



M. C. E. Society's

Abeda Inamdar Senior College

Of Arts, Science and Commerce, Camp, Pune-1

(Autonomous) Affiliated to Savitribai Phule Pune University

NAAC accredited 'A' Grade

T.Y.B.Sc. Zoology (NEP Pattern)

Semester	Offered as	Course code	Title of course	No. of credits
V	Minor	23SBZO51MN	INTRODUCTION TO CHORDATES II	02
V	Minor	23SBZO52MN	PRACTICAL COURSE ON CHORDATES II	02
V	VSC	23SBZO51VS	HANDS ON TRAINING ON MICROTOMY (Practical)	02



M. C. E. Society's

Abeda Inamdar Senior College

Of Arts, Science and Commerce, Camp, Pune-1

(Autonomous) Affiliated to Savitribai Phule Pune University

NAAC accredited 'A' Grade

T.Y.B.Sc. Zoology (NEP Pattern)

Course Title	INTRODUCTION TO CHORDATES II		
Course Code:	23SBZO51MN		
Semester: V		No. of Credits: 02	
Course Type: MN (Minor)		Total Teaching Hours: 30	

Course Objectives	
1.	To understand the key characteristics of reptiles, birds, and mammals.
2.	To differentiate between venomous and non-venomous snakes.
3.	To analyse reptilian and avian adaptations.
4.	To examine mammalian adaptations and diversity.
5.	To investigate adaptive radiation and locomotion in mammals.
6.	To study the anatomy and physiology of the rat as a model organism.

Course Outcome	
1.	The students will be able to demonstrate knowledge of reptilian characteristics and adaptations.
2.	The students will be able to understand snakebite management and first aid.
3.	The students will be able to analyse avian evolution and adaptations.
4.	The students will be able to classify and distinguish mammalian features and adaptations.
5.	The students will be able to explore mammalian diversity through adaptive radiation.
6.	The student will be able to examine the anatomy and physiology of the rat as a model organism.

7.	The learner will be able to apply comparative anatomy and functional morphology concepts.
----	---

Syllabus		
INTRODUCTION TO CHORDATES I		
Unit I	Introduction to class – Reptilia	06 hours
	1. Salient features of class Reptilia 2. Venomous and Non-venomous snakes – Cobra, Russell’s viper, Rat snake, Grass snake. 3. Poison apparatus and biting mechanism 4. Snake venom- Nature and effects. 5. First aid treatment of snakebite. 6. Desert adaptations in reptiles in brief.	
Unit II	Introduction to class –Aves	06 hours
	1. Salient features of class Aves 2. <i>Archaeopteryx</i> - a connecting link; 3. Flight adaptations in birds. 4. Types of Beaks and feet in birds. 5. Migration in birds – Altitudinal, Latitudinal, Diurnal and Nocturnal	
Unit III	Introduction to class - Mammalia	07 hours
	1. Salient features of class Mammalia 2. Egg laying mammals. 3. Aquatic adaptations in mammals. 4. Flying adaptations in mammals. 5. Cursorial and fossorial adaptation in mammals. 6. Dentition in mammals 7. Marsupials and primates in brief with examples	
Unit IV	Study of Rat	11 hours
	1. Systematic position, habit, habitat and external characters. 2. Digestive system, food, feeding and physiology of digestion. 3. Respiratory system. 4. Blood vascular system – Structure of heart. 5. Nervous system – Central nervous system only. 6. Sense organs- Structure and functions of eye and ear 7. Reproductive system.	

Suggested Readings

1. T.J. Parker and W.A. Haswel, Edited by Marshall and Williams, (1992), Text Books of Zoology, Invertebrates Vol- II, CBS publications and distribution, New Delhi.
2. Hickman CP, Roberts LS & Larson A., Integrated Principles of Zoology, Eleventh Edition International Edition, The McGraw-Hill Companies, Inc.,
3. R. L. Kotpal, 3rd edn. Modern Text Book of Zoology, Vertebrates Rastogi Publications, Meerut.
4. P. S. Dhami and J. K. Dhami, (1982), Chordate Zoology, R. Chand and Co., New Delhi.
5. Campbell and Reece. 7th Edn. Biology, Pearson Education in South Asia, Delhi.
6. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
7. Pough H., (2018), Vertebrate life, X Edition, Pearson International.
8. Hickman C. P., Roberts L. S.& Larson A. Integrated Principles of Zoology, Eleventh Edition, International Edition, The McGraw-Hill Companies, Inc.,
9. Arora M.P. Chordates I. Himalaya Publications.
10. R.S. Lull. Organic Evolution. Light & Life Publishers.
11. Jordan E. L. & Verma P. S. (2003), Chordates Zoology. S. Chand & Company Ltd. New Delhi.
12. Campbell Nand Reece Biology, 7th Edn. Pearson Education in South Asia, Delhi
13. Fishes. Mary Chandy. N.B.T. India, 2005.
14. Economic Zoology, Shukla Upadhyay, Rastogi Publication, Meerut, India, 1998.
15. Fisheries Developments, K.K. Trivedi, Oxford and IBH Pub. Co.
16. Marine Fishes in India, 1990, D.V. Bal & K. Virabhadra, Tata McGraw Hill Publication.
17. Fishery Management, 1990, S.C. Agarwal, Avinash Publication House, New Delhi.



M. C. E. Society's

Abeda Inamdar Senior College

Of Arts, Science and Commerce, Camp, Pune-1

(Autonomous) Affiliated to Savitribai Phule Pune University

NAAC accredited 'A' Grade

T.Y.B.Sc. Zoology (NEP Pattern)

Course Title	PRACTICAL COURSE ON CHORDATES II		
Course Code	23SBZO52MN		
Semester: V		No. of Credits: 02	
Course Type: MN (Minor)		Total Teaching Hours: 60	

Course Objectives	
1.	To explore the diversity, morphology, and taxonomy of Class Reptilia, Class Aves and Class Mammalia.
2.	To investigate the evolutionary connections between reptiles and birds through the study of fossils, such as Archaeopteryx, and morphological comparisons.
3.	To evaluate the ecological adaptations and functional morphology of mammals adapted for diverse activities such as running and burrowing.
4.	Study and differentiate the skull and dental structures of herbivorous, carnivorous, and omnivorous mammals to understand dietary adaptations.
5.	To appreciate mammalian diversity by observing and classifying marsupials and primates based on their adaptations.
6.	To enhance observational and reporting skills through field studies, including visits to zoos, wildlife sanctuaries, and bird sanctuaries, and through comparative studies in campus biodiversity.
7.	To develop presentation and analytical skills through student-led discussions and power-point presentations on selected animal species.
8.	To analyse the anatomical features and physiological systems of Class Mammalia, focusing on rats, cats, bats, and humans, including detailed studies of the digestive system, heart, brain, and sensory organs.

Course outcome	
1.	The student will be able to Identify and distinguish between various species within Classes Reptilia, Aves, and Mammalia, utilizing museum specimens and pictorial taxonomic keys.
2.	The student will be able examine and interpret the diversity in avian beak and foot structures, correlating these adaptations to their ecological niches and feeding behaviors.
3.	The student will be able to perform detailed anatomical studies on mammals, particularly the rat, to understand the structure and function of the digestive system, heart, brain, and sensory organs.
4.	The learner will be able to Analyze fossil evidence, such as Archaeopteryx, to elucidate the evolutionary connections between reptiles and birds.
5.	The student will be able to compare and contrast the limb structures of mammals adapted for different modes of locomotion.
6.	The student will be able to study and differentiate the skull and dental structures of herbivorous, carnivorous, and omnivorous mammals to understand dietary adaptations.
7.	The student will be able to observe and classify specimens of marsupials and primates, noting their unique adaptations and diversity within the mammalian lineage.
8.	The student will be able to conduct field observations to assess and document the diversity of reptilian and avian species in and around the campus environment.
9.	The student will be able to prepare detailed reports and deliver presentations on zoological studies, demonstrating the ability to communicate scientific findings effectively.

	Syllabus
Sr. No	Title with Contents
1.	Museum study of Class Reptilia: <i>Calotes</i> , <i>Chelone</i> , <i>Crocodile</i> , <i>Sphenodon</i>
2.	Identification of Venomous & Non-venomous snakes with the help of pictorial taxonomic keys. – (D) -Compulsory
3.	Museum study of Class Aves: Crow, Kingfisher & Duck
4.	Study of types of beak in birds – Any four.
5.	Study of types of feet in birds – Any four.
6.	Museum study of Class Mammalia: Human, Cat & Bat.

7.	Study of external characters of Rat.
8.	Study of digestive system of Rat.
9.	Study of heart of rat. - (D) -Compulsory
10.	Study of brain of Rat.
11.	Study of reptilian/avian diversity in and around the campus (2 P) Compulsory
12.	Compulsory visit to Zoo / Wildlife sanctuary / Bird sanctuary, report writing and submission. OR Power point presentation on study of any two animals from two different classes by students
13.	Study of fossil images or models of <i>Archaeopteryx</i> , noting features that link reptiles and birds.
14.	Compare the limb morphology of mammals adapted for running (e.g., horse) and burrowing (e.g., mole).
15.	Study of skulls or dental models of herbivores, carnivores, and omnivores to examine differences in dentition related to diet.
16.	Observe and classify preserved specimens or images of marsupials and primates, noting adaptations and diversity.
17.	Study of structure of eye and ear, discussing their function and adaptation in rat.



M. C. E. Society's

Abeda Inamdar Senior College

Of Arts, Science and Commerce, Camp, Pune-1

(Autonomous) Affiliated to Savitribai Phule Pune University

NAAC accredited 'A' Grade

T.Y.B.Sc. Zoology (NEP Pattern)

Course Title	HANDS ON TRAINING ON MICROTOMY		
Course Code	23SBZO51VS		
Semester: V		No. of Credits: 02	
Course Type: VSC (MN)		Total Teaching Hours: 60	

Course Objectives	
1.	To understand the fundamentals of photomicroscopy.
2.	To develop proficiency in slide preparation techniques.
3.	To apply staining techniques for enhanced visualization.
4.	To operate and maintain microscopy equipment.
5.	To analyse and identify different tissue types.
6.	To investigate specific mammalian structures.
7.	To master specialized techniques for chromosomal studies.
8.	To ensure proper slide maintenance and submission.

Course outcome	
1.	The learner is able to understand and operate photomicroscopy equipment to capture high-quality images of biological specimens.
2.	The learner can perform precise preparation of whole mounts, smears, squashes, and microscopic sections.
3.	The learner can apply appropriate fixatives and stains (e.g., hematoxylin and eosin)

	to enhance visualization of biological tissues.
4.	The learner can successfully create and submit properly cleaned, labelled, and preserved slides for academic evaluation.
5.	The learner will be able to identify and describe the histological features of epithelial, connective, muscle, and nervous tissues.
6.	The student will be able to analyse slides of various mammalian structures, including hair, teeth, tongue, stomach, intestines, glands, lungs, kidney, and reproductive organs, to understand their histology and function.
7.	The students can correlate microscopic findings with the functional roles of tissues and organs in mammals.
8.	The students will be able to demonstrate the use of sectioning equipment for trimming, ribbon cutting, spreading, and mounting biological specimens.

	Syllabus
Sr. No	Title with Contents
1.	Photo microscopy- Component, process and application
2.	Preparation of slides- whole mount, smears, squash and microscopic sections
3.	a. Fixation and fixative b. Stains and staining
4.	Dehydrating and clearing
5.	Equipments and tools needed for sectioning
6.	Preparation of microscopic sections-fixations, dehydration and clearing, embedding and block preparation (2P)
7.	Trimming and mounting of block, sectioning, ribbon cutting and spreading(2P)
8.	Hematoxylin and eosin staining
9.	Cleaning, labeling and storing of slides (submission of three slides)
10.	Study of different type of tissues- Epithelial Tissue, Connective Tissue, Muscle Tissue, Nervous Tissue

11.	Study of following permanent slides of mammals - Hair, tooth and tongue
12.	Study of following permanent slides of mammals -stomach, duodenum and ileum,
13.	Study of following permanent slides of mammals - ovary, testis and sperm
14.	Study of permanent slides of following glands in mammals - Adrenal gland, salivary gland, liver and pancreas
15.	Study of following permanent slides of mammals - trachea, lungs and kidney
16.	Study of permanent slides of cardiac muscle, smooth muscle, striated muscle and T. S. of bone
17.	Preparation of squash of salivary glands Drosophila stained in LaCour's Acetic Orcein



M. C. E. Society's

Abeda Inamdar Senior College

Of Arts, Science and Commerce, Camp, Pune-1

(Autonomous) Affiliated to Savitribai Phule Pune University

NAAC accredited 'A' Grade

T.Y.B.Sc. Zoology (NEP Pattern)

Semester	Offered As	Course Code	Title Of Course	No. Of Credits
VI	Minor	23SBZO61MN	Animal Physiology and Biochemistry	02
VI	Minor	23SBZO62MN	Practical Course on Physiology and Biochemistry	02

T.Y.B.Sc. Zoology (NEP Pattern)

Course Title	ANIMAL PHYSIOLOGY AND BIOCHEMISTRY		
Course Code:	23SBZO61MN		
Semester: VI			No. of Credits: 02
Course Type: MN (Minor)			Total Teaching Hours: 30

Course Objectives	
1.	To introduce the fundamental concepts of animal physiology and biochemistry.
2.	To provide an understanding of digestion and absorption of biomolecules such as carbohydrates, proteins, and lipids and vitamins and concept of balanced diet.
3.	To explain the functions of major physiological systems like circulation, respiration, and excretion, muscular, reproductive and endocrine , analyse the structure and function of organs and construct basic flowcharts or models of physiological processes
4.	To understand clinical significance of deficiency diseases of vitamins, carbohydrates, and importance of dialysis and endocrine glands
5.	To describe the concepts of pH, acids, bases, and biological buffers and interpret pH changes and buffer roles in biological systems
6.	To differentiate between types of enzymes, differentiate between types of enzymes, their modes of action and evaluate enzyme activity under varying physical conditions.
7.	To provide an understanding of biomolecules such as carbohydrates, proteins, and lipids and evaluate disorders related to carbohydrates and lipids

Course Outcome	
1.	Students will describe the structure and role of biomolecules in physiological functions.
2.	They will explain digestion, nutrient absorption, and the impact of vitamins on health.
3.	Learners will analyse organ system mechanisms such as respiration, circulation, and excretion.
4.	They will interpret enzyme activity and the influence of various factors.
5.	Students will evaluate clinical conditions based on biochemical and physiological knowledge.
6.	They will apply concepts in real-world contexts such as disease, diagnostics, or experiments.
7.	Learners will develop integrated understanding and problem-solving skills in physiology and biochemistry.

Syllabus		
ANIMAL PHYSIOLOGY AND BIOCHEMISTRY		
Unit I	Nutrition and digestion:	03 hours
	1.1 Nutritional requirement & balanced diet. 1.2 Digestion and absorption of carbohydrates, proteins and lipids. 1.3 Vitamins - outline of fat soluble and water-soluble vitamins; Sources, deficiency and diseases.	
Unit II	Respiration:	02 hours
	2.1 Mechanism of respiration: Regulation of ventilation in lungs, exchange of gases at respiratory surface. 2.2 Transport of gases: O ₂ and CO ₂ transport.	
Unit III	Circulation:	03 hours
	3.1 Blood: Definition and its constituents, functions of blood. 3.2 Heart: Structure of human heart, Pace maker, Cardiac Cycle. 3.3 Origin and conduction of heart beat.	
Unit IV	Excretion:	02 hours
	4.1 Structure of Uriniferous tubule. 4.2 Mechanism of urine formation. 4.3 Elementary idea of dialysis.	

Unit V	Muscles:	02 hours
	5.1 Structure of smooth, skeletal and cardiac muscles. 5.2 Mechanism of muscle contraction by Sliding filament theory.	
Unit VI	Reproduction and Endocrine Glands:	05 hours
	6.1 Physiology of male reproduction, hormonal control of spermatogenesis. 6.2 Physiology of female reproduction, hormonal control of menstrual cycle. 6.3 Structure and functions of pituitary, thyroid, parathyroid, pancreas and adrenal glands.	
Unit VII	pH and Buffers:	03 hours
	1.1 Concept of pH, pH scale & biological significance of pH 1.2 Concept of acid and base, Ionization of acids and bases. 1.3 Buffer - Definition, Concept, Functions, Types of buffer	
Unit VIII	Carbohydrates:	02 hours
	2.1 Definition, Classification & Biological importance of Carbohydrates. 2.2 Significance of Gluconeogenesis, Glycogenolysis and Glycogenesis. 2.3 Clinical Significance - Hypoglycemia and Hyperglycemia.	
Unit IX	Amino acids and Proteins :	02 hours
	3.1. Amino acid, Essential and non-essential amino acids. 3.2 Classification of proteins, 3.3 Biological importance of proteins – Biocatalysts, Carrier proteins Contractile proteins, Hormonal role of proteins.	
Unit X	Enzymes:	04 hours
	4.1 Nomenclature, Types and properties of enzymes. 4.2 Enzyme inhibition. 4.3 Factors influencing enzyme activity (pH, temperature, substrate	

	concentration). 4.5 Introduction of isoenzymes and cofactor.	
Unit XI	LIPID	02 hours
	5.1 Introduction. 5.2. Types of lipid (Simple, Compound, derived)& its biological importance 5.3 Clinical significance (obesity, atherosclerosis, myocardial infarction).	

Reference books

1. Principles of Biochemistry, 1993, Lehninger A. L. Nelson D. L. & Cox M. M. W. H. Freeman Company, USA.
2. Biochemistry, 1995 5th Edn. Zubay G. W, C. Brown Communications USA.
3. Harpers Biochemistry, 1996 26th Edn. p Murray R. K., Granner D. K., Mayes P. A. & Rodwell V. W. Prentice Hall international USA.
4. Outline of Biochemistry, 1995 5th Edn, Conn E. E., Stumph P. K. Bruening G & Doi R. H. John Wiley & Sons, USA.
5. Principals of Biochemistry, 1993, 1st Edn., Pattabhiraman T. N. Gajanan Book publishers and distributors Bangalore.
6. Clinical Biochemistry, 1994, B. P. Godkar, Bhalini Publishing House, Mumbai.
7. Biochemistry, 1995 5th Edn., Stryer San Francisco, W. H. Freeman & Co.
8. Textbook of Medical Physiology, Guyton A. C. & Hall J. E., 2006, 11th Edition, Hercourt Asia Pvt. Ltd. / W. B. Saunders Company
9. Principles of Anatomy & Physiology, 2006, 11th Edition, Tortora G. J. & Grabowski S., John Wiley & sons, Inc.
10. Haematology: De Gruchi.
11. Text book of Animal Physiology, 2008, 2nd Edn. Nagabhushanam, S. V. S. Rana, S. Kalavathy, Oxford University Press, India.
12. Endocrinology, 2005, Lohar P. S., M J P Publishers, Chennai.
13. Vander, Sherman, Luciano's Human Physiology: The Mechanisms of Body Function, 2003, 9th Edn., Eric P. Widmaier, Hershel Raff, Kevin T. Strang, Mc Graw H.

14. Tortora, G. J. and Derrickson, B. H. (2009) Principles of Anatomy and Physiology (12th edition) John Wiley and Sons, Inc.
15. Widmaier, E. P., Raff, H. and Strang, K. T. (2008) Vander's Human Physiology (9th edition) McGraw Hill.
16. Human Anatomy and Physiology, (1998) Marieb, E. (4th edition) Addison-Wesley.

T.Y.B.Sc. Zoology (NEP Pattern)

Course Title	PRACTICAL COURSE ON PHYSIOLOGY AND BIOCHEMISTRY		
Course Code	23SBZO62MN		
Semester: VI		No. of Credits: 02	
Course Type: MN (Minor)		Total Teaching Hours: 60	

Course Objectives	
8.	To recall fundamental physiological and biochemical concepts used in animal studies.
9.	To understand the structure and function of physiological systems using practical experiments (e.g., blood pressure, lung capacity).
10.	To perform biochemical tests to identify carbohydrates, proteins, lipids, and nitrogenous waste products.
11.	To examine the role of enzymes and their activity under various physical conditions like pH and temperature.
12.	To interpret diagnostic data such as ECG, blood glucose levels, and urine abnormalities.
13.	To evaluate the clinical and diagnostic significance of endocrine disorders and enzymatic deficiencies.
14.	To develop hands-on laboratory skills in sample analysis and experiment-based observations relevant to physiology and biochemistry.

Course outcome	
1.	Students will be able to identify and measure basic physiological parameters such as temperature, pulse, and blood pressure.
2.	Learners will demonstrate ability to conduct biochemical tests for detection of biomolecules and waste products.
3.	Students will analyze enzyme activity and effects of variables like temperature and pH using experimental setups.
4.	Students will evaluate clinical test data such as blood glucose levels, abnormal urine constituents, and ECG recordings.
5.	Learners will interpret medical imaging results and endocrine disorder charts to understand physiological malfunctions.

6.	Students will apply haematological techniques like RBC count and osmotic fragility testing using standard tools.
7.	Learners will integrate practical knowledge to simulate basic diagnostic approaches for animal/human health assessment.

	Syllabus
Sr. No	Title with Contents
1.	Measurement of lung capacity using Respirometer Spirometer
2.	Preparation of haemin and haemochromogen crystals.
3.	Enumeration of Red blood cell (RBC) using haemocytometer.
4.	To study the osmotic fragility of red blood cells of human blood using isotonic, hypotonic and hypertonic solutions of sodium chloride.
5.	Interpretation of an Electrocardiogram by recording on a machine or by electrocardiograph.
6.	Tests for Excretory Products of Animals of different habitats.
7.	Detection of abnormal constituents in urine.
8.	Study of disorders caused by endocrine glands with the help of photographs.
9.	Study of Muscle Fatigue Using Hand Grip Dynamometer
10.	Introduction to Medical Imaging – X ray, CT, MRI, and Ultrasound.
11.	Measurement of Temperature, Pulse and Blood Pressure in Humans
12.	Study of pH meter & Preparation of buffer of desired pH and molarity.
13.	Detection of carbohydrates (monosaccharides, disaccharides and polysaccharides) with the help of suitable tests. (C)
14.	Protein estimation by Lowry et al. method. (C)
15.	Isolation of Casein from milk by adjusting iso-electric point. (C)
16.	Assay of salivary amylase activity
17.	The effect of temperature on the activity of alpha amylase.
18.	Clinical significance of enzymes - PKU and AKU.
19.	Estimation of Total Lipids by Sulphophosphovanillin Method.
20.	To estimate the blood glucose level from given sample.

