



University of Kerala

Discipline	ZOOLOGY				
Course Code	UK4DSCZOO203				
Course Title	Comparative Anatomy of Vertebrates				
Type of Course	DSC				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pre-requisites	Pass in Class XII				
Course Summary	<p>This course explores the Comparative Anatomy of Vertebrates, focusing on the study of anatomical structures across vertebrate species to understand evolutionary relationships and functional diversity. Beginning with the significance of Comparative Anatomy in biological sciences, it delves into basic principles of vertebrate morphology and its relevance to evolutionary and phylogenetic studies. The course covers the evolution, diversity and comparative anatomy of the skeletal, circulatory, respiratory, digestive and nervous systems across vertebrates. Overall, this course offers a comprehensive understanding of vertebrate anatomy, integrating evolutionary perspectives with functional morphology to explore the unity, diversity, and adaptability of vertebrate life forms.</p>				

Detailed Syllabus

Module	Unit	Content	60 hrs
		Comparative Anatomy of Vertebrates	8
I	1.1	Comparative Anatomy among Vertebrates – What is it and Why should we study it?	1
	1.2	Importance and Applications of Comparative Anatomy in Biological Sciences (Brief note)	1

	1.3	Evolutionary Perspective in Comparative Anatomy [Brief note]	2
	1.4	Comparative Anatomy and Phylogenetic Relationships [Brief note]	2
	1.5	Basic Principles of Vertebrate Morphology	2
		Related activity: <i>Group Discussion on – Can Evolutionary perspective be drawn out from studying comparative anatomy?</i>	
II	Skeletal System		13
	2.1	Evolution and Diversity of Vertebrate Skeletons	2
	2.2	Axial Skeleton: Skull, Vertebral Column, and Ribs	3
	2.3	Appendicular Skeleton: Limbs and Girdles	2
	2.4	Comparative Analysis of Bone Structure and Function	4
	2.5	Adaptations of the Skeletal System in Different Vertebrate Groups	2
		Related activities: 1. <i>Collection/ Identification of major Vertebrate bones explained in theory class</i> 2. <i>Working with online virtual dissection tools.</i>	
III	Muscular System		14
	3.1	Evolution and Diversity of Vertebrate Muscles	2
	3.2	Comparative Anatomy of Skeletal, Smooth, and Cardiac Muscles	5
	3.3	Functional Morphology of Muscles in Movement and Locomotion	3
	3.4	Adaptations of Muscular Systems in Different Vertebrate Groups	2
	3.5	Muscle Mechanics and Biomechanics in Vertebrate Locomotion	2
		Related activities: 1. <i>Group discussion on topic – Why are there no Flying Elephants?</i> 2. <i>Debate on topic – Humans with tail! Good or Bad?</i>	
IV	Circulatory and Respiratory Systems		13
	4.1	Evolution and Diversity of Vertebrate Circulatory Systems	2
	4.2	Comparative Anatomy of Heart and Blood Vessels	3
	4.3	Circulatory Adaptations in Different Vertebrate Groups	2
	4.4	Evolution and Diversity of Vertebrate Respiratory Systems	2

	4.5	Comparative Anatomy of Lungs, Gills, and Skin Respiration	4
		Related activities: 1. Quiz on Comparative Anatomy of Vertebrate Circulatory and Respiratory Systems 2. Group Discussion – Crocodile with four chambered heart – Can this be considered as evolutionary transition between Reptiles and Birds? 3. Debate – Archaeopteryx – A myth or fact?	
V	Digestive and Nervous Systems		12
	5.1	Evolution and Diversity of Vertebrate Digestive Systems	2
	5.2	Comparative Anatomy of Mouth, Stomach, Intestines, and Accessory Organs	3
	5.3	Adaptations of Digestive Systems in Different Vertebrate Groups	2
	5.4	Evolution and Diversity of Vertebrate Nervous Systems	2
	5.5	Comparative Anatomy of Brain, Spinal Cord, and Peripheral Nerves	3
		Related activity: Group Discussion – Is the nervous system the most important system which makes humans the most advanced among vertebrates?	

References

1. Kardong, K.V. (2019). Vertebrates: Comparative Anatomy, Function, Evolution (8th Ed.). McGraw-Hill Education.
2. Romer, A.S., and T.S. Parsons. (1985). The Vertebrate Body. Saunders College Publishing.
3. Pough, F. H., Bemis, W., McGuire, B. and Janis, C. (2022). Vertebrate Life (11th Ed.). Oxford University Press. DOI: 10.1093/hesc/9780197558621.001.0001
4. Karel, F. Liem and Warren, F. Walker (2001). Functional Anatomy of the Vertebrates: An Evolutionary Perspective. Harcourt College Publishers, Fort Worth. https://archive.org/details/functionalanatom0000unse_j8q8
5. George C. Kent and Robert Carr (2001) Comparative Anatomy of Vertebrates (9th Ed.). McGraw Hill Publications, New York.
6. Brian K. Hall (2015). Bones and Cartilage: Developmental and Evolutionary Skeletal Biology (2nd Ed.). Elsevier Academic Press. <https://doi.org/10.1016/C2013-0-00143-0>
7. Saxena, R.K. and Sumitra Saxena (2015). Comparative Anatomy of the Vertebrates. MV Learning.
8. Kardong, K.V. and Edward Zalisko (2011). Comparative Vertebrate Anatomy: A Laboratory Dissection Guide. McGraw-Hill Education.

Online Resources

1. The Science Bank – Online Dissection Resources
<https://thesciencebank.org/pages/online-dissection-resources>
2. Human Anatomy in Detail - <https://www.innerbody.com/html/body.html>
3. Learn human anatomy in 3D - <https://anatomy3datlas.com/>
4. Virtual frog dissection tool - <https://norecopa.no/norina/virtual-frog-v-frog-20/>

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Recall the basic principles and importance of comparative anatomy among vertebrates.	R	PSO-1
CO-2	Identify the evolutionary perspectives and phylogenetic relationships in comparative anatomy. Explain the evolution and diversity of vertebrate skeletal, muscular, circulatory, respiratory, digestive, and nervous systems.	R, U	PSO-3
CO-3	Describe the comparative anatomy of the skeletal, muscular, circulatory, respiratory, digestive, and nervous systems across different vertebrate groups.	U	PSO-1, PSO-3
CO-4	Apply knowledge of vertebrate morphology to analyze and compare the bone structure, muscular system, circulatory and respiratory systems, digestive and nervous systems, and their adaptations in different vertebrate groups.	Ap	PSO-3, PSO-4
CO-5	Analyze the functional morphology of vertebrate muscles in movement and locomotion, and evaluate the biomechanics involved in vertebrate locomotion.	An	PSO-4

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Comparative Anatomy of Vertebrates

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1.	Recall the basic principles and importance of comparative anatomy among	PO1/ PSO-1	R	F, C	L	-

	vertebrates.					
2.	Identify the evolutionary perspectives and phylogenetic relationships in comparative anatomy. Explain the evolution and diversity of vertebrate skeletal, muscular, circulatory, respiratory, digestive, and nervous systems.	PO1,PO3, PO4,PO6, PO7,PO8/ PSO-3	R, U	F, C, P	L	-
3.	Describe the comparative anatomy of the skeletal, muscular, circulatory, respiratory, digestive, and nervous systems across different vertebrate groups.	PO1,PO3, PO4,PO6, PO7,PO8/ PSO-1, PSO-3	U	P	L	-
4.	Apply knowledge of vertebrate morphology to analyze and compare the bone structure, muscular system, circulatory and respiratory systems, digestive and nervous systems, and their adaptations in different vertebrate groups.	PO1,PO3, PO4,PO6, PO7,PO8/ PSO-3, PSO-4	Ap	C, P	L	-
5.	Analyze the functional morphology of vertebrate muscles	PO7, PO8/ PSO-4	An	P	L	-

	in movement and locomotion, and evaluate the biomechanics involved in vertebrate locomotion.					
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F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs

	PSO 1	PSO 2	PSO 3	PSO4	PSO5	PSO 6	PSO 7	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO 1	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO 2	-	-	3	-	-	-	-	3	-	1	1	-	2	1	2
CO 3	3	-	1	-	-	-	-	2	-	3	2	-	1	1	1
CO 4	-	-	2	3	-	-	-	1	-	2	2	-	3	2	1
CO 5	-	-	-	3	-	-	-	-	-	-	-	-	-	1	1

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

Topics for Assignment/Seminar

1. Evolutionary Trends in Vertebrate Skeletal Systems.
2. Muscular Systems: Similarities and Differences.
3. Comparative Analysis of Vertebrate Circulatory Systems.
4. Respiratory Adaptations in Aquatic and Terrestrial Vertebrates.
5. Digestive System Evolution: Herbivores vs. Carnivores.
6. Nervous System Complexity Across Vertebrate Groups.
7. Adaptations in Vertebrate Locomotion.
8. Comparative Anatomy of Sensory Systems.
9. Reproductive Strategies in Vertebrates: Oviparity, Viviparity, and Ovoviviparity.
10. Endocrine System Evolution and Hormonal Regulation.
11. Integumentary System: Skin, Scales, and Feathers.
12. Ecological Significance of Vertebrate Anatomy.

Continuous Comprehensive Assessment (CCA)

1. Assignments
2. Seminar
3. Collection/ Identification of major Vertebrate bones explained in theory class
4. Working with online virtual dissection tools
5. Group discussion on topic – Why there are no Flying Elephants?
6. Debate on topic – Humans with tail! Good or Bad?
7. Test
8. Quiz

End Semester Evaluation (ESE)

1. Multiple Choice Questions
2. Very Short Answer Questions
3. Short Answer Questions
4. Essay Type Questions

Mapping of COs to Assessment Rubrics

	Assignment/ Seminar	CCA	ESE
CO 1	-	✓	✓
CO 2	✓	✓	✓
CO 3	✓	✓	✓
CO 4	✓	✓	✓
CO 5	✓	✓	✓