ST JOSEPH'S UNIVERSITY

BENGALURU-27

SCHOOL OF LIFE SCIENCES

DEPARTMENT OF ZOOLOGY

SEP SYLLABUS FOR UNDER GRADUATE PROGRAME

FOR THE BATCH OF 2024-2027

SEMESTER - I

SUMMARY OF CREDITS

DEPARTMENT OF ZOOLOGY (Undergraduate) (2024 onwards)								
Semester I	**Code Number**	**Title**	**No of hours of instructions**	**Number of hours of teaching per week**	**Number of credits**	**Continuous Assessment (CA) Marks**	**End semester marks**	**Total marks**
Theory	ZO 124	**INVERTEBRATE ZOOLOGY**	45	3	3	40	60	100
Practical	ZO 1P124	**INVERTEBRATE ZOOLOGY - PRACTICAL**	30	3	2	25	25	50

CORE COURSES (CC)	
Course Title	**Code Number**
Invertebrate Zoology	ZO 124
Invertebrate Zoology – Practical	ZO 1P124

COURSE CONTENT

Semester	**I**
Paper Code	**ZO 124**
Paper Title	**INVERTEBRATE ZOOLOGY**
Number of teaching hours per week	**3**
Total number of teaching hours per semester	**45**
Number of credits	**3**

OBJECTIVE
To explain the classification, basic structural and functional aspects of Animal diversity in Invertebrates

COURSE OUTCOME
At the end of the course the student should be able to: • Understand the criteria for classification • Comprehend the International rules and different systems of animal nomenclature • Learn and appreciate the diversity, distinguishing features and functional aspects of different Invertebrate phyla. • Identify the resemblance and evolutionary significance of larval forms across the phylum Annelida, Arthropoda and Echinodermata.

INVERTEBRATE ZOOLOGY	HOURS
Unit I: INTRODUCTION	**5 hrs**
• Highlights of invertebrate origin • Systematics- Binomial and Trinomial nomenclature • International Rules of Zoological nomenclature (ICZN)	3
Criteria employed in classification • Organization, symmetry, Germ layers. • Acoelom, Pseudocoelom and Eucoelom • Segmentation, Metamerism and Cephalization • Modern taxonomic methods	2
Unit II: ANIMAL-LIKE PROTISTS	**5 hrs**
• Distinguishing features and classification up to classes • Special emphasis on class characteristics with suitable examples **(Self-study)**	1 1
• Reproduction in Protozoans- Asexual reproduction: Binary fission, Multiple fission, Plasmotomy, budding. Sexual reproduction: Conjugation in *Paramecium caudatum.*	1
• Locomotion and Nutrition in Protozoans	2
Unit III: PORIFERA	**4 hrs**
• Distinguishing features and classification, up to classes • Special emphasis on class characteristics with suitable examples	1
• Canal system - Types, canal system in Sycon and functions • Cell types and Skeleton in Sponges - Spicules and spongin fibres. **(Self-study)**	3
Unit IV: CNIDARIA	**4 hrs**
• Distinguishing features and classification, up to classes • Special emphasis on class characteristics with suitable examples	1
• Type study: External features and life cycle of Aurelia • Corals- types of corals and theories of coral reef formation - Daly's theory	3

Unit V: HELMINTHES	**4 hrs**
• Distinguishing features and classification, up to classes • Special emphasis on class characteristics with suitable examples	1
• Regeneration in Planaria (*Dugesia*) - Child's axial gradient theory	1
• Parasitic adaptations in tapeworm and liver fluke. • *Ascaris lumbricoides* and *Ancylostoma duodenale* **(Self-study)**	2
Unit VI: ANNELIDA	**6 hrs**
• Distinguishing features and classification, up to classes • Special emphasis on class characteristics with suitable examples	2
• Reproduction and development: Nereis and Heteronereis- Atoke and epitoke. Trochophore larva and its phylogenetic significance (**Self-study**)	2
• Earthworm: morphology and digestive system	2
Unit VII: ARTHROPODA	**7 hrs**
• Distinguishing features and classification, up to classes • Special emphasis on class characteristics with suitable examples	2
• Unique features and systematic position of Peripatus.	1
• Larval forms in crustaceans- Nauplius, Metanauplius, Protozoea, Zoea, Mysis.	2
• Metamorphosis- Types and neuroendocrine regulation	2
Unit VIII: MOLLUSCA	**5 hrs**
• Distinguishing features and classification, up to classes • Special emphasis on class characteristics with suitable examples • Torsion and coiling in Gastropods	2 hr
• Freshwater mussel- externals, C.S. of shell and respiratory system.	2
• Structure and function of foot in – *Neopilina*, *Chiton*, *Mytilus, Pila, Dentalium* and Octopus **(Self-study)**	1
Unit IX: ECHINODERMATA AND MINOR PHYLA	**5 hrs**
• Distinguishing features and classification, up to classes • Special emphasis on class characteristics with suitable examples	2
• Type study: Water vascular system in starfish	1

• Echinoderm larval forms: Bipinnaria larva and its phylogenetic significance (**Self-study**)	1
• Concept of Minor phyla, List of minor phyla with examples • Salient features and affinities of Rotifers	1

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Pedagogy

- **Teaching methods**: Lecture/ Presentation/ videos/ models.
- **Learning activities**: Presentation/ group discussion/ Seminar
- **Learning assessment**: Assignment/ Term Papers/ Test

Formative assessment

Assessment	Marks
Mid semester examination	20
Written Assignment/Presentation/Project /Seminar – I- CA-1	10
Written Assignment/Presentation/Project /Seminar – II- CA-II	10
Total	**40**

End of semester question paper pattern

Questions	With choices	Total marks
1 mark	10 x 1	10
5 marks	4 x 5 (6 questions)	20
10 marks	3 x 10 (5 questions)	30
	Total	**60**

Course Content - Practical

Semester	**I**
Paper Code	**ZO 1P124**
Paper Title	**INVERTEBRATE ZOOLOGY - PRACTICAL**
Number of Laboratory hours per week	**3**
Total number of laboratory hours per semester	**30**
Number of credits	**2**

OBJECTIVE
To impart practical knowledge on systematics, morphology, anatomy of invertebrates and reinforce the basic laboratory skills including microscopy, dissection and observation of animal diversity.

COURSE OUTCOME
At the end of the course the student should be able to: • Identify the systematic position of selected invertebrates through observation of preserved specimens. • Describe the external morphology and biological significance of invertebrates. • Analyse the different taxonomic groups based on anatomy and structural arrangements. • Identify the appendages of prawn and a thorough understanding of its body plan. • Describe the external morphology of *Drosophila melanogaster* • Comprehend the organ systems in *Drosophila melanogaster* larval stages

Sl. No.	Practical course content	Units
1	**PROTOZOA** • **Slides:** *Euglena, Entamoeba, Trypanosoma, Plasmodium, Paramecium* – w.m., /conjugation, *Vorticella, Noctiluca*	1
2	**PORIFERA & CNIDARIA**	1

	• **Spotters:** Sycon, *Hyalonema, Euplectella, Hydra, Physalia*, *Aurelia*, Sea anemone and Corals-*Fungia, Astrea, Alcyonium* • **Slides:** Ephyra larva, T. S. of sea anemone, Spicules and Gemmule	
3	**HELMINTHES** • **Spotters:** *Planaria*, Tapeworm Liverfluke, male roundworm, female roundworm • **Slides:** T. S. of male roundworm, T. S. of female roundworm, Scolex	1
4	**ANNELIDA** • **Spotters:** *Nereis*, Heteronereis, *Chaetopterus, Aphrodite, Arenicola, Sabella.* • **Slides:** Parapodium, Trochophore larva, Earthworm (T.S. passing through the typhlosolar region).	1
5	**ARTHROPODA** • **Spotters:** *Peripatus, Limulus,* Centipede, Millipede, *Apis*, Silk moth • **Slides:** Nauplius larva, Mysis Larva	1
6	**MOLLUSCA** • **Spotters:** *Chiton, Cypraea,* Pearl Oyster, *Haliotis, Dentalium, Nautilus*, *Sepia,* Cuttle bone, Octopus.	1
7	**ECHINODERMATA** • **Spotters:** Star fish, Brittle star, Sea lily, Sea urchin, Cake urchin, Sea cucumber. • **Slides:** Pedicellaria, Bipinnaria larva.	1
8	**TYPE STUDY- I** • Brain and digestive system of *Drosophila melanogaster* larvae	1
9	**TYPE STUDY - II** • Nervous system of Prawn Mounting of Prawn appendages	1
`10	• Collection and study of external morphology of *Drosophila melanogaster* – Body segments, bristle and ommatidia	1

Pedagogy

- **Teaching methods**: Lecture/ Presentation/ videos/models.
- **Learning activities**: Identification, type study and recording observations
- **Learning assessment**: Record keeping, Written test

Formative assessment

Assessment	Marks
End of semester examination	25
Practical Internal Assessment	25
Total	**50**

Practical end of semester examination pattern

Q. No	Question pattern	Marks
1	Identify, classify and comment on the given spotters with neat labelled diagram (A, B and C)	3 X 4 = 12
2	Identify/classify and comment on the given slides with neat labelled diagram (D and E)	2 X 4 = 8
3	Type study	05
	Total	**25**

SEMESTER - II

SUMMARY OF CREDITS

DEPARTMENT OF ZOOLOGY (Undergraduate) (2024 onwards)								
Semester II	**Code Number**	**Title**	**No. of hours of instructions**	**Number of hours of teaching per week**	**Number of credits**	**Continuous Assessment (CA) Marks**	**End semester marks**	**Total marks**
Theory	ZO 224	**CHORDATE ZOOLOGY**	45	03	03	40	60	100
Practical	ZO 1P224	**CHORDATE ZOOLOGY – PRACTICAL**	30	03	02	25	25	50

CORE COURSES (CC)	
Course Title	**Code Number**
Chordate Zoology	ZO 224
Chordate Zoology – Practical	ZO 1P224

COURSE CONTENT

Semester	**II**
Paper Code	**ZO 224**
Paper Title	**CHORDATE ZOOLOGY**
Number of teaching hours per week	**3**
Total number of teaching hours per semester	**45**
Number of credits	**3**

OBJECTIVE
To provide students with an in-depth knowledge of the diversity and biology of chordate forms and enable students to identify and classify them in their respective groups.

COURSE OUTCOME
At the end of the course, the student should be able to: • Learn the origin of chordates • Learn the general characters of chordates • Understand the chordate evolutionary tree • Identify unique and peculiar features of each class of chordates • Compare and contrast the evolution of anatomical structures in different groups of chordates

CHORDATE ZOOLOGY	HOURS
Unit I: HEMICHORDATA AND RECENT TRENDS IN CHORDATE SYSTEMATICS	**3 hrs**
• Hemichordates: Features, classification with examples, and systematic position	**2**
• Prominent Zoologists and Institutes in India associated with Chordate systematics.	**1**
Unit II: GENERAL FEATURES OF CHORDATES	**7 hrs**
• Salient features of Chordates and recent trends in classification Chordate origins: A brief account of Barrington's Combined theory	**2**
• Cephalochordata: Salient features of Cephalochordates, Amphioxus- External morphology, Feeding and digestion	**3**
• Urochordata: Salient features of Urochordates • Ascidian tadpole and retrogressive metamorphosis **(Self-study)**	**2**
Unit III: AGNATHA	**3 hrs**
• Salient features of Agnatha, Classification up to classes **(Self-study)**	**1**
• Ammocoete larva- structure and its phylogenetic significance	**1**
• Organisation and evolutionary significance of Ostracoderms	**1**
Unit IV: PISCES	**5 hrs**
• General characters – with emphasis on the primary aquatic adaptations. Outline classification.	**1**
• Differences between cartilaginous & bony fishes	
• Organisation and evolutionary significance of Placoderms	**1**
• Type study: Circulatory and Respiratory systems of shark	**2**
• Features and Evolutionary significance of Dipnoi	**1**
Unit V: AMPHIBIA	**7 hrs**
• General characters, Classification up to orders • Origin of amphibia and adaptation to life on land **(Self-study)**	**2**
• Type study: A brief account of the digestive, respiratory, circulatory, and urogenital systems of Frog	**4**

• Metamorphosis: Neuro-endocrine control of metamorphosis in Amphibia, Pedogenesis and Neoteny	**1**
Unit VI: REPTILIA	**5 hrs**
• General characters with special reference to terrestrial adaptations • Classification with examples	**1**
• A brief account on fossae in reptiles, Living fossil - Sphenodon	**2**
• Mesozoic radiation – Dinosaurs, Pterosaurs, Ichthyosaurs, and Mammal-like reptiles **(Self-study)**	**1**
• General adaptations in snakes including poison apparatus, venom types	**1**
Unit VII: AVES	**4 hrs**
• General characteristics and classification of Aves • Differences between Ratitae and Carinatae	**1**
• Origin of flight, Adaptations for aerial mode of life - anatomical and physiological, mechanism of Gas exchange, Aerodynamics of flight	**2**
• Evolution of endothermy and its significance **(Self-study)**	**1**
Unit VIII: MAMMALS	**7 hrs**
• General characteristics of Mammals, Classification with examples	**1**
• Salient features of Prototheria, Metatheria, Insectivora, Carnivora, Chiroptera, Perissodactyla, Artiodactyla, Cetacea and Proboscidea	**3**
• Origin and evolutionary trends in mammalian diversification with reference to adaptive radiation of limb structure	**2**
• Salient features and outline classification of primates with examples **(Self-study)**	**1**
Unit IX: CHORDATE INTEGUMENT AND SENSORY ORGANS	**4 hrs**
• Integument and its derivatives in vertebrates (epidermal glands, epidermal scales and scutes, horns, hair, claws, nails and hoof)	**2**
• Organs in vertebrates: Olfactory, gustatory, photoreceptors, and statoacoustic organs (lateral line system; electroreception in fishes; echolocation in Bats)	**2**

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Pedagogy

- **Teaching methods**: Lecture/ Presentation/ videos/ models.
- **Learning activities**: Presentation/ group discussion/ Seminar
- **Learning assessment**: Assignment/ Term Papers/ Test

Formative assessment

Assessment	Marks
Mid semester examination	20
Written Assignment/Presentation/Project /Seminar – I-CA-1	10
Written Assignment/Presentation/Project /Seminar – II-CA-II	10
Total	**40**

End of semester question paper pattern

Questions	With choices	Total marks
1 mark	10 x 1	10
5 marks	4 x 5 (6 questions)	20
10 marks	3 x 10 (5 questions)	30
	Total	**60**

Course content - Practical

Semester	**II**
Paper Code	**ZO 1P224**
Paper Title	**CHORDATE ZOOLOGY PRACTICAL**
Number of teaching hours per week	**3**
Total number of teaching hours per semester	**30**
Number of credits	**2**

OBJECTIVE
To impart practical knowledge on systematics, morphology, and anatomy of chordates and train students in basic laboratory skills including mounting, dissection, and identification of animal diversity.

COURSE OUTCOME
At the end of the course, the student should be able to: • Identify representative animals from each class of chordates • Collect and preserve chordate animals • Identify and differentiate various types of scales of fishes • Understand the importance of feet and beak modifications in birds

Sl. No.	Practical course content	Units
1	**MUSEOLOGY** • Collection and preservation of chordates (Videos) https://youtu.be/JwQAAYctdFY • Hemichordates: Balanoglossus, T.S of Proboscis	1
2	**LOWER CHORDATES** • Urochordata- Ascidia, Ascidian tadpole • Cephalochordates- Amphioxus • Agnatha- Petromyzon, Myxine and Ammocoetes larva	1
3	**FISHES-I** • Hammer-headed shark, Electric Ray, Saw fish, Sucker fish, Globe fish, Eel- Muraena, Hippocampus, Flat fish	1

	• Accessory respiratory organs in Anabas, Clarias and Saccobranchus • Demonstration of buoyancy in fishes (Model method)	
4	**FISHES- II** • Mounting of gill apparatus of commercially available fishes • Study of types of tail fins in fishes: Homocercal (Carps), Heterocercal (Shark) & Diphycercal (Lungfish)	**1**
5	**FISHES- III** • Mounting and microscopic examination of fish scale types	**1**
6	**AMPHIBIANS** • Necturus, Ichthyophis, Axolotl, Salamander, Ambystoma, Duttaphrynus, Hyla • Frog endoskeleton: Vertebrae, limb bones, girdles	**1**
7	**REPTILES** • Draco, Phrynosoma, Varanus, Carapace and plastron • Venomous and non-venomous snakes- Viper, Cobra, Krait, Sea snake, rat snake	**1**
8	**AVES** • Beak and feet modifications of parrot, duck, eagle, and crow, Identification of different types of feathers (Flight feathers, Contour feathers, Down feathers, and Filoplume) • Bird endoskeleton - Vertebrae, limb bones, girdles	**1**
9	**MAMMALS- I** • Anteater, Loris, Mongoose, and Bat • Virtual dissection of Rat (Video)	**1**
10	**MAMMALS- II** • Study of Taxidermic methods (Using specimens available in the museum and videos) • Study of epidermal derivatives: Horns, Hooves, Nails, Skin glands, and hair	**1**

Pedagogy

- **Teaching methods**: Lecture/ Presentation/ videos/ Virtual labs
- **Learning activities**: Identification, Individual or group Field oriented Project/ visit to a research institute.
- **Learning assessment**: Record keeping, Project report, Written test

Formative assessment

Assessment	Marks
End Semester Examination	25
Practical Internal Assessment	25
Total	**50**

Practical end of semester examination pattern

Q. No	Question pattern	Marks
1	Identify, classify and comment with a diagram on the specimen (A, B and C)	3 X 4 = 12
2	Comment on D and E (Taxidermy method / Endoskeleton/ question on virtual dissection)	2 X 2 = 4
3	Mount the given material and report the morphological features (fish scale/gill apparatus)	4
4	Field report	5
	Total	**25**

SEMESTER – III

SUMMARY OF CREDITS

DEPARTMENT OF ZOOLOGY (Undergraduate) (2024 onwards)								
Semester III	**Code Number**	**Title**	**No. of hours of instructions**	**Number of hours of teaching per week**	**Number of credits**	**Continuous Assessment (CA) Marks**	**End semester marks**	**Total marks**
Theory	ZO 325	**Human Anatomy and Physiology - I**	45	03	03	40	60	100
Practical	ZO 3P125	**Human Anatomy and Physiology – I PRACTICAL**	30	02	02	25	25	50

CORE COURSES (CC)	
Course Title	**Code Number**
Human Anatomy and Physiology – I	ZO 325
Human Anatomy and Physiology - I Practical	ZO 3P125

COURSE CONTENT

Semester	**III**
Paper Code	**ZO 325**
Paper Title	**Human Anatomy and Physiology - I**
Number of teaching hours per week	**3**
Total number of teaching hours per semester	**45**
Number of credits	**3**

OBJECTIVE
To study the structure, function, and organization of the various organ systems of the human body

COURSE OUTCOME

At the end of the course, the student should be able to:

- Identify the components of the cardiovascular system and their function; under stand heart mechanics and control of cardiac output; understand hemodynamic and control of blood flow, and functions of blood.
- Identify components of the respiratory system; understand the lung mechanics, ventilation, lung volumes, gas exchange and regulation of respiration.
- Identify the components and functions of the lymphatic system,
- Identify the components of the skeletal system and their functions
- Be aware of normal function, disorders and preventive measures pertaining to the afore mentioned systems.

HUMAN ANATOMY AND PHYSIOLOGY – I	**HOURS**
Unit -I: SKELETAL SYSTEM	**15 hrs**
Human skeletal characteristics – An introduction to Concept of skeletal system and bone types	2
An account on structure and function of the Axial skeleton: • Skull and Facial bones • Vertebral column - Atlas, Axis, Typical cervical, Seventh cervical, Thoracic, Lumbar Vertebrae, Sacrum, Coccyx • Inter Vertebral disc – Slip Disc	7

• Thoracic cage with reference to the Sternum and ribs	
Appendicular skeleton: • Pectoral girdle –Clavicle and Scapula • Bones of the upper limb – Humerus, Radius, Ulna, Carpels, Metacarpals and Phalanges. • Pelvic girdle – Innominate Bone • Bones of the lower limb- Femur, Patella, Tibia, Fibula, Tarsals, Metatarsals and Phalanges.	6
Unit -II: DIGESTIVE SYSTEM	**10 hrs**
A detailed account of the digestive system • Oral cavity, Gross structure of the tongue. Structure of tooth and dentition. • Alimentary canal: Gross structure, histo-morphology and its functions. • Associated glands: Liver and Pancreas – location, shape and gross structure	6
Digestive secretions and mechanism of control: • Salivary, gastric –Bile, Pancreatic and intestinal secretions – digestive enzymes, substrates and products • Nervous and hormonal control of digestive secretions • Disorders of digestive system- Hyperacidity, ulcers cirrhosis of liver, gall stones and appendicitis. **(self-study).**	4
Unit -III: CIRCULATORY SYSTEM	**9 hrs**
• Heart – Location, shape and structure	2
• Cardiac physiology: Mechanical – cardiac cycle and electrical conduction – Pacemaker	2
• Double circulation • A brief account of the Arterial and Venous system	3
• Disorders: Hypertension, ischemic heart diseases - Mitral stenosis, Atherosclerosis, Coronary heart disease, Angina pectoris - Angioplasty and Bypass surgery**. (self-study)**	1
• A brief introduction to lymphatic system	1

Unit-IV: RESPIRATORY SYSTEM	**12 hrs**
Definition of respiration - external and internal • Anatomy of respiratory system – Nostrils, bones, lining of the nasal passage, functions, internal nares. • Larynx, trachea and branches of the respiratory tree • Structure and function of an Alveolus.	4
• Breathing and its mechanism: Rib cage, shape and structure of diaphragm, central tendon. • External and Internal - Intercostals muscles – arrangement pattern and their movements during expiration and inspiration process. • Concepts of Tidal volume, dead space and alveolar ventilation. Respiratory cycle and its rate	3
Transportation of Respiratory gases: • Transportation of oxygen - Concepts of partial pressures of oxygen and carbon dioxide. • Oxygen dissociation curves - Bohr's effect; factors affecting the oxygen dissociation from Oxyhaemoglobin. • Transportation of carbon-dioxide - Hamburger's phenomenon. • Concept of Respiratory quotient.	3
• Respiratory pigments – Properties and types of pigments - haemoglobin, haemocyanin, haemoerythrin and chlorocruorin. **(self-study)**	1
Respiratory disorders: • A brief account on Asthma and Pneumonia – Etiology and anatomical changes	1

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14. TEXTBOOK OF MEDICAL PHYSIOLOGY by Guyton & Hall, Elsevier

Pedagogy:

Teaching methods: Lecture/ Presentation/ videos/ models.

Learning activities: Presentation/ group discussion/ Seminar

Learning assessment: Assignment/ Term Papers/ Test

Formative assessment

Assessment	Marks
Mid semester examination	20
Written Assignment/Presentation/Project /Seminar – I-CA-1	10
Written Assignment/Presentation/Project /Seminar – II-CA-II	10
Total	**40**

End of semester question paper pattern

Questions	With choices	Marks
1 mark	10 x 1	10
5 marks	4 x 5 (6 questions)	20
10 marks	3 x 10 (5 questions)	30
	Total	**60**

COURSE CONTENT - PRACTICAL

Semester	**III**
Paper Code	**ZO 3P125**
Paper Title	**Human Anatomy and Physiology - I**
Number of teaching hours per week	**3**
Total number of teaching hours per semester	**45**
Number of credits	**3**

OBJECTIVE

To familiarize students with various body structures and systems through models and diagrams and to observe and understand how different physiological processes, such as respiration, circulation and digestion occur in the human body. To interpret the relationship between the anatomical structure of organs or tissues and their corresponding physiological functions.

COURSE OUTCOME

At the end of the course, the student should be able to:

1. To identify, locate, and describe the structure and function of the major organs and systems of the human body.
2. To explain and observe the physiological functions of organs and systems, such as heart rate regulation, respiratory patterns, digestion and neural control.
3. Enhanced critical thinking and problem-solving skills by applying theoretical knowledge to practical lab scenarios, interpreting experimental results, and proposing solutions to physiological or anatomical anomalies.

Sl. No.	HUMAN SKELETAL SYSTEM	4 units
1	Skull and facial bones	1
2	Vertebrae – Atlas, Axis, Typical Cervical, 7th Cervical Vertebrae, Thoracic Vertebrae, Lumbar Vertebrae, Sacrum and Coccyx, Ribs.	1
3	Scapula and clavicle; Humerus, radius and ulna	1
4	Innominate (ox coxae or hip) bone; femur, tibia and fibula.	1

	PHYSIOLOGY	6 units
5	Estimation of oxygen consumption by an aquatic animal in unit time.	1
6	Analysis of ascorbic acid in various biological samples.	1
7	Effects of temperature and pH on the activity of salivary amylase.	1
8	Qualitative analysis of Proteins, Carbohydrates and lipids	1
9	Estimation of Haemoglobin by Sahli's method	1
10	Estimation of Arterial blood pressure and heart beat in humans during normal and physical exhaustion states.	1

Pedagogy:

Teaching methods: Lecture/ Presentation/ videos/ Virtual labs.

Learning activities: Identification of field species / visit to a research institute.

Learning assessment: Record keeping, Written test.

Formative assessment

Assessment	Marks
End Semester Examination	**25**
Practical Internal Assessment	**25**
Total	**50**

Practical end of semester examination pattern

Q. No	Question pattern	Marks
1	Identify and comment with a diagram on the specimen (A, B, C, D and E)	5 X 3 = 15
2	Physiology experiment	1 X 10 = 10
	Total	**25**

SEMESTER - IV

SUMMARY OF CREDITS

DEPARTMENT OF ZOOLOGY (Undergraduate) (2024 onwards)								
Semester IV	**Code Number**	**Title**	**No. of hours of instructions**	**Number of hours of teaching per week**	**Number of credits**	**Continuous Assessment (CA) Marks**	**End semester marks**	**Total marks**
Theory	ZO 425	**Human Anatomy and Physiology - II**	45	03	03	40	60	100
Practical	ZO 4P125	**Human Anatomy and Physiology – II Practical**	30	03	02	25	25	50

CORE COURSES (CC)	
Course Title	**Code Number**
Human Anatomy and Physiology - II	ZO 425
Human Anatomy and Physiology - II Practical	ZO 4P125

COURSE CONTENT

Semester	**IV**
Paper Code	**ZO 425**
Paper Title	**Human Anatomy and Physiology - II**
Number of teaching hours per week	**3**
Total number of teaching hours per semester	**45**
Number of credits	**3**

OBJECTIVE
To study the structure, function, and organization of the various organ systems of the human body

COURSE OUTCOME
At the end of the course, the student should be able to: • Identify the components of the muscular system and their organization and function; compare the types of muscle tissues • Describe the structures and functions of the nervous system and the special sense organs • Identify the structures of the urinary system; understand the physiological proc esses of urine formation neural and endocrine control of those process; and explain the physiology of water balance. • Identify the components of the endocrine system and understand the principles of action of hormones • Understand the anatomy & physiology of the male and female reproductive system • Be aware of normal function, disorders and preventive measures pertaining to the afore mentioned systems.

Human Anatomy and Physiology - II	HOURS
Unit 1: MUSCULAR SYSTEM • Muscle - types and characteristics. Composition and ultra structure of the muscle sarcomere, muscle proteins - actin and myosin • Muscle physiology: Mechanism of muscle contraction	**4**
Unit 2: EXCRETORY SYSTEM • Types and formation of nitrogenous wastes: Ammonia, Uric acid and Urea, Ornithine cycle. • The Kidneys: Renal anatomy, Structure of the nephron and functions. • Physiology of urine formation and composition of urine. • Renal failure - Dialysis. Renal calculi- causes and types **(Self-study)**	**5**
Unit 3: REPRODUCTIVE SYSTEM • Introduction to reproductive system and reproduction • Female reproductive system – External genitalia- Vulva, Vagina, cervix, Uterus, Fallopian tubes, Ovary - internal structure, ovarian follicular stages. • Male reproductive system- Testes, epididymis, spermatic cord, ejaculatory ducts and urethra. Penis - structure • Accessory glands- Prostate, seminal vesicles, bulbourethral (Cowper's) glands and its secretions – nature and functions	**5**
Unit 4: HOMEOSTASIS • **I**nternal environment and equilibrium - feedback mechanisms with examples. Body fluids and types **(self-study)** • **Osmoregulation:** Mechanism of Salt - water balance • **Thermoregulation:** Features of ectotherms, endotherms and heterotherms. Difference between poikilotherms, homeotherms, steno and eurythermal animals. Role and mechanism of hypothalamus in thermoregulation.	**6**

• Adaptive thermoregulation: hibernation, aestivation, frostbite and heatstroke	
Unit 5: NERVOUS SYSTEM • Organization of the nervous system – CNS, PNS & ANS. • Brain – Anatomy, meninges, ventricles of the brain, Cerebrospinal fluid and its function • Nerve impulse - properties, origin and conduction along the axon. • Synapse- Definition, types – chemical, electrical and synaptic transmission. • Neurotransmitters – Types and functions • Spinal cord – Anatomy and reflex arc • Types of neurons: Unipolar, Bipolar & Multipolar - Structure and Function **(self-study)**	**10**
Unit 6: ANATOMY OF THE HUMAN EYE • Layers of the eye wall, cornea, lens, ciliary body, suspensory ligaments. Retina – types of photosensitive cells – rods and cones – structure and pigments. Yellow spot – Macula and Fovea centralis. Blind spot, optic nerves and chiasma. • Physiology of vision: Binocular vision, role of visual pigments. • Abnormalities of refraction of the eye: Myopia and Hypermetropia. Causes and corrective measures **(self-study)** **ANATOMY OF THE EAR**: • Structure – external, middle and internal. Structure and Physiology of hearing and balance – static and dynamic equilibrium.	**5**
Unit 7: ENDOCRINOLOGY • Brief introduction of the endocrine system. Differences between Endocrine and Exocrine glands. • **PITUITARY GLAND –** Embryonic origin, position, gross structure and cellular constituents. Hormones of the Anterior, intermediate and Posterior lobes.	**10**

• Hormonal disorders: Diabetes insipidus, Growth hormone disorders (acromegaly, gigantism and Dwarfism) **(self-study)** • **THYROID AND PARATHYROID GLAND:** Position, shape and structure. • Hormones: Thyroxine – synthesis and functions. Parathormone: Functions. • Role of Calcitonin and Parathormone in calcium homeostasis • Hormonal disorders: Hypothyroidism (Myxoedema and Goitre, Cretinism) and Hyperthyroidism (Grave's disease). • **ISLETS OF LANGERHANS:** Location and structural organization. Hormones - Glucagon, Insulin, Somatostatin and Functions. • Hormonal disorders: Diabetes mellitus - Type I and Type II (Differences, Symptoms and management) **(Self-study)** • **ADRENAL GLAND:** Location, structural organization. Hormones- Cortex: glucocorticoids, mineralocorticoids and androgens. Medulla – epinephrine and nor epinephrine. Physiological role of the hormones and hormonal disorders – Cushing's and Addison's syndromes.	

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Pedagogy:

Teaching methods: Lecture/ Presentation/ videos/ models.

Learning activities: Presentation/ group discussion/ Seminar

Learning assessment: Assignment/ Term Papers/ Test

Formative assessment

Assessment	Marks
Mid semester examination	20
Written Assignment/Presentation/Project /Seminar – I-CA-1	10
Written Assignment/Presentation/Project /Seminar – II-CA-II	10
Total	**40**

End of semester question paper pattern

Questions	With choices	Marks
1 mark	10 x 1	10
5 marks	4 x 5 (6 questions)	20
10 marks	3 x 10 (5 questions)	30
	Total	**60**

Course content - Practical

Semester	**IV**
Paper Code	**ZO 4P125**
Paper Title	**Human Anatomy, Physiology – II and Comparative Anatomy practical**
Number of teaching hours per week	**3**
Total number of teaching hours per semester	**30**
Number of credits	**2**

OBJECTIVE
To equip students with practical skills and knowledge in anatomy, physiology, and comparative anatomy, fostering a better understanding of human health and evolutionary biology.

COURSE OUTCOME
At the end of the course, the student should be able to: **1.** To explore the relationship between structure and function in the human body. **2.** Understanding how the anatomical design of organs supports their physiological roles and to measure and analyse physiological parameters. **3.** To compare the anatomical structures and organ systems of humans with those of other species (e.g., mammals, reptiles, birds) to observe evolutionary adaptations and functional differences.

Sl. No.	Practical course content	Units
1	Tests for ammonia, Urea and Uric acid	1
2	Estimating the amount of salt lost or gained by the given aquatic animal (fish/crab) in unit time when transferred from one medium to another	1
3	Estimation of creatinine in the urine sample	1

4	Analysis of abnormal constituents in urine for the presence of ketone, albumin and reducing sugar	1
5	Effect of temperature on the rate of opercular movement in an aquarium fish	1
6	Estimation of glycogen by anthrone reagent	1
7	Weight changes in freshwater fish exposed to heterosmotic media	1
8	Comparative study of the brain of fish, amphibian, reptile, bird and rat or any mammal	1
9	Comparative study of the heart of fish, amphibian, reptile, bird and rat or any mammal	1
10	Comparative study of the skin of fish, amphibian, reptile, bird and mammal	1

Pedagogy:

Teaching methods: Lecture/ Presentation/ videos/ Virtual labs.

Learning activities: Identification of field specimens/ visit to a research institute.

Learning assessment: Record keeping, Written test.

Formative assessment

Assessment	Marks
End Semester Examination	25
Practical Internal Assessment	25
Total	**50**

Practical end of semester examination pattern

Q. No	Question pattern	Marks
1	Physiology – Major experiment	1 X 10 = 10
2	Physiology – Minor experiment	1 X 7 = 7
3	Comparative Anatomy	1 X 8 = 8
	Total	**25**