

**SCHEME AND SYLLABUS UNDER CHOICE BASED CREDIT SYSTEM
B.Sc. WITH ZOOLOGY**

	CORE COURSE (12)	Ability Enhancement Compulsory Courses AEC (2)	Skill Enhancement Courses SEC (4)	Discipline Specific Elective DSE (4)
I	CC- Botany I CC-Zoology I CC- Chemistry I	Environmental Science		
II	CC- Botany II CC-Zoology II CC- Chemistry II	English Communication		
III	CC- Botany III CC-Zoology III CC- Chemistry III		SEC-I	
IV	CC- Botany IV CC-Zoology IV CC- Chemistry IV		SEC-II	
V			SEC-III	DSE-Botany I DSE-Zoology I DSE-Chemistry I
VI			SEC-IV	DSE-Botany II DSE-Zoology II DSE-Chemistry II

Discipline Core Courses: Zoology

1. Animal Diversity
2. Comparative Anatomy and Developmental Biology of Vertebrates
3. Physiology and Biochemistry
4. Genetics and Evolutionary Biology

Discipline Specific Electives: Zoology (Any two)

1. Applied Zoology
2. Animal Biotechnology
3. Aquatic Biology
4. Immunology
5. Reproductive Biology
6. Insect, Vector and Diseases

Skill Enhancement Courses: Zoology

1. Apiculture
2. Aquarium Fish Keeping
3. Aquatic Biology
4. Medical Diagnostics
5. Public Health and Hygiene
6. Sericulture

CORE COURSE I

ANIMAL DIVERSITY

THEORY

(CREDITS 4)

Unit 1: Kingdom Protista General characters and classification up to classes; Locomotory Organelles and locomotion in <i>Paramecium</i>	04
Unit 2: Phylum Porifera	04
Unit 3: Phylum Cnidaria General characters and classification up to classes; Polymorphism in Hydrozoa	03
Unit 4: Phylum Platyhelminthes General characters and classification up to classes; Life history of <i>Taenia solium</i>	03
Unit 5: Phylum Nematelminthes General characters and classification up to classes; Life history of <i>Ascaris lumbricoides</i>	05
Unit 6: Phylum Annelida General characters and classification up to classes; Metamerism in Annelida	03
Unit 7: Phylum Arthropoda General characters and classification up to classes; Metamorphosis in Insects, Structure of ommatidium	05
Unit 8: Phylum Mollusca General characters and classification up to classes; Ctenidium and Pulmonary Sac in <i>Pila</i>	04
Unit 9: Phylum Echinodermata General characters and classification up to classes; Water-vascular system in Asteroidea	04
Unit 10: Protochordates General features and Phylogeny of Protochordata	02
Unit 11: Agnatha General features of Agnatha and classification of cyclostomes up to classes	02
Unit 12: Pisces General features and Classification up to orders; Osmoregulation in Fishes	04
Unit 13: Amphibia General features and Classification up to orders; Parental care	04
Unit 14: Reptiles General features and Classification up to orders; Poisonous and non-poisonous snakes, Biting mechanism in vipers	04

Unit 15: Aves 05
 General features and Classification up to subclass; Air sacs & Respiration in *Columba*

Unit 16: Mammals 05
 Classification up to subclass; Origin of mammals

Note: Classification of Unit 1-9 to be followed from "Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition" & for 12 Nelson, J. S. *Fishes of the World* (2006)

ANIMAL DIVERSITY

PRACTICAL

(CREDITS 2)

1. Study of the following specimens:

Amoeba, Paramecium, Scypha, Obelia, Physalia, Taenia solium, Male and female *Ascaris lumbricoides*, *Aphrodite*, *Nereis*, *Pheretima*, *Hirudinaria*, *Macrobrachium*, *Carcinoscorpius*, *Julus*, *Periplaneta*, *Apis dorsata*, *Chiton*, *Pila*, *Lamellidens*, *Loligo*, *Sepia*, *Octopus*, *Ophiura*, *Echinus*, *Cucumaria* and *Antedon*, *Balanoglossus*, *Branchiostoma*, *Petromyzon*, *Pristis*, *Torpedo*, *Catla Exocoetus*, *Ichthyophis*, *Salamandra*, *Duttaphyrnus*, *Rachophorus*, *Hemidactylus*, *Chamaeleon*, *Draco*, *Calotes*, *Vipera*, *Naja*, *Psittacula*, *Passer*, *Pycnonotus*, *Alcedo*, *Pteropus*, *Funambulus*, *Suncus*.

2. Study of the following permanent slides:

Study of life history stages of *Taenia*, T.S. of Male and female *Ascaris*

3. An "animal album" containing photographs, cut outs, with appropriate write up about the above mentioned taxa.

SUGGESTED READINGS

1. Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
3. Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
4. Pough H. *Vertebrate life*, VIII Edition, Pearson International
5. Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.
6. Nelson, J. S. (2006). *Fishes of the World*, Wiley

CORE COURSE II

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

THEORY	(CREDITS 4)
Unit 1: Integumentary System Integument: general structure and its derivatives in mammals	04
Unit 2: Skeletal System Types of visceral arches	03
Unit 3: Digestive System Structure and Function of Bovine Ruminant Stomach	04
Unit 4: Respiratory System Brief account of Gills, Accessory Respiratory Organs in Fishes	05
Unit 5: Circulatory System Evolution of heart and aortic arches	04
Unit 6: Urinogenital System Types of kidneys, Urinogenital ducts in vertebrates	04
Unit 7: Nervous System Comparative account of brain in carp, toad, Garden Lizard and Pigeon	03
Unit 8: Sense Organs Functions of different types of sensory receptors in fish and reptiles	03
Unit 9: Early Embryonic Development Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals, vitellogenesis in birds; Fertilization: external (amphibians), internal (mammals), blocks to polyspermy; early development of frog (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula).	12
Unit 10: Late Embryonic Development Formation of human placenta and functions, other types of placenta on the basis of histology; Metamorphic events in frog life cycle and its hormonal regulation.	10
Unit 11: Genetic Control of Development wrt Inborn errors Chromosome Changes in Human (Numerical and Structural) with reference to Down syndrome, Turner syndrome, Klinefelter syndrome & Thalassemia	08

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

PRACTICAL**(CREDITS 2)**

1. Osteology:
 - i) Skull: Toad, Pigeon, Guinea pig.
 - ii) Vertebrae, Girdles: Toad, Pigeon, Guinea pig.
 - iii) Limb Bones: Toad
2. Frog - Study of developmental stages - whole mounts and sections through permanent slides – cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages.
3. Study of the different types of placenta- histological sections through permanent slides or photomicrographs.
4. Examination of gametes - frog/ rat - sperm and ova through permanent slides or photomicrographs.
5. Study of developmental stages in Chick embryo (24, 48, 72 h)

SUGGESTED READINGS

1. Kardong, K.V. (2005) *Vertebrates' Comparative Anatomy, Function and Evolution*. IV Edition. McGraw-Hill Higher Education.
2. Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of the Vertebrates*. IX Edition. The McGraw-Hill Companies.
3. Hilderbrand, M and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons.
4. Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House.
5. Gilbert, S. F. (2006). *Developmental Biology*, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
6. Balinsky, B.I. (2008). *An introduction to Embryology*, International Thomson Computer Press.
7. Carlson, Bruce M (1996). *Patten's Foundations of Embryology*, McGraw Hill, Inc

CORE COURSE III**PHYSIOLOGY AND BIOCHEMISTRY****THEORY****(CREDITS 4)**

Unit 1: Nerve and muscle Structure of a neuron, action potential and its propagation in myelinated and non-myelinated nerve fibres, Molecular and chemical basis of muscle contraction	08
Unit 2: Digestion Physiology of digestion in the alimentary canal; Absorption of lipids	05
Unit 3: Respiration Transport of Oxygen and carbon dioxide in mammalian blood	05
Unit 4: Excretion Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism	05
Unit 5: Cardiovascular system Composition of blood, Hemostasis, Structure of Heart, Origin and conduction of the cardiac impulse, cardiac cycle	06
Unit 6: Reproduction and Endocrine Glands Spermatogenesis, Oogenesis & hormonal controls; menstrual cycle and hormonal control, Structure and function of pituitary, thyroid, Parathyroid, pancreas and adrenal	07
Unit 7: Carbohydrate Metabolism Glycolysis, Krebs cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogen metabolism, Review of electron transport chain	08
Unit 8: Lipid Metabolism Biosynthesis and β oxidation of palmitic acid	05
Unit 9: Protein metabolism Transamination, Deamination and Urea Cycle	05
Unit 10: Enzymes Introduction, Mechanism of action, Enzyme Kinetics, Inhibition and Regulation	06

PHYSIOLOGY AND BIOCHEMISTRY**PRACTICAL****(CREDITS 2)**

1. Preparation of hemin crystals from
2. Staining of Blood-film of Man.
3. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland
4. Study of permanent slides of liver, lung, kidney
5. Qualitative tests to identify carbohydrates in given solutions (Glucose, Fructose & Sucrose,)

6. Estimation of total protein in given solutions by Lowry's method.

SUGGESTED READINGS

1. Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley & Sons, Inc.
2. •Widmaier, E.P., Raff, H. and Strang, K.T. (2008) Vander's Human Physiology, XI Edition., McGraw Hill
3. Guyton, A.C. And Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
4. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
5. Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). Principles of Biochemistry. IV Edition. W.H. Freeman and Co.
6. Murray, R.K., Grinner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). Harper's Illustrated Biochemistry. XXVIII Edition. Lange Medical Books/Mc Graw3Hill.

CORE COURSE IV**GENETICS AND EVOLUTIONARY BIOLOGY
THEORY****(CREDITS 4)**

Unit 1: Introduction to Genetics Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information	03
Unit 2: Mendelian Genetics and its Extension Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and co- dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, sex linked inheritance, extra-chromosomal inheritance, Chi Square test	08
Unit 3: Linkage, Crossing Over and Chromosomal Mapping Linkage and crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses	09
Unit 4: Mutations Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced versus Spontaneous mutations	07
Unit 5: Sex Determination Chromosomal mechanisms, dosage compensation	04
Unit 6: History of Life Origin of Life	02
Unit 7: Introduction to Evolutionary Theories Lamarckism, Darwinism, Neo-Darwinism	05
Unit 8: Direct Evidences of Evolution Types of fossils, Incompleteness of fossil record, Phylogeny of horse	05
Unit 9: Processes of Evolutionary Change Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive)	09
Unit 10: Species Concept Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric, Sympatric)	06
Unit 11: Macro-evolution Macro-evolutionary Principles (example: Darwin's Finches)	05
Unit 12: Extinction Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of extinction in evolution	06

GENETICS AND EVOLUTIONARY BIOLOGY

PRACTICAL

(CREDITS 2)

1. Study of Mendelian Inheritance using suitable examples. Verify the results using Chi-square test.
2. Study of gene mapping using the data.
3. Study of Human Karyotypes (normal and abnormal).
4. Study of fossil evidences from plaster cast models and pictures
5. Study of homology and analogy from suitable specimens/ pictures
6. Charts:
 - a) Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors
 - b) Darwin's Finches with diagrams/ cut outs of beaks of different species
7. Visit to Natural History Museum and submission of report

SUGGESTED READINGS

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India.
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings.
4. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co.
6. Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing
7. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring, Harbour Laboratory Press.
8. Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and Bartlett Publishers
9. Campbell, N. A. and Reece J. B. (2011). Biology. IX Edition, Pearson, Benjamin, Cummings.
10. Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.