



बिरसा मुंडा ट्रायबल युनिवर्सिटी Birsā Munda Tribal University

राजपिपला, जि० नर्मदा Rajpipla, Dist. Narmda

Established by Tribal Development Department, Govt. of Gujarat

School of Science

M.Sc. (Zoology) Programme

Subject Code& Name: - MS02CZOO01 - Systematics, Structural and Functional Anatomy of Vertebrates

Teaching and Evaluation Scheme:

Teaching Scheme				Examination Scheme			
Credits				Component Weightage			
				Internal		External	
L	T	P	Total	TH	PWE	TH	PWE
4	--	--	4	50%	--	50%	--

Programme Name	M.Sc. Zoology
Semester	II
Course Code	MS02CZOO01
Course Title	Systematics, Structural and Functional Anatomy of Vertebrates
Course Content Type (Th./Pr.)	Theory
Course Credit	4
Sessions	4
Total Teaching/Lab. Hours	60 Hours

Learning Objectives

- Understand vertebrate diversity, classification and evolutionary relationships.
- Analyze the structural organization and functional adaptations of vertebrate organ systems.
- Examine evolutionary modifications of skeletal, integumentary, circulatory, respiratory, nervous, excretory, and reproductive systems.
- Interpret adaptive significance of vertebrate anatomical innovations in diverse habitats.

Prerequisites (if any)

- Student have basic knowledge of Fundamentals of Animal Diversity, Basic Chordate Zoology
- Comparative Anatomy at B.Sc. level and Principles of Evolution.

Learning Outcomes

After successful completion of the course, students will be able to:

- Explain vertebrate diversity and evolutionary relationships using modern systematic principles.
- Compare major vertebrate organ systems and interpret their functional significance.
- Analyze evolutionary trends and adaptive modifications in vertebrate anatomy.
- Relate structural organization to ecological and physiological adaptations in vertebrates.



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Detailed Contents		
UNIT	TOPIC/SUB-TOPIC	TEACHING HOURS
I	Vertebrate Diversity, Systematics and Integumentary System: • Origin and evolution of chordates • Diagnostic characters of Chordata • Modern classification and phylogenetic relationships of chordates • Diversity of Protochordata and Vertebrata (Taxonomic outline) • Major evolutionary transitions in vertebrates (water to land, amniotic egg, endothermy) Integumentary System: • Structure and development of vertebrate integument • Skin and its functions • Evolution and adaptive significance of integumentary derivatives: Scales, Feathers, Hair, Horns and antlers, Claws, nails and hoofs and Cutaneous glands	15
II	Functional Morphology of Feeding, Respiration and Circulation Digestive System: • Comparative organization of alimentary canal in vertebrates • Feeding adaptations in fishes, amphibians, reptiles, birds and mammals • Evolution of digestive glands Respiratory System • Evolution of respiratory organs in vertebrates • Gills, lungs and accessory respiratory organs • Respiratory adaptations to aquatic and terrestrial environments Circulatory System • Evolution of heart in vertebrates • Evolutionary modifications of aortic arches • Functional significance of single and double circulation • Cardiovascular adaptations in vertebrates	15



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III	Comparative study of nervous system, Sensory Systems and Skeletal Adaptations of Vertebrates: Nervous System • Evolution of vertebrate brain • Comparative organization of forebrain, midbrain and hindbrain • Cranial nerves and autonomic nervous system Sense Organs • Evolution and functional adaptations of: Eye, Ear and vestibular apparatus and Lateral line system Skeletal System • Functional morphology of endoskeleton • Evolution of jaw suspension • Vertebral column and its modifications • Evolution of girdles and limbs • Adaptive radiation in locomotory structures	15
IV	Comparative study of Reproduction, Excretion and Evolutionary Adaptations Reproductive System • Evolution of vertebrate reproductive strategies • Gonads and reproductive ducts • Oviparity, ovoviviparity and viviparity • Parental care in vertebrates Excretory System • Evolution of vertebrate kidney • Pronephros, Mesonephros and Metanephros • Urinogenital ducts and urinary bladder • Osmoregulation in aquatic and terrestrial vertebrates Evolutionary Adaptations • Neoteny and paedogenesis • Hibernation and aestivation • Adaptive radiation and ecological adaptations in vertebrates	15



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Text Book(s)

1. Chordate Zoology by E. L. Jordan and P. S. Verma, S. Chand & Company Ltd.
2. Chordate Zoology and Animal Physiology by P. S. Dhami and J. K. Dhami, R. Chand & Company
3. The Chordates by H. H. Newman, Eurasia Publishing House
4. Chordate Zoology by R. L. Kotpal, Rastogi Publications
5. Biology of Chordates by P. S. Verma and V. K. Agarwal, S. Chand & Company Ltd.
6. Textbook of Vertebrate Zoology by S. N. Prasad and V. Kashyap, New Age International Publishers
7. Comparative Anatomy of Vertebrates by G. C. Kent and Larry Miller, McGraw-Hill Education
8. Vertebrate Zoology by P. C. Srivastava, Prentice-Hall of India

Reference Books

1. Vertebrates: Comparative Anatomy, Function, Evolution by Kenneth V. Kardong, McGraw-Hill Education
2. The Vertebrate Body by Alfred Sherwood Romer and Thomas S. Parsons, Saunders College Publishing
3. Comparative Anatomy of the Vertebrates by George C. Kent and Robert K. Carr, McGraw-Hill Education
4. Vertebrate Life by F. Harvey Pough, Christine M. Janis and John B. Heiser, Pearson Education
5. Functional Anatomy of the Vertebrates: An Evolutionary Perspective by Karel F. Liem, Warren F. Walker Jr. and Lance Grande, Brooks/Cole
6. Integrated Principles of Zoology by Cleveland P. Hickman Jr., Susan L. Keen and Allan Larson, McGraw-Hill Education
7. Animal Evolution: Interrelationships of the Living Phyla by Claus Nielsen, Oxford University Press
8. Evolutionary Biology of the Vertebrates by J. A. Moore, Cambridge University Press
9. Life of Vertebrates by J. Z. Young, Oxford University Press
10. Comparative Vertebrate Morphology by Kenneth Kardong, McGraw-Hill Education



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Web Resources

- Animal Diversity Web – <https://animaldiversity.org>
- Understanding Evolution – <https://evolution.berkeley.edu>
- e-PG Pathshala – <https://epgp.inflibnet.ac.in>
- NPTEL – <https://nptel.ac.in>
- OpenStax Biology – <https://openstax.org/details/books/biology-2e>
- Tree of Life Web Project – <http://tolweb.org>
- UC Museum of Paleontology – <https://ucmp.berkeley.edu>
- NCBI Bookshelf – <https://www.ncbi.nlm.nih.gov/books>
- Smithsonian National Museum of Natural History – <https://naturalhistory.si.edu>

Required Software(s) (if any)

Practical(s) (if any)

L:: Lecture, **T::** Tutorial, **P::** Practical

PWE:: Practical Work Examination

(PWE includes Laboratory practical work, project work, viva simulation exercise work etc.)