

**U.G. 3<sup>rd</sup> SEMESTER SYLLABUS**  
**DEPARTMENT OF ZOOLOGY**  
**COTTON UNIVERSITY**

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**PAPER: ZOO301C**

**COMPARATIVE ANATOMY OF VERTREBRATES AND HISTOLOGY**  
(Credits: 3+0+2=5)

**A. COMPARATIVE ANATOMY**

**Unit 1: Comparative Account of Integumentary to Respiratory system (14L)**

**1.1: Integumentary system: 3L**

1. Comparative structure, 2. function and derivatives of integument in amphibian, 3. birds and mammals.

**1.2: Skeletal system: 4L**

1. Jaw suspension; structure of branchial and visceral arches; 2. Comparative account of the axial and appendicular skeleton.

**1.3: Digestive System 3L**

1. Comparative account of feeding mechanism; 2. Alimentary canal and associated glands; 3. Comparison of dentition in vertebrates.

**1.4: Respiratory system 4L**

1. Comparative account of respiration through buccopharynx, skin, gills, lungs; 2. Accessory respiratory organs

**Unit 2: Circulatory system to sense organs in vertebrates (15L)**

**2.1: Circulatory system 4L**

1. General plan of circulation in vertebrates; 2. Comparative account of heart and aortic arches in vertebrates

**2.2: Nervous system 3L**

1. Comparative account of brain; 2. Cranial nerves in vertebrates; 3. Cranial nerves in mammals

**2.3: Urigenital system 4L**

1. Succession of kidney in vertebrates 2. Evolution of urinogenital ducts 3. Types of mammalian uteri

**2.4: Sense organs 4L**

1. Types of receptors in vertebrates; 2. Brief account of visual and auditory receptors in vertebrates

**B. HISTOLOGY**

**Unit 1: Differentiation and tissues (7L)**

**1.1: Differentiation: 3L**

1. Types of differentiation; 2. Mechanism of cellular differentiation and organization of tissue

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**1.2: Animal tissue: 4L**

1. Types, structure and their functions; 2. Epithelial; 3. Muscular; 4. Connective; 5. Nervous tissues

**Unit2: Histological structure of organs 8L**

Histology of 1. GI tract, 2. Liver, 3. pancreas, 4. spleen, 5. lung, 6. kidney of mammal.

**Unit3: Fixation and staining of tissues 4L**

1: Basic principles of fixation and staining, classification, composition and properties of dye, use of mordants and metachromatic dyes; 2: Microtomy technique

**PRACTICAL : (Credit-2)**

1. Study of disarticulated skeleton of Toad, Pigeon and Guinea pig.
3. Comparative study of skull in vertebrates.
4. Circulatory system, brain, pituitary, urinogenital system in *Channa punctatus* (Demonstration).
5. Study of histological slide: T.S. of skin, stomach, intestine, liver, pancreas, kidney testis, ovary of mammals through permanent slides.
6. Study of blood cells in vertebrates.
7. Preparation of permanent slides of any five mammalian tissues- Microtomy technique.

**\*\*Lab note book, with drawing and labelling; methods where applicable.**

**References:**

1. Chordate Zoology, E.L. Jordan and P.S. Verma, S. Chand Publication
2. Kardong K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education
3. Kent, G.C. and Carr R. K. (2000). Comparative Anatomy of Vertebrates. IX Edition, The McGraw-Hill Companies
4. Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons
5. Walter, H.E. and Sayles, L.P. Biology of Vertebrates, Khosla Publishing House

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**PAPER: ZOO302C**

**PHYSIOLOGY AND ENDOCRINOLOGY**  
**(Credits: 3+0+2=5)**

**A. PHYSIOLOGY (28L)**

**Unit 1: Life sustaining systems (18L)**

**1.1 Physiology of digestion: 3L**

1. Structural organisation and functions of Gastrointestinal tract; 2. Mechanical and chemical digestion of food; 3. Absorptions of carbohydrates, lipids, proteins, water, minerals, vitamins.

**1.2 Physiology of Respiration: 4L**

1. Mechanism of Respiration; 2. transport of Oxygen and Carbon dioxide in blood; 3. Dissociation curves and the factors influencing it; 4. respiratory pigments; 5. Carbon monoxide poisoning.

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**1.3 Physiology of Circulation: 5L**

1. Components of Blood and their functions; Structure and functions of haemoglobin;  
2. Haemostasis: coagulation of blood; 3. Haemopoiesis: mechanism and regulation; 4. Blood groups; ABO and Rh factor.

**1.4 Physiology of heart: 3L**

1. Structure of mammalian heart; 2. Coronary Circulation, Origin and conduction of cardiac impulses; 3. Cardiac Cycle and cardiac output; 4. Blood pressure and its regulation; 5. Autonomic control and chemical regulation of heart rate

**1.5 Thermoregulation & Osmoregulation: 3L**

1. Physiological classification based on thermal biology; 2. Thermal biology of endotherms; 3. Osmoregulation in aquatic vertebrates; 4. Extra renal osmoregulatory organs in vertebrates.

**Unit 2: Control and coordinating systems (10L)**

**2.1: Nervous System 5L**

1. Structure of neuron, resting membrane potential; 2. Propagation of nerve impulse; 3. Types of synapse, Synaptic transmission and Neuromuscular junction; 4. Reflex action and its types.

**2.2: Muscular system 2L**

1. Ultra structure of muscles; 2. Molecular and chemical basis of muscle contraction.

**2.3 Renal Physiology : 3L**

1. Renal blood supply; 2. Mechanism of urine formation; 3. Regulation of acid-base balance.

**B. Endocrinology (20L)**

**Unit 1: Introduction to Endocrinology 4L**

1. brief account of structural features & function of endocrine glands; 2. Classification, Characteristic and Transport of Hormones.

**Unit 2: Epiphysis, Hypothalamo-hypophysial Axis & peripheral endocrine glands (10L)**

**2.1. Epiphysis, Hypothalamo-hypophysial Axis: 6L**

1. Structure of pineal gland, Secretions & their functions in biological rhythms & reproduction; 2. Regulation of neuroendocrine glands, Feedback mechanisms; 3. Structure of pituitary gland, its hormones and functions, Hypothalamo-hypophysial portal system.

**2.2 Structure and function of peripheral endocrine glands: 4L**

1. Thyroid; 2. Parathyroid; 3. Adrenal; 4. Endocrine pancreas; 5. Testis; 6. Ovary

**Unit 3: Regulation of Hormone Action & Hormonal dysfunctions (6L)**

**3.1 Regulation of Hormone Action 4L**

1. Bioassays of hormones using RIA & ELISA; 2. Estrous cycle in rat and menstrual cycle in human; 3. Multifaceted role of Vasopressin & Oxytocin; 4. Effects of abnormal secretions of hormones

**3.2 Hormonal dysfunctions and diseases 2L**

1. Dwarfism and acromegaly; 2. Goiter; 3. Addison's disease; 4. Diabetes mellitus.

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**PRACTICAL: (Credit-2)**

1. Determination of ABO Blood group.
2. Enumeration of red blood cells and white blood (total count) cells using haemocytometer
3. Estimation of haemoglobin using Sahli's haemoglobinometer
4. Preparation of haemin and haemochromogen crystals from mammal/fish blood.
5. Recording of blood pressure using a sphygmomanometer
6. Determination of pulse rate at rest and after exercise.
7. Differential count of WBC
8. To demonstrate the activity of salivary amylase and effect of acid & heat (temp) on its activity.
11. Study of permanent slides of different endocrine glands in vertebrates (pituitary, thyroid, testis, ovary)

**\*\*Lab note book, with drawing and labelling; methods where applicable.**

**Recommended books:**

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Harcourt Asia PTE Ltd. W.B. Saunders Company.
2. Eckert Animal Physiology: Mechanisms and adaptations Randall, Berggren and French.
3. Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills.
4. Balinsky: An Introduction to Embryology.
5. Turner and Bagnara: General Endocrinology, 6th ed. 1984, Saunder.
6. Vertebrate Endocrinology by David O. Norris.
7. Hadley: Endocrinology (5th ed., 2000, Prentice Hall)

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**PAPER: ZOO303C**

**GENETICS (CLASSICAL APPLIED GENETICS)**  
**(Credits: 3+0+2=5)**

**Unit 1: Mendelism 10L**

**Genetics and its Extension -**

1. Mendel and his experiments; 2. Principles of segregation and independent assortment and their chromosomal basis; 3. Test cross; 4. Application of laws of probability to Mendelian inheritance; 5. Principles of inheritance, Incomplete dominance and co-dominance, Epistasis, Multiple alleles, Lethal alleles, Pleiotropy; 6. Sex-linked, sex-influenced and sex-limited inheritance, Polygenic Inheritance.

**Unit 2: Linkage, Crossing Over, Chromosomal Mapping and mutations 12L**

1. Linkage and Crossing Over, molecular basis of crossing over, Cytological aspects of crossing over in *Drosophila*; 2. Measuring Recombination frequency and linkage intensity using three factor crosses, Interference and coincidence. 3. Types of gene mutations; 4. Types of chromosomal aberrations, Non-disjunction and variation in chromosome number; 5. Molecular basis of mutations in relation to UV light and chemical mutagens.

- Unit 3: Sex Determination and Human Genetics 13L**
1. Mechanisms of sex determination in *Drosophila*; 2. Sex determination in mammals; 3. Dosage compensation in *Drosophila* & Human; 3.

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Karyotype, banding, nomenclature of chromosome subdivisions and genetic map; 4. Genetic disorders, Chromosomal aneuploidy (Down, Turner and Klinefelter syndromes); 5. Chromosome translocation (chronic myeloid leukemia) and deletion (“cry of cat” syndrome); 6. Gene mutation (cystic fibrosis); 7. Genetic counselling.

**Unit 4: Applications of genetic engineering and applied Genetics 13L**

1. Molecular diagnosis of genetic disorders and gene therapy; 2. Crop and livestock improvement; 3. Extra-chromosomal Inheritance- Criteria for extra chromosomal inheritance, Kappa particle in Paramoecium; 4. Recombination in Bacteria and Viruses Conjugation, Transformation, Transduction, Complementation test in Bacteriophage; 5. Transposable Genetic Elements Transposons in bacteria, P elements in *Drosophila*.

**PRACTICALS: Credit 2**

1. Pedigree analysis of some human inherited traits.
2. Human blood grouping, Genotypic frequency of Human ABO blood group.
3. Analysis of Hardy-Weinberg’s equilibrium by citing any example.
4. Preparation and Mounting of sex chromatin (bar bodies) from the buccal epithelium.
5. Study of human karyotypes and numerical alterations (Down syndrome, Klinefelter syndrome and Turner syndrome) through charts.
6. Study of mutant varieties of *Drosophila*.

**\*\* Lab notebook with labelled diagrams, methods (wherever applicable) and results must be maintained.**

**Books Recommended –**

1. Brooker: Genetics : Analysis and Principles (1999, Addison-Wesley,)
2. Gardner et al: Principles of Genetics (1991, John Wiley)
3. Griffith et al: An Introduction to Genetic Analysis (2005, Freeman)
4. Hartl& Jones: Essential Genetics: A Genomic Perspective (2002, Jones & Bartlett)
5. Russell: Genetics (2002, Benjamin Cummings)
6. Snustad& Simmons: Principles of Genetics (2006, John Wiley)
7. Lewin: Genes IX (2008, Jones & Bartlett).
8. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings.
9. Bhamrah, H.S., Text Book of Genetics, Amazon Co.

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(Generic Elective Paper -3)

**PAPER: ZOO304G**

**FOOD, NUTRITION AND HEALTH**

**(Credits: 2+1+0=3)**

**Unit 1: Basic concept of food and nutrition 4L**

Food Components and food-nutrients; Concept of a balanced diet, nutrient needs and dietary pattern for various groups- adults, pregnant and nursing mothers, infants, school children, adolescents and elderly.

**Unit II: Nutritional Biochemistry 10L**

Carbohydrates, Lipids, Proteins- Definition, Classification, their dietary source and role; Vitamins- Vitamins- Fat-soluble and Water-soluble vitamins- their dietary source and importance Minerals-- Iron, calcium, phosphorus, iodine, selenium and zinc: their biological functions.

**Unit III: Health Introduction to health 10L**

Definition and concept of health, Major nutritional Deficiency diseases- Protein Energy Malnutrition (kwashiorkor and marasmus), Vitamin A deficiency disorders, Iron deficiency disorders, Iodine deficiency disorders- their causes, symptoms, treatment, prevention and government programmes, if any; Life style related diseases- hypertension, diabetes mellitus, and obesity- their causes and prevention through dietary and lifestyle changing; Problems of smoking, alcoholism, drug dependence and Acquired Immuno Deficiency Syndrome (AIDS): their causes, treatment and prevention.

**Unit IV: Food hygiene: 8L**

Food and Water borne infections: Bacterial infection, Cholera, typhoid fever, dysentery; Viral infection: Hepatitis, Poliomyelitis; Protozoan infection: amoebiasis, giardiasis; Parasitic infection: taeniasis and ascariasis their transmission, causative agent, sources of infection, symptoms and prevention; Brief account of food spoilage: Causes of food spoilage and their preventive measures.

**PRACTICAL: (Credits 1)**

1. To detect adulteration in Ghee, Sugars, Tea leaves and Turmeric
2. Estimation of Lactose in milk
3. Ascorbic acid estimation in food by titrimetry

**\*\* Lab notebook with labelled diagrams, methods (wherever applicable) and results must be incorporated.**

**Recommended Books-**

1. Mudambi, SR and Rajagopal, MV. Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed; 2007; New Age International Publishers
2. Srilakshmi B. Nutrition Science; 2002; New Age International (P) Ltd. Srilakshmi B. Food Science; Fourth Ed; 2007; New Age International (P) Ltd.
3. Swaminathan M. Handbook of Foods and Nutrition; Fifth Ed; 1986; BAPPCO.
4. Bamji MS, Rao NP, and Reddy V. Text Book of Human Nutrition; 2009; Oxford & IBH Publishing Co. Pvt Ltd.
5. Wardlaw GM, Hampl JS. Perspectives in Nutrition; Seventh Ed; 2007; McGraw Hill.
6. Lakra P, Singh MD. Textbook of Nutrition and Health; First Ed; 2008; Academic Excellence.
7. Manay MS, Shadaksharaswamy. Food-Facts and Principles; 1998; New Age International (P) Ltd.
8. Gibney et al. Public Health Nutrition; 2004; Blackwell Publishing.

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(Skill Enhancement Course -1)

**PAPER: ZOO101SEC**

**VERMICOMPOSTING AND BIOFERTILIZER**  
(Credits: 2+0+0=2)

**Unit 1: Vermicomposting I (5L)**

Vermiculture - Definition, scope and importance, common species for culture, Environmental parameters; Vermicomposting of wastes in field pits, tank method, roof shed method, bin method, harvesting of compost, storage, vermiwash-preparation and application.

**Unit II: Vermicomposting II (5L)**

Application of vermicomposting, earthworms for management of municipal, biomedical wastes; future perspective of vermicomposting, constraints for vermiculture in india. Marketing the product of vermiculture, market research, visit to relevant labs /field visits.

**Unit III: Biofertilizer I (11L)**

Biofertilizers - Introduction, scope. A general account of Biofertilizersorganisms, Cyanobacteria (BGA), Bacteria and Mycorrhizae, Cyanobacteria (BGA) as biofertilizers, Mass cultivation of *Azolla*, Symbiotic association of Cyanobacteria, Field application of Cyanobacterial inoculants, Preparation of biofertilizers from wastes (banana peels, cow dung, vegetable wastes, egg peels)

**Unit IV: Biofertilizer II (11L)**

Bacterial biofertilizers: General account of bacterial biofertilizer organisms. *Azospirillum*, *Azotobacter*, *Frankia*, *Phosphobacteria* and *Rhizobium*, Mechanism of nitrogen fixation (free-living and symbiotic), Mycorrhizal biofertilizers: A general account of Ecto, Endo and Arbuscular mycorrhizae; Application methods for different biofertilizers and its importance; National and Regional Biofertilizers Production and Development Centres.

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