

B.Sc. (Hons.) Zoology I Semester
Core Course
ANIMAL DIVERSITY - I

Course Code: ZYB-151

Credits: 4	
Sessional	30
End-Term Examination	70
Total:	100

- Unit-I:** **Protozoa:** Salient features and classification up to classes; Ultra-structure and life cycle and diseases caused by *Plasmodium vivax*; *Leishmania donovani*, *Trypanosoma brucei* and *Entamoeba histolytica*.
- Proifera:** Salient features and classification up to classes; Spicules; Cell types and Canal system in sponges; Morphology and reproduction in *Scypha* sp.
- Cnidaria & Ctenophora:** Salient features and classification up to classes; Mophology and life cycle of *Obelia* sp; Polymorphism in Cnidaria; Brief account of corals and coral reefs; Ctenophora: Characters and affinities.
- Unit-II:** **Platyhelminthes:** Salient features and classification up to classes; Morphology and life cycle of *Fasciola hepatica* and *Echinococcus granulosum*. Parasitic adaptations in platyhelminthes.
- Nematoda:** Salient features and classification up to classes; Morphology and life cycle of *Ascaris lumbricoides*.
- Unit-III:** **Annelida:** Salient features and classification up to classes; Morphology, Digestive, Circulatory, Excretory and Reproductive system of *Pheretima posthuma*.
- Arthropoda:** Salient features and classification up to classes; Morphology, digestive, respiratory, circulatory and reproductive system of *Periplaneta americana*; Metamorphosis in insects (ametabolous, hemimetabolous, holometabolous development).
- Unit-IV:** **Mollusca:** Salient features and classification up to classes; Torsion and coiling in gastropoda; Morphology, Digestive, Respiratory, Nervous system and Sense organs of *Pila globosa*.
- Echinodermata: Salient features and classification up to classes; Morphology and Water vascular system of *Asterias* sp. Larval forms and development of echinoderms. Phylogenetic relationships of echinoderms.

BOOKS RECOMMENDED

1. Parker & Haswell (revised by Marshal & Williams): A textbook of Zoology (Volume I)
2. Koptal: Modern Text Book of Zoology Invertebrates
3. Jordan & Verma: Invertebrate Zoology
4. Barnes: Invertebrate Zoology

B.Sc. (HONS.) ZOOLOGY
II-SEM (CBCS Pattern)
ANIMAL DIVERSITY-II

Credits: 04	
Sessional	30
End-Term Examination	70
Total:	100

Course Code: ZYB-251

Unit-I: Introduction to Hemicordata. Affinities and systematic position.
 Introduction to **Chordates**. General characters. Classification up to Orders of Urochordata and Cephalochordata. Retrogressive metamorphosis in Urochordata.
 Introduction to **Vertebrata**. General characters and classification up to Orders of **Agnatha**.
 Introduction to Superclass: **Pisces and Tetrapoda**.

Unit-II: Superclass Pisces: General characters and Classification up to Orders, Lung fishes: Characteristics and distribution, Locomotion in fishes, Migration in fishes, Coloration.
Scoliodon: Morphology, Exoskeleton, Digestive, Circulatory and Urinogenital system.
Superclass Tetrapoda
Class Amphibia: General characters and Classification up to Orders, Parental care, Neoteny.

Unit-III: Class Reptilia: General characters and classification up to Orders. Adaptation of reptiles as the land vertebrates. Poisonous and non-poisonous snakes. Poison apparatus and biting mechanism.
Uromastix: Morphology, Digestive, Respiratory, Circulatory and Urinogenital system.

Unit-IV: Class Aves: General characters and classification up to Orders. Adaptation to aerial mode of life. Flight muscles and flight mechanism. Migration in Birds. Sexual dimorphism in birds.
Class Mammalia: General characters and classification up to Orders. Egg laying Mammals and Marsupials. Aquatic adaptation in Mammals. Adaptations and diversity in Primates.
Oryctolagus (Rabbit): Morphology, Digestive, Circulatory and Urinogenital system.

Books recommended:

Parker & Haswell:	Textbook of Zoology-Vertebrates (Vol. II)
(Revised by Marshall & Williams)	
Young:	The life of vertebrates
Kotpal:	Modern Textbook of Zoology-Vertebrates
Jordan & Verma:	Chordate Zoology

B.Sc. (HONS.) ZOOLOGY
III SEM (CORE COURSE)
ANIMAL ECOLOGY

Credits: 04	
Sessional	30
End-Term Examination	70
Total:	100

Course Code: ZYB-351

Unit-I: Introduction, history and scope of Ecology; Life supporting properties of water; Physical factors: temperature, light, pH and salinity, thermal stratification, factors influencing light penetration in water; Concept of limiting factors and laws governing these factors.

Unit-II: Unitary and Modular populations, Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal; Exponential and logistic growth, equation and patterns, r and K strategies, Population regulation: density-dependent and independent factors; Ecological niche; Gause's Principle with laboratory and field examples.

Unit-III: Community characteristics: Dominance, diversity, species richness, abundance, stratification; Ecotone and edge effect; Types of interaction: Inter and intra-specific; Ecological succession; Types of ecosystem with detailed account of pond, desert and forest ecosystems; Detritus and grazing food chains, food web, energy flow through ecosystem; Ecological pyramids and Ecological efficiencies; Biogeochemical cycles: C, N, P & S cycles.

Unit-IV: Environmental ethics; Pollution: Air, water and noise pollution and their control; Natural resources: Mineral, water and forest, their significance and conservation; Types of biodiversity, Hotspots, benefit and threat of conservation strategies; Application of ecology in wild life management, Conservation of biological diversity: National parks, Sanctuaries, Biosphere reserve.

Books recommended:

Odum, E.P. & Barrett, G.W.:	:	Fundamentals of Ecology
Stiling, P.	:	Ecology: Theories and application
Singh, H.R.	:	Environmental Biology
Subrahmanyam, N.S. &	:	Ecology
Sambamurty, A.V.S.S.	:	
Dhaliwal, G.S., Sangha,	:	Fundamentals of Environmental Science
G.S. & Ralhan, P.K.	:	

**B.Sc. (Hons.) Zoology III Semester
Skill Enhancement Course
Public Health and Hygiene**

Course Code: ZYB-352

Credits: 2	
Sessional	30
End-Term Examination	70
Total:	100

Unit-I: Introduction to public health and hygiene. Determinants and factors affecting health and hygiene. Pollution and associated hazards; water and air borne diseases. Prevention of diseases through health education and environment improvements.

Unit-II: Classification of foods (micro and macro nutrients). Balanced diet and malnutrition. Diseases caused by deficiency of proteins, vitamins and minerals.

Unit-III: Infectious agents responsible for diseases in humans. Communicable diseases such as measles, polio, chickungunya, rabies, leprosy, tuberculosis, AIDS, hepatitis and their preventive measures.

Unit-IV: Non-communicable diseases such as hypertension, coronary heart disease, stroke, diabetes, obesity, mental ill-health, cancer and their preventive measures.

Books Recommended

1. Introduction to Public Health – Mary Jane Schneider
2. A Short Book of Public Health – Muthu, V.K.
3. Oxford Textbook of Public Health (6th Ed.) – Roger Detels
4. Public Health Nutrition – Gibney
5. Nutrition, Health and Disease - Wong

B.Sc. (Hons.) Zoology III Semester
Skill Enhancement Course
PISCICULTURE

Course Code: ZYB-353

Credits:	2
Sessional	30
End-Term Examination	70
Total:	100

- Unit-I:** Aquaculture: Definition and Scope, commercially important cultivable finfish species in freshwater, brackish water and marine water environments. Entrepreneurship opportunities in pisciculture.
- Unit-II:** Types of fish ponds and their management; Fish polyculture with special reference to Indian major carps; Integrated fish farming and its significance. Induced breeding and its significance in pisciculture.
- Unit-III:** Mariculture with reference to commonly cultivable marine finfish species in India; Ornamental fish culture and its significance; culture method of a commercially important ornamental finfish species.
- Unit-IV:** Feeding practices in pisciculture; traditional feed and nutritionally-balanced diet; Type of feeds commonly used in pisciculture; commonly occurring diseases in pisciculture and their control.

Books Recommended

Fish and Fisheries - V.G. Jhingram

A textbook of Fish Biology and Fisheries, 3rd Edition - S.S. Khanna and H.R. Singh

B.Sc. (HONS.) ZOOLOGY
IV-SEM (CORE COURSE)
DEVELOPMENTAL BIOLOGY

Credits: 04	
Sessional	30
End-Term Examination	70
Total:	100

Course Code: ZYB-451

Unit-I: Introduction and Definition; History and basic concepts: Preformation, Epigenesis, Mosaic and Regulative development; Discovery of induction and Cell interaction; Reproduction: Types and significance; Gametogenesis: Spermatogenesis, Oogenesis, Types of egg, egg membranes; Fertilization: Structural and biochemical changes in gametes during and after fertilization.

Unit-II: Planes and Patterns of cleavage; Fate maps and cell lineage; Blastulation: General process and types; Gastrulation: General process and morphogenetic movement; Early development of frog and chick up to gastrulation; General account of Tubulation and fate of germ layers; Extra embryonic membranes: Structure and function; Implantation of embryo in human.

Unit-III: Placenta: Structure, types and function; Metamorphosis: Changes and hormonal regulation in insects and Amphibians; Growth: Auxetic, multiplicative and accretionary (isometric and allometric); Regeneration: Modes of regeneration, epimorphosis, morpholaxis and compensatory regeneration; Ageing: Concepts and models.

Unit-IV: Teratogenesis: Teratogenic agents and their effects on embryonic development; *In vitro* fertilization; Amniocentesis; Infertility: Definition and causes; Test tube baby: Techniques, advantages and disadvantages; Stem cell culture; Gamete intra-fallopian transfer (GIFT); Intra cytoplasmic sperm injection (ICSI); Artificial insemination (AI).

Books recommended:

- | | |
|---------------------------------|-------------------------------|
| 1. B.I. Balinsky & B.C. Fabian: | Introduction to Embryology |
| 2. S.F. Gilbert: | Developmental Biology |
| 3. T. Subramonium: | Developmental Biology |
| 4. P.S. Verma: | Chordate Embryology |
| 5. A.K. Berry: | An Introduction to Embryology |

**B.Sc. (Hons.) Zoology IV Semester
Skill Enhancement Course
SERICULTURE**

Course Code: ZYB-452

Credits: 2	
Sessional:	30
End-Term Examination	70
Total:	100

- Unit-I** Introduction to sericulture industry in India. Role of Central Silk Board and its research institutes in promoting the silk industry. Types of commercial silk in India. Mulberry and non-mulberry silkworm species, their distribution, host plants and raw silk production from each variety. Concept of pure races and hybrid, univoltine, bivoltine and tri-or multivoltine races of silkworm.
- Unit-II** Maintenance and conservation of mulberry germplasm bank. Taxonomy and description of mulberry with special reference to popular varieties of temperate and tropical sericulture. Types of mulberry plantations on the bases of training. Mulberry leaf production including common practices
- Unit-III** Mulberry silkworm rearing; disinfection techniques; grainage operations, mother moth examination, production of disease free layings. Incubation of eggs, black boxing; brushing of worms, chawki and late age rearing techniques. Bed cleaning, use of bed disinfectants. Mounting of worms and types of montages, harvesting of cocoons, stifling process, cooking and reeling operations.
- Unit-IV** Insect pests and diseases of mulberry plantations and their control measures. Diseases of silkworm, bombyx mori and their management. Pest in sericulture – precocoon and postcocoon and their control measures.

Books Recommended

1. Appropriate Sericulture Techniques – Eds.: Dr. Manjeet S. Jolley
2. Handbook of Sericulture Technologies – Eds.: S.B., Dandin; Jayant Jayaswal and K. Gridhar
3. Pests and Diseases of Mulberry and their Management - M.A. Khan, Anil Dhar, S.B. Zeya and A.R. Trag.

B.Sc. (Hons.) Zoology IV Semester
Skill Enhancement Course
POULTRY FARMING

Course Code: ZYB-453

Credits: 2	
Sessional	30
End-Term Examination	70
Total:	100

Unit-I Poultry Breeds

Introduction to Poultry Farming; Poultry birds viz chicken, duck, turkey, quail and emu Commercial breeds of chicken viz. Indian, American, English, Oriental and Mediterranean Breeds. Breeders, Sitters and Broilers. Hybrids. Mendelian traits in poultry. Inheritance of qualitative traits in poultry and their usefulness. Inheritance of comb, plumage and other qualitative traits. Economically important traits and their modes of inheritance.

Unit-II Poultry Rearing

System of rearing viz Range-Semi-Intensive and Intensive, Deep litter system and individual cage system of rearing. Nutritional requirement, Different systems of feeding wet mash, dry mash, crumble and pellet feeding. Restricted and phase feeding programme. Food and feeding of Breeders and Broilers, Floor space requirement, Design of poultry houses like brooder, grower, broiler layer and cage houses.

Unit-III Poultry Health Management

Common diseases of poultry- bacterial, viral, fungal, protozoan, parasitic and other emerging diseases of poultry, their prevention, control and treatment. Metabolic and nutrient deficiency disorders. Vaccination and deworming programmes. General farm sanitation and hygiene. Safe disposal of dead birds and farm waste. Stress control: Heat stroke, cold shock, bio-security measures in poultry farms.

Unit-IV Poultry Products, Marketing and Economics

Structure, chemical compositions and nutritive value of egg. Various measures of egg quality. Shell, albumen and yolk quality assessment. Weight and quality grades of egg as per BIS, Agmark and USDA standards. Processing, packing, preservations and grading of poultry meat. Poultry industry in India – past, present and future prospects. Statistics of egg and meat production in India. Transportation of eggs and chicken. Marketing approaches. HACCP System.

Books Recommended

1. Poultry farming in the East by A.R. Fawkes
2. Poultry Keeping in India by P.M.N. Naidu
3. Handbook of Animal Husbandry by ICAR
4. Applied Zoology by Nagendra S. Pawar
5. Roundworm of Poultry By P.G. Deo
6. Biological Sciences by R. Soper
7. Economic Zoology by Prakash Malhotra

BOS: 02.01.2016

**B.Sc. (HONS.) ZOOLOGY
IV-SEM (OPEN ELECTIVE)
Pure & Applied Zoology**

Credits: 02	
Sessional	30
End-Term Examination	70
Total:	100

Course Code: ZYB-491

Unit-I: Origin and Evolution of life: Concept, process, product and sequence of evolution; Theories of organic evolution; Evidences of organic evolution from Comparative anatomy, Embryology and Palaeontology; Origin of diversity; Zoogeographical regions.

Unit-II: Structure and functions of vital organs; Heart: Cardiac cycle, Electrocardiogram (ECG), Common heart diseases; Kidney: Different excretory products, Formation of urine, Regulation of water and salts, Osmoregulation in aquatic animals; Lung: Breathing and gas exchange; Transport mechanism of O₂ and CO₂, Oxygen dissociation curves; Endocrine glands: Types, function and associated diseases.

Unit-III: Introduction and scope of Applied Zoology; Edible species of fishes; Fish culture: Sources of fish feeds and induced breeding, Cultivable fish species, Fish by-products; Edible species of prawn, lobsters and molluscs; Shell fish farming: Prawn and pearl oyster;

Unit-IV: Brief account of Sericulture, Apiculture and Lac-culture; Poultry industry and commercially important poultry breeds in India; Meat, leather and wool industries, their production and export potentials; Breeds of cattle and buffaloes, Dairy farming in India; Milk production and pasteurization.

Books recommended:

1. P.S. Verms & V.K. Aggrawal: Evolution
2. Moody: Introduction to evolution
3. A.K. Berry: A textbook of Animal Physiology
4. C.D. Moyes & P.M. Schulte: Principles of Animal Physiology
5. G.S. Shukla & V.B. Upadhyay: Economic Zoology
6. P.D. Srivastava: Economic Zoology
7. Prakash Malhotra: Economic Zoology

BSc (Hons.) Zoology
V-Semester (Core Course)
Animal Physiology

Course Code: ZYB-551

Credits:	04
Sessional:	30
End-Term Examination:	70
Total:	100

Unit-I Nutrition, Digestion, Circulation

Requirements of the body; Biological significance of carbohydrates, proteins, fats, vitamins and minerals. Digestion, assimilation and role of liver. Blood-cells and plasma; Coagulation, blood groups. Defense mechanism of the body, immunoglobulins, innate and acquired immunity; hypersensitivity, transplantation. Functional anatomy of heart, cardiac cycle, cardiac output electrocardiogram (ECG), Integration of cardiovascular function.

Unit-II Respiration, Muscle Contraction, Thermoregulation

Breathing and gas exchange, gas transport, Hb and O₂ dissociation, chloride shift, carbohydrate, fat and protein metabolism, BMR. Types of muscles, physical properties and ultrastructural organization of skeletal muscle fibres, muscle contraction. Modes of heat transfer, survival of poikilotherms in cold and hot environment, Mechanism of thermoregulation in homeotherms. Torpor.

Unit-III Nervous Integration, Sense organs physiology, Endocrine system

Functional architecture of neuron, ionic basis of resting and action potentials, nerve impulse and its transmission, synapse and synaptic transmission, divisions of the nervous system. Somatic, autonomic and central nervous systems, Reflex action. General organizations and functioning of different sense organs, vision, hearing, taste and smell. Endocrine glands, methods of study, pituitary, feedback mechanisms, thyroid, parathyroid, adrenal cortex and medulla, pancreas, gonads.

Unit-IV Excretion, Osmoregulation, Reproduction

Organs of excretion, nephron structure, and urine formation, control of excretion (role of ADH, RAS and counter current mechanism), excretion of nitrogenous wastes. Mechanisms of osmoregulation in fresh water and marine organisms, stenohalinity and euryhalinity. Breeding patterns, Estrous & Menstrual cycle, implantation, gestation, parturition, lactation, birth control.

Books recommended:

1. **Berry:** A text book of animal physiology
2. **Rastogi:** Text book of Physiology
3. **H.R. Singh:** An introduction to animal physiology and related biochemistry
4. **Vander, Sherman and Luciano:** Human Physiology
5. **Moyes and Schulte:** Principles of Animal Physiology
6. **Freeman:** Biological Sciences

B.Sc. (Hons) Zoology
V Semester (CORE COURSE)
Comparative Anatomy of Vertebrates

Course Code: ZYB-552

Credits: 04	
Sessional:	30
End-Term Examination:	70
Total:	100

Unit-I: Comparative anatomy of integument from fishes to mammals; types external scales in fishes viz., placoid, ganoid, cycloid, ctenoid; dermal scales in reptiles; derivatives of integuments; hooves, antlers in mammals; feathers viz., contour, down and filoplume and; evolution of heart; comparative anatomy of heart in vertebrates; evolution of aortic arches and their significance.

Unit-II: Visceral arches in vertebrates; outline of axial and appendicular skeleton; comparative anatomy of pelvic and pectoral girdles from fishes (bony and cartilaginous fishes) to mammals; development of brain; comparative study of brain in various classes of vertebrates.

Unit-III: Digestive system: Comparative anatomy of jaw suspension, oral cavity, teeth (dentition in mammals); oesophagus, stomach and intestine in vertebrates; comparative accounts of digestive glands viz., liver, pancreas, gall bladder.

Respiratory system: Aquatic respiration; types of gills, structure of gills, outline of accessory respiratory organs in fishes. Terrestrial respiration; respiratory tract,, nasal passage, trachea, sound producing organs (larynx, syrinx); comparative anatomy of lungs in amphibians, reptiles, birds and mammals.

Unit-IV: Urogenital system: Types of kidney, developmental stages of kidney and their ducts in anamniotes; developmental stages of kidney and their ducts in amniotes; comparative accounts of testes and ovaries from fishes to mammals.

BOOKS RECOMMENDED:

1. Anatomy of Chordates- Charles K. Weichert
2. Modern Text Book of Zoology (Vertebrates)- R. L. Kotpal
3. Chordate Zoology- E. L. Jordan and P. S. Verma
4. Comparative Anatomy of Vertebrates- R. K. Saxena and Sumitra Saxena

B.Sc. (Hons.) Zoology
V Semester (Discipline Centric Elective)
Animal Behaviour

Course Code: ZYB-553

Credits: 04	
Sessional:	30
End-Term Examination:	70
Total:	100

Unit-I: Introduction to animal behaviour: brief history and scope. Types of stimuli: internal and external cues. Kinds of behaviour: foraging behaviour, territorial behaviour, mate selection and courtship behaviour, parental care, defensive behaviour, allelomimetic and maladaptive (abnormal) behaviour.

Unit-II: Biological clocks: circadian and circannual rhythms, photoperiodism, tidal, solar and lunar rhythms, entrainments. Advantages of biological rhythms. Applications of Chronobiology. Migratory behaviour in birds.

Unit-III: Innate behaviour: communication. Patterns of innate behaviour and neural control: kineses, taxes, simple reflexes, instinct and motivation. Hormonal control of behaviour (e.g., Ring Dove and Red Deer).

Unit-IV: Learning (Learnt behavior): habituation, imprinting, conditioned reflex, trial and error learning, latent learning, insight learning. Social behaviour: aggregation, group selection, kin selection, altruism. Social organization (e.g., Honeybee, Termites Naked Mole Rat and Monkey).

Books recommended:

1. Animal Behaviour (Ethology) by Reena Mathur
2. Ethology (Animal Behaviour) by Satguru Prasad
3. Animal Behaviour (Ethology) by Devid Farland
4. Animal Behaviour (Ethology) by V.K. Agarwal

B. Sc. (Hons.) Zoology
V-Semester (Discipline Centric Elective)
Biotechniques

Course Code: ZYB-554

Credits: 04	
Sessional	30
End-Term Examination	70
Total:	100

Unit-I: Microscopy: Introduction to Microscopy. Definitions-Resolving Power, Limit of Resolution and Magnification, Numerical Aperture. Types of microscopes. Basic principles of Light, Electron, Fluorescence and Confocal Microscopy. Measurements, Drawings and Photomicrography.

Unit-II: Biochemistry and Physiology: Physiological Salines, Buffers and the use of pH meter. Extraction of Tissue Glycogen, Proteins, Lipids and Nucleic Acids by Graaf's Method. Subcellular Fractionation by Differential Centrifugation. Basic Principle and Application of Colorimetry and Spectrophotometry, Beer-Lambert's Law. Separation of Biomolecules by Native PAGE, 2D PAGE, Agarose gel electrophoresis and Chromatography.

Unit-III: Immunology and Endocrinology: Introduction to Antigens, Antibodies, Adjuvants. Raising Polyclonal and Monoclonal Antibodies. Antigen-Antibody Interactions-Immunodiffusion, Ouchterlony's Double Immunodiffusion, Counter-Current Immunoelectrophoresis, Western Blotting, ELISA, Principle & Working of ELISA Reader, Hormones assay methods. Application of Immunological techniques in disease diagnosis.

Unit-IV: Cell Culture and Laboratory Animals: Cell culture and its basic requirements. Culture media-Nutrient and Non-nutrient, commonly used media for human cell lines. Sterilization of culture wares and Media. Lymphocyte culture. Cell harvesting and Storage Methods. *In Vitro* culture of *Entamoeba histolytica*, *Coenorhabditis elegans*. Maintenance and Handling of laboratory rats and rabbits. Bioethics.

Books recommended:

- | | |
|---------------------|-----------------------------------|
| 1. Jayaraman: | Laboratory Manual in Biochemistry |
| 2. Plumer: | Practical Biochemistry |
| 3. Wilson & Walker: | Practical Biochemistry |
| 4. Freshney: | Culture of Animal Cells |

B.Sc. (Hons.) Zoology
V-Semester (Discipline Centric Elective)
Wildlife Conservation & Management

Course Code: ZYB-555

Credits:	04
Sessional:	30
End-Term Examination:	70
Total:	100

Unit-I: Definition of wildlife. Values of wildlife- positive and negative. Status of wildlife in India; endangered birds and mammals of India. Wildlife rich areas of India with reference to hotspot sites. Introduction to protected areas in India: Wildlife sanctuaries, National parks, Biosphere reserves, Conservation reserves and CommUnity reserves.

Unit-II: Management practices in protected areas of India: Grassland management (burning, cutting etc.), Logging of forests and its impact on habitat. Wetlands as major habitat for waterfowl. Carrying capacity of habitat and its evaluation. Fire as management tool for wildlife habitat management.

Unit-III: Concepts of zoning in protected areas: Core zone, buffer zone, multiple use zone. Forest fires and its impact on wild life habitat. Wildlife corridors. Weeds and their management. Wildlife/ Eco-tourism in protected areas and its significance. Management of locally abundant wildlife population by translocation.

Unit-IV: IUCN categories of conservation status of species such as endangered, vulnerable, near threatened, threatened and least threatened taxa. Wildlife conservation and NGOs: BNHS, WWF-India, Wetlands International; Major initiatives taken by Government of India for wild life conservation such as Indian Board of Wildlife (IBWL). Convention on Biological Diversity (CBD), RAMSAR sites. Wildlife Protection Act 1972, its amendments and implementation. Project Tiger; Project Elephant; Rhino reintroduction; Lion conservation.

Suggested Readings:

1. Wildlife of India, V.B. Saharia, Natraj Publishers, Dehradun.
2. Wildlife Management Manual, Robert Giles, Natraj Publishers, Dehradun.
3. Wildlife Protection Act (1972), Wildlife Trust of India, Delhi.
4. Threatened Birds of India, Asad A. Rahmani, BNHS-Oxford University Press Publication.

B.Sc. (HONS.) Zoology
VI-Semester (Core Course)
Genetics and Molecular Biology

Course Code: ZYB-651

Credits: 04	
Sessional	30
End-Term Examination:	70
Total:	100

Unit-I: MENDELIAN GENETICS, EXTENSION AND MODIFICATIONS: Concept of Dominance (Complete, Incomplete, and Co-dominance); Laws of Heredity: Segregation, Independent Assortment, Molecular biology of wrinkled seed; Test Cross, Back Cross; Modifications in Mendelian Di-hybrid Ratio; Epistasis, Multiple Allelism in Human Blood System, Human Mendelian Traits.

Unit-II: SEX DETERMINATION AND EXTRANUCLEAR INHERITANCE: Sex determination in *Drosophila*: Chromosomal theory, origin of Gynanders and Intersexes, Genic balance. Sex determination in human: Gene Dosage Compensation and Molecular basis of X-chromosome inactivation. Cytoplasmic inheritance: Sigma factor in *Drosophila*, Kappa particle inheritance. Chromosomal aneuploidy in human beings.

Unit-III: CHROMOSOME, DNA AND REPLICATION: Composition of chromatin and structural organization, Nucleosome model. Giant chromosomes: Lampbrush chromosomes and Polytene chromosomes. Chemistry of nucleic acids, DNA as genetic materials and Structural variants of DNA, DNA replication: Process, origin of replication, unwinding of DNA helix, role of primers, elongation, DNA repair mechanisms.

Unit-IV: GENE EXPRESSION AND rDNA TECHNOLOGY: Transcription and Translation in Prokaryotes. Post transcriptional modifications. Regulation of gene expression, Lac Operon and Tryp Operon. rDNA Technology: Introduction, Cloning Vectors, Restriction Enzymes and Cloning Methods, PCR, Gene Transfer Methods, Microarray. Ethical Issues in Genetics and Molecular Biology.

Books recommended:

- | | |
|---------------------------|-------------------------------------|
| 1. Gardener: | Principle of Genetics |
| 2. P. K. Gupta: | Genetics |
| 3. P. S. Verma: | Genetics |
| 4. Waseem Ahmad (Faridi): | Genetics and Genomics |
| 5. Lewin: | Gene XI |
| 6. Walker and Rapley: | Molecular Biology and Biotechnology |
| 7. Watson: | Molecular Biology of the Gene |

B.SC. (HON) ZOOLOGY
VI Semester (Core Course)
Cell Biology and Histology

Course Code: ZYB-652

Credits: 04	
Sessional:	30
End-Term Examination:	70
Total:	100

CELL BIOLOGY

Unit-I: General structure of prokaryotic and eukaryotic cells. Major organic and inorganic constituents of cells (ions, proteins, carbohydrates, lipids, enzymes and nucleic acids). Structure and function of plasma membrane (fluid mosaic model and Unit mosaic model). Structure and function of extra-nuclear cell organelles (mitochondria, endoplasmic reticulum, Golgi apparatus, lysosomes, ribosomes, polysomes, microsomes and plasmids). The cytoskeleton: microfilaments, microtubules tonofilaments / intermediate filaments

Unit-II: Structure and function of the nuclear membrane. Chromatin fibres, chromosomes – nomenclature, types and structure. Salient stages in mitosis and meiosis. The eukaryotic cell cycle. DNA structure and variants; RNA structure and variants.

HISTOLOGY

Unit-III: Introduction to tissues. Histological techniques. Epithelial tissue: types, structure and characteristics. Apical surface modifications: striated/brush border, cilia, flagella, stereocilia. The basement membrane: structure and characteristics. Cell junctions. Exocrine glands: types, structure and classification. Endocrine glands: characteristics and structure of pituitary, thyroid, parathyroid, pancreas and adrenals. Connective tissue: Classification of connective tissue. Connective tissue cells, fibres and ground substance. Structure and function of loose, dense and adipose tissue. Cartilage: hyaline, elastic and fibrous.

Unit- IV: Bone: classification, gross organization and fine structure. Development of long bone. Blood: characteristics of plasma. Types of blood cells – their structural and functional characteristics. Lymph and its characteristics. Bone marrow and haemopoiesis. Structure & function of spleen. Muscular tissue: organization, structure including ultrastructure of smooth, skeletal and cardiac muscles. Muscle tendon attachment. Organization of nervous tissue. Structure and classification of neurons. Types of supporting (glial) cells and their function. Myelin sheath and its formation. Types of sensory nerve endings. Degeneration and regeneration of neurons. Membranes of the brain and spinal cord.

Books recommended:

- | | |
|--------------------------|--|
| 1. Powar: | Cell Biology |
| 2. Cooper: | The Cell – a molecular approach |
| 3. Karp: | Cell Biology |
| 4. Bloom & Fawcett: | A Textbook of Histology |
| 5. Kelly, Wood & Enders: | Bailey's Textbook of Microscopic Anatomy |
| 6. Majumdar: | A Textbook of Histology |

B.Sc. (Hons.) Zoology
VI Semester (Discipline Centric Elective)
Evolutionary Biology

Course Code: ZYB-653

Credits: 04	
Sessional:	30
End-Term Examination:	70
Total:	100

- Unit-I:** Introduction to Evolution. Origin of life, chemical and organic evolution, Evolution of prokaryotes and eukaryotes. Endosymbiosis of Margulius. Evidences of evolution: Fossils record, types of fossils, geological eras, punctuated equilibria, serological, embryological, bio-geographical.
- Unit-II:** Morphological evidences (homology, analogy, vestigial organs), Panglossian paradigm. Evolutionary Theory: Lamarckism, Darwinism, Neo-Darwinism, Neo-Lamarckian and Evo-Devo Approach. Sources of Variation (Genetic and Epigenetic Variation).
- Unit-III:** Population Genetics: Hardy-Weinberg Law. Mutation, selection, drift, migration. Modes and Types of Selection: - Stabilizing, directional, disruptive, sexual, kinship. Concept of micro and macro evolution.
- Unit-IV:** Origin and evolution of man. Unique hominid characteristics contrasted with primate characteristics. Primate phylogeny from *Dryopithecus* leading to *Homo sapiens*. Species Concepts. Speciation: Allopatric and sympatric speciation. Phylogeny: Molecular Phylogenetic trees, construction and interpretation of trees.

BOOKS RECOMMENDED:

1. Moodey: Introduction to Evolution
2. Th. Dobzansky: Genetic and the Origin of the speices
3. Strickberger: Evolution
4. Ayala: Population Genetics

B.Sc. (Hons.) Zoology
VI Semester (Discipline Centric Elective)
Applied Zoology

Course Code: ZYB-654

Credits:	04
Sessional:	30
End-Term Examination:	70
Total:	100

Unit – I: Introduction and scope of Applied Zoology and its role in human welfare, pharmaceuticals from animals, sea food: fish by-products, value addition, MPEDA, HACCP, FSSAI, Animal-waste recycling, biogas and its production, types of biogas plants and their functioning.

Unit–II: Edible species of fishes; fish culture: Source of fish seeds and induced breeding, cultivable fish species. Types of fish ponds, management of fish culture farm, harvesting and marketing. Polyculture of Indian major carps. Edible *species* of prawn, lobster and mollusks, shellfish farming: prawn and pearl oyster.

Unit–III: Sericulture, with emphasis on *Bombyx mori*. Apiculture, Lac culture, Vermiculture, Meat, Leather and Wool processing industries, their production and export potential. Diseases and natural enemies related to above cultures. Slaughter house by-products/wastes and their utilization.

Unit–IV: Poultry farming: commercial breeds of chicken. Rearing of chicken: food, feeding and housing, poultry diseases Broiler and egg industry. Breeds of cattle and buffaloes. Role of assisted reproduction in breed improvement. Dairy-farming in India: food, feeding and housing. Dairy products, Pasteurization techniques and their advantages.

BOOKS RECOMMENDED:

- | | |
|-----------------------------------|---|
| 1. H.C. Nigam: | Modern Trends in Biology & Economic Zoology |
| 2. G.S. Shukla and V.B. Upadhyay: | Economic Zoology |
| 3. P.D. Srivastava: | Economic Zoology |
| 4. Prakash Malhotra: | Economic Zoology |
| 5. P.R. Venkitaraman: | Textbook of Economic Zoology |

B.Sc. (Hons.) Zoology
VI Semester (Discipline Centric Elective)
Bioinformatics & Biostatistics

Course Code: ZYB-656

Credits: 04

Sessional:	30
End-Term Examination:	70
Total:	100

BIOINFORMATICS

Unit-I: Introduction and Scope. Brief historical perspective. Basics of Bioinformatics, definitions, Computational biology, Genomics, Proteomics and Metabolomics. Biological Databases and Data Mining, Predictive methods using DNA, RNA and Protein Sequences. Protein Structure Prediction and Analysis. Microarray Technology.

Unit-II: Analysis of Gene Expression, Sequence Polymorphism, Sequence Alignment Tools-BLAST and FASTA, Multiple Sequence Alignment. Phylogenetic Analysis, Molecular Phylogeny and Evolution. Computational Approaches in Comparative Genomics. From Parasite to Primates. Bioinformatics and Pharmaceutical Industry. Ethical Issues in Bioinformatics.

BIOSTATISTICS

Unit-III: Introduction, Basic concepts, Sampling and its Techniques, Sample Mean, Median, Mode Variance, Random Samples and Random Numbers, Sample SD, SEM; Collection, Classification, Tabulation and Presentation of Data; Idea of Significance, t-tests, X^2 tests; Correlation of Measurements, Correlation Coefficients and Significance Tests.

Unit-IV: Probability- Basic concepts, definitions, Theorems, Probability problems-Factorials, Permutations, Combinations and Arrangements, Random Variables, Probability distribution- Normal, Random, Binomial, Poisson and Exponential. Correlation and Regression Analysis, Chi-Square Analysis, Testing of Hypothesis, Analysis of Variance or ANOVA-one way, two way classification. Use of some common statistical softwares available (SPSS, SigmaPlot, GraphPad prizm IV and Spread Sheet).

Recommended Books:

1. Bioinformatics-A practical guide to the analysis of genes and proteins by Baxevanis & Ouellette.
2. Bioinformatics by SK Agarwal
3. Bioinformatics by Arunima Mukherjee
4. Bioinformatics and Functional Genomics by Jonathan Pevsner
5. An introduction to Experimental Design and Statistics for Biology by David Heath
6. Statistical Methods in Biology by Baily
7. Biostatics- How it Works by Steve Selvin
8. Biostatics by Sarma, Reddy, Pullaiah.