

SEMESTER -III
DEPARTMENT OF ZOOLOGY
Category I

(B.Sc. Honours in Zoology in three years)

DISCIPLINE SPECIFIC CORE COURSE -7 –:
Diversity of Chordates
Zoo-DSC-7

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Diversity of Chordates Zoo-DSC-7	04	02	Nil	02	Passed Class XII	NIL

Learning Objectives

The learning objectives of this course are as follows:

- The course aims to impart in-depth knowledge about the diverse life forms from the taxonomic positions of Protochordates and Agnatha to Mammalia.
- It will help the students to identify the body plan types of complex chordates and their systematic organization based on evolutionary relationships, structural and functional affinities.
- The course will help the students to understand the characteristic morphological, adaptive and anatomical features of diverse animals.
- The course will help students to understand the economic and ecological significance of various animals in human life.
- The course will create interest among them to explore and appreciate the animal diversity in nature.

Learning Outcomes

By studying this course, students will be able to

- Correlate the importance of systematics, taxonomy, and structural organization of chordates.
- Recognize the diversity of chordates living in varied ecological habitats.
- critically analyse the organization, complexity and characteristic features of chordates.
- comprehend the economic importance of chordates, their interaction with the

environment and their role in the ecosystem.

- enhance collaborative learning and communication skills through practical sessions, teamwork, group discussions, assignments, and projects.

SYLLABUS OF DSC-7

UNIT-I: Introduction to Chordates

2 hrs

General characteristics and outline classification.

UNIT-2: Protochordata

3hrs

General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of Tornaria and Ascidian larval forms in protochordates.

UNIT-3: Origin of Chordates

2 hrs

Theories of Origin of chordates with detailed concept of Dipleurula and the Echinoderm theory.

UNIT-4: Agnatha

2 hrs

General characteristics and classification of cyclostomes up to Class.

UNIT-

5:

Pisces

3 hrs

General characteristics of Chondrichthyes and Osteichthyes; Classification up to order; Osmoregulation; Swimbladder in fishes

UNIT- 6: Amphibia

4 hrs

General characteristics and classification up to order; Origin of Tetrapods (Evolution of terrestrial ectotherms); Parental care in Amphibians.

UNIT-7:

Reptilia

4 hrs

General characteristics and classification up to order; Affinities and evolutionary significance of *Sphenodon*; Poison apparatus and biting mechanism in snakes.

UNIT- 8: Aves

4 hrs

General characteristics and classification up to order; Flight adaptations; Migration in birds.

UNIT- 9: Mammalia

4 hrs

General characteristics and classification up to order; Adaptive radiation with reference to locomotory appendages.

UNIT- 10: Zoogeography

2 hrs

Zoogeographical realms, Plate tectonics and Continental drift theory.

Practical

60 hrs

(Laboratory periods: 15 classes of 4 hours each)

- 1. Protochordata:** *Balanoglossus*, *Herdmania*, *Branchiostoma*, Colonial Urochordata, Sections of *Balanoglossus* through proboscis and branchio-genital regions, Sections of *Amphioxus* through pharyngeal, intestinal and caudal regions. Permanent slide of *Herdmania* spicules.
- 2. Agnatha:** *Petromyzon*, *Myxine*.
- 3. Pisces:** *Scoliodon*, *Sphyrna*, *Pristis*, *Torpedo*, *Chimaera*, *Mystus*, *Heteropneustes*, *Labeo*, *Exocoetus*, *Echeneis*, *Anguilla*, *Hippocampus*, *Tetrodon/Diodon*, *Anabas*, Flatfish. Permanent slides of Placoid and Cycloid Scales.
- 4. Amphibia:** *Ichthyophis/Ureotyphlus*, *Necturus*, *Bufo*, *Hyla*, *Alytes*, *Salamandra*.
- 5. Reptilia:** *Chelone*, *Trionyx*, *Hemidactylus*, *Varanus*, *Uromastix*, *Chamaeleon*, *Ophiosaurus*, *Draco*, *Bungarus*, *Vipera*, *Naja*, *Hydrophis*, *Zamenis*, *Crocodylus*; Key for Identification of poisonous and non-poisonous snakes.
- 6. Aves:** Study of six common birds from different orders. Types of beaks and claws.
- 7. Mammalia:** *Sorex*, Bat (Insectivorous and Frugivorous), *Funambulus*, *Loris*, *Herpestes*, *Erinaceus*.
- 8. Student Presentation:** Power point presentation on any two animals from two different classes.

***Note:** Refer Young, J.Z. (2004) for the classification of Protochordates and Tetrapods, and Parker T.J. and Haswell W.A. (1972) for the classification of Agnatha and Pisces.

Essential/recommended readings

1. Young, J.Z. (2004). **The Life of Vertebrates**. III Edition, Oxford University Press.

2. Parker T.J. and Haswell W.A. (1972). **Text book of Zoology Vertebrates**. VII Edition, Volume II.

Suggestive readings

1. Pough H. (2018). **Vertebrate Life**. X Edition, Pearson International.
2. Darlington P.J. (1966). **The Geographical Distribution of Animals**. R.E. Krieger Pub. Co.

NOTE: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE -8 – :
Biochemistry: Metabolic Processes
Zoo-DSC-8

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Biochemistry: Metabolic Processes Zoo-DSC-8	04	02	Nil	02	Passed 12 th Class	NIL

Learning Objectives

The learning objectives of this course are as follows:

- To provide fundamental and precise knowledge of the metabolic processes that play a crucial role in all processes of life and the development of diseases.
- To apprise the students of the various functions of the molecules like providing structural integrity to the tissue-engineered constructs.
- Through this course, the students would be able to understand myriads of health, potential treatments of diseases and solve several industrial problems
- The enzymatic study would enable them to understand the various metabolic pathways and physiological reactions.

Learning Outcomes

By studying this course, students will be able to

- Interpret the structure-functional relationships of carbohydrates, proteins, lipids and nucleic acids.
- Understand the clinical knowledge and importance of antioxidants.
- Understand the process of biological oxidation crucial to generation of energy for a living cell.
- Appreciate the action of various types of enzymes under variety of conditions.

Syllabus of DSC-8

UNIT- 1: Carbohydrate Metabolism

9 hrs

Glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis.

UNIT- 2: Lipid Metabolism

7 hrs

β -oxidation and omega-oxidation of saturated fatty acids with even number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis.

UNIT- 3: Protein Metabolism

4 hrs

Catabolism of amino acids: Transamination, Deamination, Urea cycle.

UNIT- 4: Oxidative Phosphorylation

7 hrs

Redox systems; review of mitochondrial respiratory chain: electron carriers, sites of ATP production, Oxidative phosphorylation; Chemiosmotic hypothesis, mitochondrial shuttle system.

UNIT- 5: Liver as a Major Metabolic Hub

3 hrs

Inter-connection of glucose-6-phosphate, pyruvate and acetyl-CoA; fates of amino acids, fatty acids and glucose in liver cells; cascade of metabolic events in fasting and starvation.

Practical

60 hrs

(Laboratory periods: 15 classes of 4 hours each)

1. Estimation of total protein in given solutions by Lowry's method.
2. Detection of SGOT and SGPT in serum/ tissue.
3. Estimation of GST and GSH in serum/ tissue.
4. To study the enzymatic activity of Lipase.
5. Study of biological oxidation (SDH) [goat liver].
6. To perform the Acid and Alkaline phosphatase assay from serum/ tissue.
7. Dry Lab: To trace the labelled 'C' atoms of Acetyl-CoA till they evolve as CO₂ in the TCA cycle through models.

Essential/recommended readings

3. Nelson, D.L., Cox, M.M. (2017). Lehninger: Principles of Biochemistry (7th ed.). New York, WH: Freeman Company.
4. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry. XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.

Suggestive readings

1. Stryer, L., Berg, J., Tymoczko, J., Gatto, G. (2019). Biochemistry (9th ed.), New York, WH: Freeman.
2. Voet, D., Voet, J. G. (2013). Biochemistry (4th ed.). New Jersey, John Wiley & Sons Asia Pvt. Ltd.

**DISCIPLINE SPECIFIC CORE COURSE– 9:
Human Physiology- Life Sustaining Systems
Zoo-DSC-9**

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Human Physiology- Life Sustaining Systems Zoo-DSC-9	04	02	Nil	02	Passed 12 th Class	NIL

Learning Objectives

The learning objectives of this course are as follows:

- The course will provide a thorough understanding of the normal body function and helps to determine the cause of disease.
- It will enable the development of new and more effective treatments and guidelines for maintaining good health.
- It will equip the students with an ability to pursue career in medical and healthcare sector, pharmaceuticals and other related areas.
- It will help in understanding how these systems interact among themselves to maintain stability or homeostasis.

Learning Outcomes

By studying this course, students will be able to:

- Appreciate human physiology and have its enhanced knowledge.
- Recognize and identify principal and physiology of digestion.
- Understand the functions of important physiological systems including the digestive, circulatory, renal and respiratory system.
- Learn an integrative approach to understand how these separate systems interact to yield integrated physiological responses to maintain homeostasis in the body along with feedback mechanisms.
- Amalgamate ideas to make the connection between knowledge of physiology and real-world situations, including healthy lifestyle decisions and problems faced due to homeostatic imbalances.
- Perform, analyze and report on experiments and observations in physiology.
- Know the fundamentals and understand advanced concepts so as to develop a strong foundation that will help them to acquire skills and knowledge to pursue an advanced degree.

SYLLABUS OF DSC-9

UNIT- I Physiology of Digestion**7 hrs**

Overview of gastrointestinal tract and its associated glands; digestion; Absorption of carbohydrates, lipids, proteins; Hormonal control of secretion of enzymes in gastrointestinal tract.

UNIT- 2 Blood**4 hrs**

Structure and functions of haemoglobin; Blood clotting system, Fibrinolytic system.

UNIT- 3: Physiology of Heart**7 hrs**

Structure of heart; Coronary circulation; Origin and conduction of cardiac impulses; Cardiac cycle; Cardiac output and its regulation; nervous and chemical regulation of heart rate.

UNIT- 4: Physiology of Respiration**6 hrs**

Overview of respiratory system; Mechanism of respiration, Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood; Dissociation curves and the factors influencing it; regulation of respiration.

UNIT- 5: Renal Physiology**6 hrs**

Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance.

Practical**60 hrs****(Laboratory periods: 15 classes of 4 hours each)**

1. To understand the components of blood, their functions and Hematopoiesis.
2. To study whole blood hemolysis with ammonium chloride solution.
3. Preparation of haemin and haemochromogen crystals.
4. Measurement and statistical analysis of variations observed in the student population in the class for the following parameters:
 - a) White blood cells using haemocytometer
 - b) Red blood cells using haemocytometer
 - c) Hemoglobin
 - d) Blood pressure
5. Examination of histological sections of mammalian oesophagus, stomach, duodenum, ileum, rectum, liver, trachea, lung, kidney.
6. Study of Electrocardiogram; Analysis of ECG records and calculation of heart rate.
7. Detection of abnormal constituents in urine and their physiological significance.

Essential/recommended readings

1. Tortora, G.J. and Derrickson, B.H. (2017). Principles of Anatomy and Physiology. XV Edition, John Wiley and Sons, Inc.
2. Ganong W.F. (2019). Review of Medical Physiology 26th ed. Mc Graw-Hill.
3. Widmaier E, Raff H and Strang K. (2013) Vander's Human Physiology: The Mechanism of Body Functions. XIII Edition, McGraw-Hill Education.
4. Guyton, A.C. and Hall, J.E. (2011) Textbook of Medical Physiology. XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company.
5. Eroschenko, Victor P. (2012) Di Fiore's Atlas of Histology with Functional Correlations; 12th edition, CBS Publishers and Distributors Pvt. Ltd.

Suggestive readings

1. Chatterjee, C.C. (2021) Human Physiology, 14th Edition, Volume 1 & Volume II, CBS Publishers and Distributors Pvt. Ltd.
2. Vander A, Sherman J, and Luciano D (2014). Vander's Human Physiology

DISCIPLINE SPECIFIC ELECTIVES (DSE-3): Medical Zoology Zoo-DSE-3

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
Medical Zoology Zoo-DSE-3	04	03	00	01	Passed 12 th Class	NIL

Learning Objectives

The learning objectives of this course are as follows:

- This course offers an insight about the various types of human diseases.
- The students will understand the concepts of pathogenic and pathological basis of diseases including infectious diseases caused by viruses, prokaryotes, protozoans, helminthes, vector borne and zoonotic diseases.
- Learn about nutritional deficiencies and lifestyle diseases, endocrine diseases and cancer.

Learning Outcomes

By studying this course, students will be able to:

- understand various types of human diseases.
- clarify the concepts of pathogenic and pathological basis of diseases.
- Recognize deficiencies and lifestyle diseases, endocrine diseases and cancer.
- broaden the understanding of medical importance of studying Zoology.

SYLLABUS OF DSE-3

UNIT-1: Introduction to Infectious diseases 6 hrs

Concept of Epidemiology, Incidence, Prevalence, Virulence, Pathogenicity, Transmission, Definitive host, Intermediate host, Parasitism, Symbiosis, Commensalism, Reservoir, Zoonosis.

UNIT- 2: Transmission, prevention and control of Viral infection 6 hrs

Dengue, Polio, Measles, Mumps, influenza, SARS, HIV.

UNIT-3: Bacterial infections 6 hrs

Tetanus, Diphtheria, Tuberculosis, Typhoid, Cholera; brief account of *Rickettsia*, *Borellia*, *Treponema* and *Leptospira*.

UNIT- 4 Protozoan and Helminthic infection 6 hrs

Life history and pathogenicity of *Entamoeba histolytica*, *Plasmodium vivax*, *Trypanosoma gambiense*; *Wuchereria bancrofti*, *Faciolopsis buski*, *Ancylostoma duodenale*.

UNIT-5: Nutritional deficiency and lifestyle-based diseases. 6 hrs

Kwashiorkar, Marasmus, Beri-beri, Scurvy, Pellagra, Anaemia, Night blindness, Rickets, Osteoporosis, Obesity, Cardiovascular diseases (CVD), Atherosclerosis, Diabetes mellitus, Inflammatory Bowel Disease (IBD).

UNIT-6: Endocrine Diseases 9 hrs

Hormonal imbalances leading to diseases: Diabetes insipidus, Acromegaly, Gigantism, Dwarfism, Goitre, Cretinism, Cushing and Crohn's syndrome, Addison's disease.

UNIT-7: Cancer 6 hrs

Definitions, Nomenclature, characteristics of benign and malignant neoplasms, grading and staging of cancer, biology of tumor growth, invasion and metastasis, carcinogens and cancer.

Practical 30 hrs

(Laboratory periods: 15 classes of 2 hours each)

1. Study of Disease specific bacteria and viruses through pictures/micrographs/Videos.
2. Performing of gram staining and study of Acid Fast staining through permanent slides.
3. Urine analysis for abnormal constituents: protein, blood, bile salts and glucose.
4. Study of arthropod vectors associated with human diseases: *Anopheles*, *Aedes*, *Culex*, *Phlebotomus*, *Xenopsylla*.
5. Study of permanent slides and specimens of *Plasmodium sp*, *Entamoeba histolytica*, *Trypanosoma gambiense*, *Schistosoma haematobium* and *Wuchereria bancrofti*.
6. Study of endocrine diseases through case studies (any 2).
7. Identification and study of cancer cells- Slides/Photomicrographs/Videos.
8. Project work/report: field visit to a research institute/laboratory to study some of the pathological and diagnostic techniques.

Essential/recommended readings

1. Park, K. (2017) Textbook of Preventive and social medicine. 23rdEdition. B.B Publisher.
2. Robbins, Basic Pathology, 9th edition (2012), Kumar, Abbas, Fausto and Mitchell; Saunders Publication, ISBN-13: 978-1437717815
3. Ramnik. Sood (2009) Medical Laboratory Technology Methods and Interpretations, 6th edition; Jaypee Brothers Medical Publishers, ISBN-13: 978-8184484496.

Suggested readings

1. Robbins and Cotran. Pathologic Basis of Disease, 8th edition (2009), Vinay Kumar, Abul. K. Abbas, Jon C. Aster, Nelson Fausto; Saunders Publishers, ISBN-13: 978-1416031215
2. Arora, D.R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications

COMMON POOL OF GENERIC ELECTIVES (GE) COURSES

GENERIC ELECTIVES (GE-5): Food, Nutrition & Health Zoo-GE-5

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
Food Nutrition & Health Zoo-GE-5	04	02	00	02	Passed 12 th Class	NIL

Learning Objectives

The learning objectives of this course are as follows:

- This course offers an overview of the concepts of normal food and nutrition required by the human body to maintain good health.
- To understand physiology, biochemistry, pathology, immunology, medicine, food science, and other fields with context to nutrition.
- Learn the concept of malnutrition, lifestyle-related disorders, addiction-related social health problems and eating disorders will be introduced.
- Appreciate knowledge that can be applied in everyday life.
- Learn the role of macronutrients and micronutrients, their nutritional requirements for different age groups during various health conditions.
- The students will be encouraged to pursue further studies in nutrition and health.

Learning Outcomes

By studying this course, students will be able to

- have an in-depth understanding of the dietary sources and role of nutrients in forming a balanced diet.
- appreciate the concept of nutritional requirements for different age groups and in pregnancy and lactation.
- know about the various food allergens and the body's hypersensitivity towards it.
- understand the concept of health and role of various nutrients in mitigating several deficiency disorders.
- identify and analyse the causes of malnutrition, lifestyle-related disorders, addiction-related social health problems and eating disorders.

- appreciate the various techniques from identification of adulterants, estimation of essential nutrients in food products, to measurement of vital anthropometric indicators of health, as widely used by practitioners.

SYLLABUS OF GE-5

UNIT-1: Basic concept of food and nutrition

2 hrs

Components of nutrients (Macronutrients and Micronutrients).

UNIT-2: Dietary sources and physiological functions

6 hrs

Carbohydrates, Proteins, Lipids Vitamins and Minerals (Iron, Iodine, Calcium, Selenium, Zinc); beneficial effects of dietary fibres; elementary idea of Probiotics, Prebiotics, Organic Food.

UNIT-3: Nutritional requirements

4 hrs

Study of different age groups (infants, preschool children, school children, adolescents, adults, elderly) and in pregnant women and lactating mother.

UNIT-4: Concept of a balanced diet

4 hrs

Food groups, Food Pyramid, Food and Culture; Food Hypersensitivity: Food allergy (nuts and seafood) and Food intolerance (lactose and gluten).

UNIT-5: Health

2 hrs

Definition and concept of health. Indicators of metabolic health.

UNIT-6: Nutritional deficiencies and disorders

9 hrs

Symptoms and prevention of the following: Protein Energy Malnutrition (Kwashiorkor and Marasmus), Vitamin deficiency (A, D, B1, B3 B12, C) Mineral deficiency (Iron, Iodine, Calcium, Selenium, Zinc).

Lifestyle-related diseases: Causes, Symptoms and Complications of Hypertension, Diabetes mellitus and Obesity. Role of dietary and lifestyle modifications for the prevention of these diseases.

Eating Disorders: Complications and Management of Anorexia nervosa and Bulimia nervosa.

UNIT-7: Social health problems

3 hrs

Deleterious effects of addiction-related social health problems: Smoking, alcoholism, and drug dependence.

Practical**60 hrs****(Laboratory periods: 15 classes of 4 hours each)**

1. To detect adulteration in (a) Ghee (b) Sugar (c) Tea Leaves (d) Turmeric.
2. Study of nutrition labelling of any 5 popular packaged foods.
3. Study and comparison of food pyramids of any 3 popular diet trends with focus on their pros and cons.
4. Ascorbic acid estimation in food by titrimetry.
5. Estimation of calcium in food by titrimetry.
6. Measurement of anthropometric indicators of health (BMI, Waist to hip ratio, Skin fold test).
7. Plan the diet chart of any three different age groups using RDA values (infants, preschool children, school children, adolescents, adults and elderly).
8. An exercise based on 24-hour food recall of students for quantification and analysis of the macronutrients' and micronutrients' uptake based on the current RDA values (with focus on nutritional status and risk factors).
9. Project Work on the Indian government initiatives focused on nourishment of school children/ expectant mothers.

OR

A small-scale questionnaire-based survey on the knowledge and usage of available resources for quitting smoking and its success/relapse rates.

Essential/recommended readings

1. Gibney MJ et al (2009) Introduction to Human Nutrition, 2nd edition, Wiley-Blackwell, Hoboken
2. ICMR-NIN (2020) Expert Group on Nutrient Requirement for Indians, Recommended Dietary Allowances (RDA) and Estimated Average Requirement (EAR)
3. Elia M et al (2013) Clinical Nutrition, 2nd edition, Wiley-Blackwell, Hoboken

Suggested readings:

1. Mann J and Truswell AS (2017) Essentials of Human Nutrition, 5th edition, Oxford University Press. Oxford
2. Kaveri Chakrabarty and A.S. Chakrabarty (2020) Textbook of Nutrition in Health and Disease, 1st edition, Springer Nature Singapore Pte Ltd