

**Scheme of B.Sc.
Zoology**

Year	Course Code	Subject Name	Theory/ Practical	Total Credit	Total Marks	
					Max	Min
First year	ZOOL-1T	Animal Diversity:Non-Chordata and Chordata , Comparative Anatomy and Physiology of Non-chordates	Theory	4	50	17
	ZOOL-2T	Cell Biology , Histology and Comparative Anatomy & Physiology Of Chordates	Theory	4	50	17
	ZOOL-1P	Practical	Practical	2	50	17

Part A: Introduction			
Program: Certificate Course	Class: B.Sc. I st Year	Year: 2022	Session: 2022-2023
1	Course Code	ZOOL-1T	
2	Course Title	Animal Diversity: Non-Chordata and Chordata, Comparative Anatomy and Physiology of Non-chordates	
3	Course Type	Theory	
4	Pre-requisite (if any)	No	
5	Course Learning Outcomes (CLO)	Upon completion of the course students should be able to : • Learn about the importance of systemic, taxonomy and phylogeny to get a concrete idea of evolution of non-chordate phyla. • Understand the various morphological, anatomical structures and functions of animals of different phyla. • Get the knowledge about economic, ecological and medical significance of various animals in human welfare. • Understand the important parasites and their control measures. • Comparison of the anatomy and physiology of the different taxa of non-chordates.	
6	Credit Value	4	
7	Total Marks	Max. Marks: 50	Min Passing Marks : 17

Part B: Content of the Course		
Total Lectures: 60		
Unit	Topics	No. of Lectures
I	Taxonomy, Protozoa, Porifera Taxonomy- Elementary knowledge of Zoological Nomenclature and International Code. Classification of Animal Kingdom upto Phylum of acoelomate and coelomate non-chordates according to Parker and Haswell 7th edition. Protozoa- Phylum Protozoa: General characters of the phylum and classification up to order with characters and suitable examples. Structure, life history and pathogenicity of malaria parasite (<i>Plasmodium vivax</i>). Protozoa and disease. Porifera- Phylum Porifera: General characters of the phylum and classification up to order with characters and suitable examples. Type study of Sycon.	12
II	Coelenterata, Platyhelminthes, Nematelminthes : Coelenterata- Phylum Coelenterata: General characters of the phylum and classification up to order with characters and suitable examples. Type Study of Obelia. Platyhelminthes - Phylum Platyhelminthes: General characters of the phylum and classification up to order with characters and suitable examples. Type Study of Liverfluke. Nematelminthes- Phylum Nematelminthes: General characters of the phylum and classification up to order with characters and suitable examples. Pathogenic nematodes and diseases.	12
III	Annelida, Arthropoda, Mollusca : Annelida- Phylum Annelida: General Characters of the phylum and classification up to order with characters and suitable examples. Types study of Earthworm (<i>Pheretima</i>). Arthropoda - Phylum Arthropoda: General Characters of the phylum and classification up to order with characters and suitable examples. Type study of Prawn. Insects as a vector of human disease. Mollusca - Phylum Mollusca: General characters of the phylum and classification up to order with characters and suitable examples. Type study of <i>Pila</i>.	12


 A.K.R. Jadhav
 31.5.2022

IV	Echinodermata, Hemichordata, Classification of Chordata : Echinodermata - Phylum Echinodermata: General characters of the phylum and classification up to order with characters and suitable examples. Type study of Starfish (<i>Asterias</i>). Hemichordata - Phylum Hemichordata: General characters of the phylum hemichordate and relationship with non-chordates and chordates. Type study of <i>Balanoglossus</i> . Classification of Chordata - Classification of Chordata up to order with characters and suitable examples. Brief account of Urochordata, Cephalochordata and Vertebrata.	11
V	Comparative Anatomy and Physiology of Non-chordates: Coelom and coelomducts in Non-chordate. Locomotory organs and locomotion in Non-chordate. Pattern of feeding and digestion in lower Metazoans. Comparative anatomy and physiology of respiration and excretion in Non-chordate. Primitive, diffused and advance nervous system in Non-chordate. Reproduction in Non-chordates.	13

Keywords : Locomotory organ, feeding and digestion, respiration, International Commission on Zoological Nomenclature (ICZN), Classification, Protozoa, Classification. Liver Fluke, Trochophore, Arthropoda, Crustacea larva, Echinodermata larva

Part C - Learning Resource

1. Text Books, Reference Books, Other Resources –
2. Parker, J, Haswell, WA, "A Text Book of Zoology", VII edition, Vol. I & II, Low Price Publications, Delhi, 1990.
3. Barnes, RD, "Invertebrate Zoology", VII Edition, Cengage Learning, India, 2006.
4. Pechenik, JA, "Biology of the Invertebrates" McGraw-Hill Education, VII Edition, 2015.
5. Sedgwick, A, "A Students Text Book of Zoology", Vol. I, II & Vol. III., Low Price Publications, Delhi, 1990.
6. Dhami and Dhami, "Invertebrate Zoology" R., Chand & Co., India, 2009.
7. Jordan and Verma, "Invertebrate Zoology," S. Chand & Company, New Delhi, 2013.
8. Agarwal, VK, "Zoology for Degree Students: Non-Chordata", S Chand & Company, 2017.
9. Kotpal, R, "Modern Text Book of Invertebrates", Rastogi Publications, Meerut, 2017.
10. Kotpal, R, "Protozoa to Echinodermata (Phylum Series)", Rastogi Publications, Meerut, 2017.
11. Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4th edition). McGraw-Hill
12. Jordan, E. L. and Verma, P. S. (2013) Chordate Zoology (14th edition).
13. Saxena, R. K. and Saxena, S. (2015) Comparative Anatomy of Vertebrates (2nd edition).

E- Resources –

1. SWAYAM- <https://swayam.gov.in/explorer?searchText=>
2. <https://academic.oup.com>
3. <https://medlineplus.gov>
4. <https://ncin.nih.gov>
5. <https://zoologylearningpoint.woodpress.com>
6. <https://zoologyresources.com>
7. National digital library – <https://ndl.iitkgp.ac.in>
8. e-PG Pathshala (MHRD) Portal, <https://egpg.inflibnet.ac.in>
9. Science Direct Open Access Content – <https://www.sciencedirect.com/book/9781843342038/open-Access>
10. <https://egyankosh.ac.in>

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31.5.2022

Part D: Assessment and Evaluation

Maximum Marks. University exam. - :50

Part A: Introduction			
Program: Certificate Course	Class: B.Sc. 1 Year	Year: 2022	Session: 2022-2023
1 Course Code	ZOOL-2T		
2 Course Title	Cell Biology, Histology and Comparative Anatomy & Physiology of Chordates		
3 Course Type	Theory		
4 Pre-requisite (if any)	To study this course, a student must have/had the subject Biology in class 12 th .		
5 Course Learning Outcomes (CLO)	At the end of this course, the students will be able : • Understand the basic structure, functioning of the cell and cell organelles and understand the intricate cellular mechanisms involved. • Understand the tissues, how tissues are produced from cells in a normal course and about any malfunctioning which may lead to benign or malignant tumor. • Develop an understanding of the evolution of vertebrates thus integrating structure, function and development. • Understand the morphological, anatomical and physiological adaptation in diverse habitats. • 5. Develop an understanding of the evolution of vertebrates thus integrating structure, function and development.		
6 Credit Value	Theory : 4		
7 Total Marks	Max. Marks: 50	Min Passing Marks : 17	

Part B: Content of the Course

Total Lecturer: 60

Unit	Topics	No. of Lectures
I	Prokaryotic and Eukaryotic cells : General structure of prokaryotes, bacteria, archaea and eukaryotes. Ultra structure and function of endoplasmic reticulum, ribosomes, Golgi apparatus, lysosome, Mitochondria, nuclear apparatus. Cell membrane and transport mechanism : Structure, composition, models and function. Fluid mosaic model Junctional complexes, membrane receptor modifications : microvilli, desmosomes and plasmodesmata.	12
II	Cell cycle, cell signaling and cell culturing : Cell cycle, cell division – mitosis and meiosis. Cell division check points and their regulation. Role of growth factors. Programmed cell death (Apoptosis). Cell regulation and cell signaling : Signaling molecules and their receptors. Functions of cell surface receptors. Regulation of signaling pathways. Cell culture : Types of cell culture – monolayer and suspension culture. Types of culture media. Basic characteristics of tissue culture media. Tissue culture and engineering.	12
III	Structure and functional significance of animal tissues : Introduction to tissues. Epithelial tissue: types, structure and characteristics. Exocrine and endocrine glands: type and structure. Structure and function of loose, dense and adipose tissue. Muscular tissue: Ultra structure of smooth, skeletal and cardiac muscles. Muscle contraction. Membrane of the brain and spinal cord.	11
IV	Structure and function of integument, skeletal, digestive, circulatory system : Integument : Structure of integument from fish to mammals. Function of integument. Epidermal and dermal derivatives of integument and their functional significance. Skeletal system : Comparative account of pelvic and pectoral girdles from fishes (cartilaginous and bony) to mammals. Digestive system : Dentition in mammals. Comparative study of alimentary canal and digestive glands from fish to mammal. Physiology of digestion in mammal.	13

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V	Circulatory system: Evolution of aortic arches and their significance. Structure and evolution of heart in vertebrates. Cardiac cycle. Blood : Composition and function. Structure and function of circulatory, respiratory, excretory, reproductive and endocrine system : Respiratory system : Aquatic and terrestrial respiration. Comparative anatomy of lungs in amphibian, reptile, bird and mammals. Excretory system : Physiology of excretion, urine formation. Reproductive system : Comparative details of testes and ovaries from fishes to mammals. Estrous and menstrual cycle. Endocrine system : Types and functional significance of endocrine glands and hormones.
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12

Keywords: Tissue, Endocrine glands, Girdles, Cell signaling, Cell culture, Excretion, Circulatory system, Aortic arches, Heart, Reproductive cycle.

Part C - Learning Resource

Text Books, Reference Books, Other Resources -

1. Books of M. P. Hindi Granth Academy
2. Rastogi V. B. : Introduction to Cytology
3. Cell Biology and Molecular Biology : N. Arumugam
4. Cell Biology : N. Arumugam
5. Molecular Cell Biology : N. Arumugam
6. Cell Biology, Genetics, Molecular Biology and Evolution : Verma P. S., Agrawal V. K.
7. Sheelar and Binachi : Cell and Molecular Biology
8. Karp : Cell and Molecular Biology
9. De Robertis : Cell and Molecular Biology
10. Powar C. B. : Cell Biology
11. A Textbook of Animal Histology : A. K. Berry, Emkey Publication, Delhi
12. A Textbook of Histology and Practical guide: J. P. Gunasegaram
13. Animal Cell Culture : R. Freshney
14. Animal Cell and Tissue Culture : Shivangi Mathur
15. Chordate Zoology : R. L. Kotpal & P. S. Verma
16. Modern Text Book of Zoology - Vertebrate : R. L. Kotpal
17. A Text Book of Chordates : A. Thangamani, N. Arumugam, Saras Publication
18. Biology of Animals, Volume - II, Sinha, Adhikari, Ganguly
19. Comparative Anatomy of vertebrates, 2nd edition : R. K. Saxena, Sunita Saxena
20. Comparative Anatomy and Developmental Biology : Kotpal, Shastry and Shukla
21. Chordata and Comparative Anatomy : R. L. Kotpal
22. Chordate Zoology : Jordan E. L. and Verma P. S.
23. Anatomy of Chordates, 4th edition : Weichert C. K.
24. Comparative vertebrate Anatomy : L. H. Hyman

E-Resources -

1. SWAYAM - <https://swayam.gov.in/explorer?searchText=>
2. <https://academic.oup.com>
3. <https://medlineplus.gov>
4. <https://ncin.nih.gov>
5. <https://zoologylearningpoint.woodpress.com>
6. <https://zoologyresources.com>
7. National digital library - <https://ndl.iitkgp.ac.in>
7. e-PG Pathshala (MHRD) Portal, <https://eppg.inlibnet.ac.in>
8. Science Direct Open Access Content - <https://www.sciencedirect.com/book/9781843342038/open-access>
9. <https://egyankosh.ac.in>

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Part D: Assessment and Evaluation

University Exam(UE): Maximum Marks: 50 Marks

Part A: Introduction			
Program: Certificate Course		Class: B.Sc. 1 Year	Year: 2022 Session: 2022-2023
1	Course Code		
2	Course Title	ZOOL-IP	
3	Course Type	Lab Course - I	
4	Pre-requisite (if any)	Practical	
5	Course Learning Outcomes (CLO)	No	
		After completion of practical work the outcome will be : • Able to know animal diversity in the form of museum/slide for invertebrate and invertebrates. • Capable to enumerate biology of invertebrates. • Capable to explore anatomy of animas. • Able to understand cytological, histological and osteological configuration for animal life. • Capable to explain hematology of animal system.	
6	Credit Value	2	
7	Total Marks	Max. Marks: 50	Min Passing Marks : 17

Part B: Content of the Course
Total classes: 30

	Content	No. of classes
	Tentative list of practical/exercise : The practical's work will be based on theory syllabus and the students will be required to show the knowledge of the following – 1. Study of museum specimens representing to invertebrate phyla. 2. Study of permanent slides : Paramecium, Euglena, T. S. Sycon, Sponge Spicules, Sponge gemmule, Obelia colony, Obelia medusa, Ephyra larva. Fasciola larval forms (miracidium, Radia, Cercaria, Metacercaria). Trochophore larva, Zoea larva, Bipinnaria larva. 3. Dissection/ demonstration/ clay model of – a) Pheretima : Digestive system, Reproductive system. Nervous system b) Palaemon : Appendages, Nervous system c) Periplaneta : Mouth parts, Digestive system d) Pila : Nervous system 4. Exercise based on cytology : squash preparation from onion root tip and study of cell division. 5. Study of museum specimens representing the chordata from cyclostomes to mammals. 6. Study of permanent slides of chordates – Fish skin, scales, V. S. Skin of frog, reptile, bird, mammal, T.S. liver, pancreas, testes, ovary of frog and mammal. 7. Osteology : Study of girdles of amphibian, reptile, bird and mammal. 8. Temporary mounting : a) Palaemon : Statocyst b) Pila : Ctenidium, osphradium c) Pheretima : Septal nephridia d) Fish scale : Placoid, Cycloid, Ctenoid 9. Exercise based on blood : blood group, blood pressure measure 10. Field visit report : Photography & identification of any five local invertebrate or vertebrate fauna.	30


 21-05-2022

Part C - Learning Resource

Text Books, Reference Books, Other Resources -

1. Practical zoology Invertebrate : S. S. Lal
2. Practical zoology vertebrate : S. S. Lal
3. A Manual of practical zoology invertebrates : P. S. Verma
4. A Manual of practical zoology Chordates : P. S. Verma
5. Saras Practical zoology Vol. I, Vol. II, N. Arumugam

Part D: Assessment and Evaluation

University Exam(UE): Maximum Marks: 50 Marks