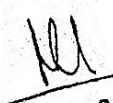


Part A: Introduction			
Program: Certificate Course	Class: B.Sc. I st Year	Year: 2022	Session: 2023-2024
1	Course Code	ZOOL-IT	
2	Course Title	Animal Diversity: Non-Chordata and Chordata, Comparative Anatomy and Physiology of Non-chordates	
3	Course Type	Theory	
4	Pre-requisite (if any)	No	
5	Course 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 7 th 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 Pila.	12


 A. K. R. Talwar
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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 Educations, 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	


 Dr. K.R. Dahiya
 31.5.2022

Part A: Introduction			
Program: Certificate Course	Class: B.Sc. I Year	Year: 2022	Session: 2022-23
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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	Circulatory system: Evolution of aortic arches and their significance. Structure and evolution of heart in vertebrates. Cardiac cycle. Blood : Composition and function.	
V	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.	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 -	
- Books of M. P. Hindi Granth Academy - Rastogi V. B. : Introduction to Cytology - Cell Biology and Molecular Biology : N. Arumugam - Cell Biology : N. Arumugam - Molecular Cell Biology : N. Arumugam - Cell Biology, Genetics, Molecular Biology and Evolution : Verma P. S., Agrawal V. K. - Sheelar and Binachi : Cell and Molecular Biology - Karp : Cell and Molecular Biology - De Robertis : Cell and Molecular Biology - Powar C. B. : Cell Biology - A Textbook of Animal Histology : A. K. Berry, Emkey Publication, Delhi - A Textbook of Histology and Practical guide: J. P. Gunasegram - Animal Cell Culture : R. Freshney - Animal Cell and Tissue Culture : Shivangi Mathur - Chordate Zoology : R. L. Kotpal & P. S. Verma - Modern Text Book of Zoology - Vertebrate : R. L. Kotpal - A Text Book of Chordates : A. Thangamani, N. Arumugam, Saras Publication - Biology of Animals, Volume - II, Sinha, Adhikari, Ganguly - Comparative Anatomy of vertebrates, 2nd edition : R. K. Saxena, Sunita Saxena - Comparative Anatomy and Developmental Biology : Kotpal, Shastry and Shukla - Chordata and Comparative Anatomy : R. L. Kotpal - Chordate Zoology : Jordan E. L. and Verma P. S. - Anatomy of Chordates, 4th edition : Weichert C. K. - Comparative vertebrate Anatomy : L. H. Hyman	
E-Resources - - SWAYAM- https://swayam.gov.in/explorer?searchText= https://academic.oup.com https://medlineplus.gov https://ncin.nlon.nih.gov https://zoologylearningpoint.woodpress.com https://zoologyresources.com - National digital library - https://ndf.iiitkep.ac.in - e-PG Pathshala (MHRD) Portal, https://eppg.in/libnet.ac.in - Science Direct Open Access Content - https://www.sciencedirect.com/book/9781843342038/ open-Access https://egyankosh.ac.in	


 Dr. K. R. Sahu
 31-5-2022

Part A: Introduction			
Program: Certificate Course		Class: B.Sc. I Year	Year: 2022
		Session: 2023-2024	
1	Course Code	ZOOL-IP	
2	Course Title	Lab Course - I	
3	Course Type	Practical	
4	Pre-requisite (if any)	No	
5	Course Learning Outcomes (CLO)	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 animals. • 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 – ✓ Study of museum specimens representing to invertebrate phyla. ✓ - 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, Zoa larva, Bipinnaria larva. - Dissection/ demonstration/ clay model of – ✓ Pheretima : Digestive system, Reproductive system, Nervous system ✓ Palaemon : Appendages, Nervous system c) Periplaneta : Mouth parts, Digestive system d) Pila : Nervous system ✓ Exercise based on cytology : squash preparation from onion root tip and study of cell division. ✓ Study of museum specimens representing the chordata from cyclostomes to mammals. ✓ 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. ✓ 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 ✓ Exercise based on blood : blood group, blood pressure measure * ⑩ Field visit report : Photography & identification of any five local invertebrate or vertebrate fauna. C	30


 A. K. Pal
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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

DECLARATION

This is to certify that the syllabus is framed by the central board of study (Zoology) as the guidelines of the department of higher education, Chhattisgarh.

1. Dr. K. R. Sahu - Chairman - Assistant Professor, Govt. Pandit Madhav Rao Sapre College, Pendra Road
2. Dr. Ajit Hundet - Member - Professor, Govt. D. B. Girls College, Raipur
3. Dr. Prem Prakash Singh - Member - Professor, Govt. College, Kusmi
4. Dr. Shubhada Rahalkar - Member - Professor, Govt. Bilasa Girls P. G. College, Bilaspur
5. Dr. Anil Kumar Shrivastava - Member - Professor, Govt. V. Y. T. P. G. Autonomous College, Durg
6. Dr. R. K. Tamboli - Member - Assistant Professor, Kirodimal Govt. Arts & Science College, Raigarh
7. Dr. Parmita Dubey - Member - Assistant Professor, Govt. J. Y. Chhattisgarh College, Raipur
8. Dr. Shashi Gupta - Member - Assistant Professor, Govt. Nagarjuna P. G. College of Science, Raipur
9. Dr. L. P. Miri - Member - Assistant Professor, Govt. J.P. Verma P. G. Arts & Commerce College, Bilaspur
10. Dr. Rajesh Kumar Rai - Member - Assistant Professor, Govt. Mahamaya College, Ratanpur, Bilaspur
11. Dr. Kavita Krishnamoorti - Member - Assistant Professor, Govt. Lahiri P. G. College, Chirimiri, Koriya

Date : 31.05.2022

Hemchand Yadav Vishwavidyala, Durg (C.G.)

Zoology

B.Sc. Part – II (2019-20)

Paper – I

(Anatomy and Physiology)

Comparative Anatomy of various organ systems of vertebrates:

Unit: I

- Integument and its derivatives: structure of scales, hair and feathers
- Alimentary canal and digestive glands in vertebrates
- Respiratory organs : Gills and lung , air-sac in birds

Unit: II

- Endoskeleton: (a) Axial Skeleton- Skull and Vertebrae, (b) Appendicular Skeleton Limbs and girdles
- Circulatory System: Evolution of heart and aortic arches
- Urinogenital System: Kidney and excretory ducts

Unit: III

- Nervous System: General plan of brain and spinal cord
- Ear and Eye: structure and function
- Gonads and genital ducts

Unit: IV

- Digestion and absorption of dietary components
- Physiology of heart, cardiac cycle and ECG
- Blood Coagulation
- Respiration: mechanism and control of breathing

Unit: V

- Excretion: Physiology of excretion, osmoregulation
- Physiology of muscle contraction
- Physiology of nerve impulse, Synaptic transmission

Zoology
B.Sc. Part – II (2019-20)

Paper-II

**VERTEBRATE ENDOCRINOLOGY, REPRODUCTIVE BIOLOGY
BEHAVIOUR, EVOLUTION AND APPLIED ZOOLOGY**

Unit: I

- Structure and function of Endocrine glands
- Hormone receptor
- Biosynthesis and secretion of thyroid, adrenal, ovarian and testicular hormones
- Endocrine disorder of pituitary, thyroid, adrenal and pancreas

Unit:II

- Reproductive cycle in vertebrates
- Menstruation, lactation and pregnancy
- Mechanism of parturition
- Hormonal regulation of gametogenesis

Unit: III

- Evidences of organic evolution.
- Theories of organic evolution.
- Variation, Mutation, Isolation and Natural selection.
- Evolution of Horse

Unit:IV

- Introduction to Ethology: Branches and concept of ethology.
- Patterns of Behaviour, Taxes, Reflexes, Drives and Stereotyped behaviour.
- Reproductive behavioural patterns.
- Drugs and behavior, Hormones and behaviour

Unit:V

- Prawn Culture
- Sericulture
- Apiculture
- Pisciculture
- Poultry keeping
- Elements of Pest Control: Chemical & Biological Control

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Zoology
B.Sc. Part II (2019-20)
Practical

The practical work in general shall be based on the syllabus prescribed and the students will be required to show the knowledge of the following:

- Study of the representative examples of the different chordates (Classified characters).
- Dissection of various systems of scoliodon-Afferent and Efferent branchial cranial nerves, internal ear.

Alternative methods: By Clay/Thermacol/ Drawing/ Model etc.)

- Simple microscopic technique through unstained or stained permanent mount.
- Study of prepared slides histological, as per theory papers.
- Study of limb girdles and vertebrae of Frog, Varanus, Fowl and Rabbit.
- Identification of species and individual of honey bee.
- Life cycle of honey bee and silkworm.
- Exercise based on Evolution and Animal behavior.

Scheme of Practical Exam

Time: 3:30hrs

• Major dissection (Cranial nerves/efferent branchial vessel)	10
• Exercise based on evolution	05
• Exercise based on applied zoology	05
• Exercise based on animal behavior	04
• Spotting-8 (slides-4,bones-2,specimen-2)	16
• Viva	05
• Sessional marks.	05

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Zoology

B.Sc. Part III (2021-22)

Paper-I

ECOLOGY, ENVIRONMENTAL BIOLOGY: TOXICOLOGY, MICROBIOLOGY AND MEDICAL ZOOLOGY

Unit: I (Ecology)

- Aims and scopes of ecology
- Major ecosystems of the world-Brief introduction
- Population- Characteristics and regulation of densities
- Communities and ecosystem
- Bio-geo chemical cycles
- Air & water pollution
- Ecological succession

Unit: II (Environmental Biology)

- Laws of limiting factor
- Food chain in fresh water ecosystem
- Energy flow in ecosystem- Trophic levels
- Conservation of natural resources
- Environmental impact assessment

Unit: III (Toxicology)

- Definition and classification of Toxicants
- Basic Concept of toxicology
- Principal of systematic toxicology
- Heavy metal Toxicity (Arsenic, Mercury, Lead, Cadmium)
- Animal poisons- snake venom, scorpion & bee poisoning
- Food poisoning

Unit: IV (Microbiology)

- General and applied microbiology
- Microbiology of domestic water and sewage
- Microbiology of milk & milk products
- Industrial microbiology: fermentation process, production of penicillin, alcoholic beverages, bioleaching.

Unit: V (Medical Zoology)

- Brief introduction to pathogenic microorganisms, Rickettsia, Spirochaetes, AIDS and Typhoid
- Brief account of life history & pathogenicity of the following pathogens with reference to man: prophylaxis & treatment
- Pathogenic protozoan's- Entamoeba, Trypanosome & Plasmodium
- Pathogenic helminthes- Schistosoma
- Nematode pathogenic parasites of man
- Vector insects

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Zoology
B.Sc. Part III (2021-22)
Paper II

GENETICS, CELL PHYSIOLOGY, BIOCHEMISTRY, BIOTECHNOLOGY AND BIOTECHNIQUES

Unit: I (Genetics)

- Linkage & linkage maps, Sex Determination and Sex Linkage
- Gene interaction- Incomplete dominance & Codominance, Supplementary gene, Complementary gene, Epistasis Lethal gene, Pleiotropic gene and multiple alleles.
- Mutation: Gene and chromosomal mutation
- Human genetics: chromosomal alteration: Down, Edward, Patau, Turner and Klinefelter Syndrome Single gene disorders: Alkaptonuria, Phenylketonuria, Sickle cell anemia, albinism and colour blindness

Unit: II (Cell Physiology)

- General idea about pH & buffer
- Transport across membrane: Diffusion and Osmosis
- Active transport in mitochondria & endoplasmic reticulum
- Enzymes- classification and Action

Unit: III (Biochemistry)

- Amino acids & peptides- Basic structure & biological function
- Carbohydrates & its metabolism- Glycogenesis; Gluconeogenesis; Glycolysis; Glycogenolysis; Cori-cycle
- Lipid metabolism- Oxidation of glycerol; Oxidation of fatty acids
- Protein Catabolism- Deamination, transamination, transmethylation

Unit: IV (Biotechnology)

- Application of Biotechnology
- Recombinant DNA & Gene cloning
- Cloned genes & other tools of biotechnology (Tissue culture, Hybridoma, Transgenic Animals and Gene library)

Unit: V (Biotechniques)

1. Principles & techniques about the following:

- (i) pH meter
- (ii) Colorimeter
- (iii) Microscopy- Light microscopes: Compound, Phase contrast & Electron microscopes
- (iv) Centrifuge
- (v) Separation of biomolecules by chromatography & electrophoresis

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B. Sc. Part III (2021-22)

Zoology Practical

The practical work in general shall be based on syllabus prescribed in theory.

The candidates will be required to show knowledge of the following:

- Estimation of population density, percentage frequency, relative density.
- Analysis of producers and consumers in grassland.
- Detection of gram-negative and gram-positive bacteria.
- Blood group detection (A,B,AB,O)
- R. B. C. and W.B.C count
- Blood coagulation time
- Preparation of hematin crystals from blood of rat
- Observation of *Drosophila*, wild and mutant.
- Chromatography-Paper or gel
- Colorimetric estimation of Protein.
- Mitosis in onion root tip.
- Biochemical detection of Carbohydrate, Protein and Lipid.
- Study of permanent slides of parasites, based on theory paper.
- Working principles of pH meter, colorimeter, centrifuge and microscope.

Scheme of marks distribution

Time: 3:30hrs

• Hematological Experiment	08
• Ecological Experiment: Grassland Ecosystem/ Population Density/Frequency/relative density	06
• Bacterial staining	05
• Biochemical experiment	06
• Practical based on Instrumentation (Chromatography/ pH meter/microscope/centrifuge.	05
• Spotting (5 spots)	10
7 Viva	05
8. Sessional	05