*, *Ascarislumbricoides*, *Ancylostoma*, *Enetrobius*
- 2.5 *Aphrodite*, *Tubicola*, *Chaetopterus*, *Serpula*, *Arenicola*, *Pheretima*, *Pontobdella*,
- 2.6 *Balanus*, *Lepas*, *Cray fish*, *Palaemon*, *Cancer*, *Limulus*, *Palamnaeus*, *Scolopendra*, *Julus*, *Periplaneta*, *Apis*.
- 2.7 *Chiton*, *Mytilus*, *Dentalium*, *Pila*, *Unio*, *Loligo*, *Sepia*, *Octopus*
- 2.8 *Pentaceros*, *Ophiura*, *Echinus*, *Cucumaria* and *Antedon*
- 2.9 *Balanoglossus*, *Herdmania*, *Branchiostoma*
- 2.10 *Petromyzon*, *Myxine*, *Sphyrna*, *Pristis*, *Torpedo*, *Chimera*, *Protopterus*, *Amia*, *Salmo*, *Labeo*, *Exocoetus*, *Anguilla*, *Barbus*, *Cyprinus*, *Clarias*, *Heteropneustes*, *Ophiocephalus*, *Anabas*, *Echineis*
- 2.11 *Ichthyophis/Ureotyphlus*, *Salamandra*, *Axolotl larva*, *Bufo*, *Hyla*
- 2.12 *Chelone*, *Trionyx*, *Kachuga*, *Testudo*, *Sphenondon*, *Hemidactylus*, *Chamaeleon*, *Draco*, *Calotes*, *Typhlops*, *Python*, *Bungarus*, *Vipera*, *Naja*, *Crocodylus*, *Hydrophis*, *Gavialis*,
- 2.13 Any six common birds from different orders,
- 2.14 *Echidna*, *Macrophus*, *Manis*, *Sorex*, Bat, *Funambulus*, *Loris*

3. Dissection of the following animals to expose and study the various systems:

- 3.1 Earthworm: Alimentary canal, Reproductive system
- 3.2 *Palaemon*: Alimentary canal, Nervous system

4. Preparation of permanent stained mounts of the following

Obelia, Parapodium of *Neries*, Nephridium of Earth worm, Ovary of Earthworm, Mouthparts of Cockroach, mouth parts of mosquito and radula of *Pila*.

5. Key for Identification of poisonous and non-poisonous snakes

6. An “**animal album**” containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.

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B.Sc Semester-II

Course No. UZOTC-201

Course Title: **COMPARATIVE ANATOMY AND
DEVELOPMENTAL BIOLOGY OF VERTEBRATES**

CREDITS: 4

**Learning Outcome-Based Curriculum Framework (LOCF) Syllabus for the Examination to
be held in December, 2020; December, 2021 and December, 2022**

Course Learning Objective:

This course aims to provide the undergraduate students a thorough knowledge of structural details and comparative account of the different organ systems of the body from lower to higher vertebrates, and protochordates, thus enabling them to appreciate the incredible vertebrate diversity. The course furnishes an understanding of evolutionary basis of morphological and anatomical differences as well as similarities that occur among vertebrates. It helps students propose possible homology between structures, and understand how they evolved as the vertebrates dwelled different habitats. The structural modifications of digestive, circulatory, respiratory and skeletal system relates to the distribution of animals in their different comfort zones of habitat and ecological niches. The understanding of anatomical details of organ systems of mammals like rat and mice aims to give the basic information for their use in experimental and research studies in different branches of Zoology like Immunology, Medical Zoology and Reproductive Biology etc.

Course Learning Outcome:

Upon completion of the course, students should be able to:

- Explain comparative account of the different vertebrate systems
- Understand the pattern of vertebrate evolution, organisation and functions of various systems.
- Learn the comparative account of integument, skeletal components, their functions and modifications in different vertebrates.
- Understand the evolution of heart, modification in aortic arches, structure of respiratory organs used in aquatic, terrestrial and aerial vertebrates; and digestive system and its anatomical specializations with respect to different diets and feeding habits.
- Learn the evolution of brain, sense organs and excretory organs to a complex, highly evolved form in mammals;
- Learn to analyze and critically evaluate the structure and functions of vertebrate systems, which helps them to discern the developmental, functional and evolutionary history of vertebrate species.
- Understand the importance of comparative vertebrate anatomy to discriminate human biology.

UNDER CHOICE BASED CREDIT SYSTEM

1. Course /Paper Title	:	Comparative anatomy and Developmental Biology of Vertebrates (Theory)
2. Maximum Marks	:	100
i) External (Univ. Exam.)	:	80
ii) Internal Assessment	:	20
4. Minimum Pass Marks	:	
i) External	:	29
ii) Internal	:	07
5. Duration of Univ. Exam.	:	3 Hrs.

Unit 1:

Integumentary Skeletal System

13 Hrs

1.1 Integument System

1.1.1 Integument: Structure and Function

1.1.2 Derivatives of integument:

1.1.2.1 Glands

1.1.2.2 Scales and Scutes

1.1.2.3 Digital Cornifications

1.1.2.4 Horns

1.1.2.5 Feathers

1.1.3 Comparative account of Integument in different classes of chordates

1.2 Skeletal System

1.2.1 Evolution of visceral arches

1.2.2 Jaw suspension in vertebrates.

Unit 2: Digestive and Respiratory System

13 Hrs

2.1 Digestive System

2.1.1 Comparative account of alimentary canal and digestive glands in vertebrates.

2.2 Respiratory System

2.2.1 Brief account of Gills, lungs in Vertebrates

2.2.2 Accessory Respiratory Organs in Vertebrates

2.2.2.1 Swim Bladder

2.2.2.2 Air Sacs

Unit 3: Circulatory and Urinogenital System

13 Hrs

3.1 Circulatory System

3.1.1 Evolution of heart in vertebrates

3.1.2 Evolution and modifications of aortic arches in vertebrates

3.1.3 Venous system in vertebrates and its significance

3.2 Urinogenital System

3.2.1 Origin and types of Vertebrate Kidney

3.2.2 Evolution of Urinogenital ducts in vertebrates

Unit 4: Nervous System and Sense Organs

13 Hrs

4.1 Comparative account of vertebrate brain

4.2 Classification of Sensory Receptors

4.3 Photoreception in Vertebrates

Unit 5: Development Biology**13 Hrs**

- 5.1 Gametogenesis: Spermatogenesis and oogenesis in mammals.
- 5.2 Fertilization
 - 5.2.1 Types of fertilization: External & Internal
 - 5.2.2 Capacitation, Acrosome Reaction, Penetration and Activation of Ovum, Migration of Pronuclei and amphimixis.
- 5.3 Cleavage: Planes and patterns, Blastulation and fate maps in Frog
- 5.4 Gastrulation in Frog up to formation of three germ layers, types of morphogenetic movements
- 5.5 Extraembryonic membranes of chick
- 5.6 Placentation in mammals
- 5.7 Metamorphic events in frog life cycle and its hormonal regulation.

Note: 1 There shall be one written theory paper of 100 marks and one practical paper of 100 marks. 20% (20 marks) of the marks shall be reserved for internal assessment in theory paper and 50 % (50 marks) in the practical paper. Theory paper will be set for 80 marks and the practical paper for 50 (40 marks for paper and 10 for viva-voce). Daily evaluation of practical records/viva voce/attendance etc. will be of 50 marks (including 20% (10 marks) for attendance, 20% (10 marks) for viva voce and 60% for the internal test and day to day performance (15 marks each) In case of the regular students internal assessment received from the college will be added to the marks obtained by them in the university examination and in case of private candidates marks obtained by them in the University examination shall be increased proportionately in accordance with the statutes / regulation.

Internal Assessment Test

One long answer type question of 10 marks and five short answer type questions of 2 marks each

Note 2: For paper setters:**External End Semester University Exam**

Section A: 10 very short answer type questions are to be set. The maximum length of answer shall be 50 words. All the questions are compulsory. Each question will carry 2 marks, total weightage being 20 marks.

Section B: This section will comprise of ten long answer type questions, with two questions from each unit. Candidate will have to attempt 5 questions selecting one question from each unit. Each question will, carry 12 marks and the total weightage being 60 marks.

Teaching and Learning Process:

In order to ensure best understanding of concepts and learning of skills by students, various strategies will be adopted to explore and compare the major vertebrate groups. Class room lectures and crossover learning will provide a conceptual foundation to the learner and will bridge the informal learning to formal learning. Use of models and computer-assisted learning by showing photographs/diagrams/models/animations/videos will help to clarify theoretical as well as practical concepts, from referred textbooks and E-resources available in NCBI, SWAYAM etc. Project work will encourage students to undertake projects on certain topics like modifications in GI tract, appendages, respiratory organs etc. with respect to different habitats. Peer teaching including presentation and group discussions on various topics of

vertebrate comparative anatomy will allow effective participation of students in class room and develop confidence in students. Computer-aided methods by showing virtual dissections or videos of anatomy of circulatory, digestive and reproductive systems of frog and rat, will provide an understanding of animal systems. Viewing documentary films or visiting biodiversity parks, aquarium, sanctuaries and zoological parks will help students correlate the anatomical changes in the vertebrates studied in the classroom with actual observation in living animals. Assignments will improve the writing and abstracting skills of students.

Assessment Methods:

- Formative assessment on regular basis: This includes putting up questions in order to monitor students' learning. Students are marked on the basis of continuous assessment and end term exam.
- Continuous assessment: includes class test, assignment and attendance.
- Marks for the attendance: to maintain regularity in the class.
- Practical: provide a great opportunity to assess students for their understanding about a concept lectured, and demonstrate activity in small groups. Additionally, regular assessment of the practical skills gained by students can also be done.
- Summative assessment: includes project reports, assignments, oral presentations, *viva-voce*, evaluation of practical records, regular tests.

Books recommended:

1. Text book of zoology – Parker and Haswell Vol. II
2. Chordate Zoology and Elements of Animal Physiology –E.L. Jordan and Verma, P.S.
3. Zoology and Chordates by H.C. Nigam, Vishal Publications, Jalandhar
4. Comparative Anatomy- M.D.L. Srivastava
5. Comparative Anatomy – Kingley
6. Manual of Zoology Vol II Chordata – Ayyar, E.K., T.N. Anorthakrishnan
7. Chordate structure and function – Waterman, A.N. and Others
8. General and Comparative Physiology – W.S. Hoar
9. Principles of Animal Physiology – Wood, D.W.
10. Animal physiology –Eckert
11. An Introduction to Embryology –Balinsky
12. Biology of Developing System – Grant
13. Developmental Biology – Gilbert.
14. Animal Physiology-Nagabhushnam
15. Chordate Zoology- N. Arumugam, Vol. 2. SarasPublication
16. Chordate Zoology-E.L.Jordan& P.S. Verma. S. Chand Limited
17. Chordate zoology- P.S. Dhama&J.K. Dhama (1981) (R. Chand & Co.)
18. Principles of anatomy and physiology-G.J.Tortora&N.P. Anagnostakos (1984) (Harper & Row Publ., N.Y.).
19. Textbook of zoology, Vertebrates-A.J. Marshall (1995) (The McMillan Press Ltd., UK).
20. Modern textbook of Zoology (Vertebrates) -R.L.Kotpal (2000). (Rastogi Publ., Meerut).
21. Functional Anatomy of the Vertebrates: An Evolutionary Perspective- Liem, Karel F., William E. Bemis, Warren F. Walker, Lance Grande (2001). Brooks Cole.
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B.SC. SEMESTER-II

Core Course No. : UZOPC 201 (PRACTICAL)
Core Course Title: COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES
CREDITS : 2

1. Preparation of permanent mounts of the following:
 - 1.1 Velum, Oral hood and Pharyngeal region of Amphioxus
 - 1.2 Ampullae of Lorenzini, Placoid scale, Ctenoid scale of fish, stripped muscles of frog from pectoral girdle or thigh
2. Study of following skeleton:
 - 2.1 Skull of Fowl and Rabbit
 - 2.2 Axial and Appendicular skeleton of Fowl and Rabbit
 - 2.3 Carapace and plastron of turtle /tortoise
3. Frog - Study of developmental stages - whole mounts and sections through permanent slides – cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages.
4. Study of chick embryology through stained mounts (18 Hrs.; 24 Hrs.; 36 Hrs.; 48 Hrs.; 72 Hrs.)
5. Demonstration of different types of Placenta in mammals through models or preserved specimens.
6. Study of histological sections of mammalian placenta through permanent slides or photomicrographs.
7. Examination of gametes - frog/rat - sperm and ova through permanent slides or photomicrographs.
8. Study of types of feet and claws, feathers and beaks in birds.
10. Dissect a locally available fish to study the following systems:
 - 10.1 Digestive system
 - 10.2 Nervous System
 - 10.3 Taking out Pituitary and Weberian ossicles

