## M.Sc. ZOOLOGY

### SCHEME OF INSTRUCTION AND EXAMINATION

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Title of the Course</th>
<th>Core/ Elective</th>
<th>No. of Credits</th>
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<td>Any one of the following 404-A- Animal Biotechnology and Microbiology 404-B-Biomedical Sciences</td>
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Total Marks excluding SSC : 2400

### Number of Hours allotted

- **a)** Theory : 4 hours/ week
- **b)** Practicals : 9 hours/ week
- **c)** IA: Internal Assessment for Non-CBCS Students : 20 80 100
SRI VENKATESWARA UNIVERSITY::TIRUPATI
SVU COLLEGE OF SCIENCES
DEPARTMENT OF ZOOLOGY
CHOICE BASED CREDIT SYSTEM

SEMESTER -I
(effective from the batch of students admitted during the academic year 2015-16)
REVISED SYLLABUS

ZOO-101: INVERTEBRATA & CHORDATA

UNIT-I : Invertebrata
1.1 Evolutionary time scale, Eras, Periods & Epoch - major events.
1.2 Species concept, International code of Zoological nomenclature, Taxonomical procedures, New Trends in taxonomy.
1.3 Patterns of feeding and digestion in lower metazoans: Holozoic nutrition, Pinocytosis, Saprophytic Nutrition, Myxotrophic nutrition, Nutrition of parasites.
1.4 Feeding in Polychaeta, Mollusca, Echinodermata.

UNIT-II : Invertebrata
2.1 Acoelomata, Pseudocoelomata, Coelomata, Proterostomia and Dueterostomia.
2.2 Structure of Gill, lungs, trachea and Mechanism of Respiration, Circulatory system in Annelids, Arthropods & Molluscs.
2.3 Advanced nervous system - Annelida, Arthropoda and Mollusca.
2.4 Larval forms of Crustaceans: Larval forms: Nauplius, Metanauplius, Protozoa, Zoaea, Cypris, Mysis, Megalopa, Phyllosoma, Alima. Significance of larval forms;
   Larval forms of Echinodermata: Asteroidea Bipinnaria Larva, Ophiuroidea, Echinoidea, Holothuroidea, Crinoidea Doliolaria Larva, Significance of Echinoderm larval forms.

UNIT – III : Anatomy
3.1 Vertebrate integument and derivatives: - Skin structure and functions - glands, scales, horns, claws, nails, hoofs, feathers and hair.
3.2 Comparative anatomy of heart: - Types - structure, blood circulation - aortic arches and portal system.
3.3 Comparative anatomy of reproductive system: - Organs of male reproductive system – organs of female reproductive system – functions.
3.4 Comparative account of excretory system.

UNIT – IV : Organs
4.1 Comparative anatomy of respiratory organs: - Gills, trachea and lungs – types-structure-mechanism of respiration.
4.2 Comparative anatomy of brain and spinal cord: - structure, composition and functions
4.3 Organs of vision: structure of eye in different phyla - mechanism of vision, Photoreceptors-fishes, Amphibians, Reptiles, Birds and Mammals.
4.4 Organs of Gustatory hearing and tactile responses: - Structure of hearing organs in different Phyla - mechanism of hearing - tactile organs.

SUGGESTED READING MATERIAL:
UNIT-I : Molecular nature of Genome

1.1 Watson and Crick Model: Types of DNA; Properties of DNA (C-value paradox, Cot value)
1.2 Nuclear and mitochondrial genome
1.3 Structure of gene (Cistron, Muton, Recon, Cis-trans test) and Gene families: Simple multi gene families, Complex multi gene families.
1.4 DNA damage and repair: Biological indication of repair, photo reactivation, Excision repair, Recombination repair, SOS repair, and Mismatch repair.

UNIT-II: Replication:

2.1 Replication in Prokaryotes: Geometry of DNA replication, semi conservative replication.
2.2 Enzymology of DNA replication: DNA polymerase I, II and III; Replication of Eukaryotic Chromosomes; Eukaryotic DNA polymerases; Multiple fork; Replication of Chromatin.
2.3 Discontinuous Replication: Fragments in Replication fork and detection of fragments; Events in the Replication fork; De novo initiation and covalent extension.
2.4 Bidirectional replication, Termination of replication

Unit-III : Transcription and Translation:

3.1 Synthesis of RNA: RNA polymerase. Site selection I- The promoter, Site selection II- Auxiliary proteins, RNA chain initiation, elongation, termination and release of newly synthesized RNA.
3.2 Classes of RNA molecules: Types, structure and processing of mRNA, tRNA and rRNA in E.coli. Transcription in eukaryotes, inhibitors of Transcription.
3.3 Outlines of Translation: the Genetic code; Types of codons, Basic composition of the codons.
3.4 Identification of the stop codons; Universality of the code, exception to Genetic code, Redundancy of the code, the decoding system; the codon and Anticodon. Interactions wobble Hypothesis, the Genetic code in mitochondria.

Unit-IV : Translation:

4.1 Ribosomes: Physical structure and chemical composition of prokaryotic and eukaryotic Ribosomes.
4.2 Protein synthesis: Directions of polypeptide chain growth and of mRNA; Initiation, Elongation and Termination of polypeptide chain; Role of GTP and antibiotics in protein Synthesis. Inhibitors of Translation, post translational modification of proteins, protein targeting and targeting.
4.3 Gene regulation and its products: General aspects of the gene regulation in prokaryotes; Induction, Repression of Lactose Operons, Galactose Operon and Tryptophan Operon.
4.4 Gene regulation in Eukaryotes.

SUGGESTED READING MATERIAL

1. Biochemistry by A.L. Lehninger
2. Cell and Molecular Biology-E.D.P. De Robertis and E.M.F.
5. Molecular Biology by David Freifelder, 1993
UNIT-I: Introduction to Computers

1.1 History of Computers, classification of computers, computer generations
1.2 Input, output processing and storage devices - Floppy disk, hard disk, CD-ROM, DVD, Digital devices etc.,
1.3 Operating system – Introduction – types of operating systems – MS DOS, WINDOWS, LYNUX
1.4 MS – ACCESS, FOXPRO

UNIT–II: Applications

2.1 Computer Graphics – graphic generation methods, uses of computer graphics, graphic forms
2.2 Internet concepts: Internet access tools, Web searching, e-mail, File transfer Protocol (FTP).
2.3 Word processing and presentation software MS – WORD, POWER POINT, EXCEL.
2.4 Use of commonly available statistical packages, such as SPSS, etc.

UNIT-III: Introduction to Bioinformatics, Genomics and Proteomics

3.1 Scope, importance and status of Bioinformatics
3.2 Internet basics; Tools for web search, Data retrieval tools; Database types; Sources of Web sites
3.3 Proteomics; Prediction of Protein structure and protein folding; Protein sequence databases; Submission of sequence to the database
3.4 Phylogenetic Analysis and Evolutionary Trees

UNIT-IV: Biological Databases and Emerging areas of Bioinformatics

4.1 Homology-BLAST- types of BLASTs
4.2 Mapping of genome; Prediction of gene structure, Functional genomics.
4.3 DNA microarrays.
4.4 Human genome project

SUGGESTED READING MATERIAL:

UNIT-I: Instrumentation
1.2 Spectroscopy, Centrifugation and X-ray Refraction MALDI.
1.3 Electrophoresis: principle, Matrices and used in electrophoresis – starch, cellulose acetate, agarose and acrylamide. use of PAGE for separation of proteins, molecular mass determination. Separation of nucleic acids using agarose gel electrophoresis. Pulse field electrophoresis and isoelectric focusing.
1.4 Blotting techniques: western, southern and northern blotting techniques.

UNIT-II: Tissue Culture
2.1 Introduction to cell and tissue culture: Preparatory techniques – cleaning, sterilization, sterile handling tissue culture laboratory requirements, Design of tissue culture laboratory: Equipments and purpose.
2.2 Cell types (Primary and secondary) and cell lines, Cell proliferation measurements, Cell viability testing: Dye inclusion and dye exclusion tests facs.
2.3 Culture media: composition, preparation and sterilization, macro and micro nutrients, Importance of serum and limitation with serum media, cell harvesting methods.
2.4 The biology of stem cell: overview; different types of stem cells – embryonic stem cells, fetal tissue stem cells, adult stem cells, stem cell nuclear transfer, somatic cell nuclear transfer, Animal cloning.

UNIT–III: Introduction and Scope of Biostatistics
3.1 Definition of statistics: Biostatistics, classification, variables and attributes, Diagramatic distribution of biological data.
3.2 Measures of location and dispersion: Arithmetic mean, median and mode. Mean deviation, quartile deviation, Standard deviation and co-efficient of variation.
3.3 Curve fitting: Fitting strait line, parabola exponential curve and geometric curve to the data. Fitting of straight line using Ms-Excel.
3.4 Correlation and regression: Scatter diagram, types of relationship. Positive and negative correlation, computation of correlation coefficient, Interpretation of correlation coefficient. Simple regression lines and its interpretation.

UNIT-IV: Statistical Tests
4.1 Normal probability distribution & its applications.
4.2 Tests of significance: level of significance, null and alternative hypothesis, power of test and p-value of a test.
4.3 Student t-test for one a sample and two samples means paired t-tests.
4.4 F-test, chi square test and their application, concept of ANOVA.

SUGGESTED READING MATERIAL:
SEMESTER - II
ZOO-201: PHYSIOLOGICAL CHEMISTRY

UNIT-I : Metabolism of carbohydrates

1.1 Thermodynamic principles in biology.
1.2 Carbohydrate : structure and classification – Properties of Monosaccharides, Oligo and Poly saccharides.
1.3 Major pathways of carbohydrate metabolism: Glycolysis – TCA cycle and their biomedical importance.
1.4 Gluconeogenesis - HMP Shunt - Metabolism of Galactose and Fructose.

UNIT-II : Metabolism of proteins

2.1 Classification of proteins, structure and properties of proteins
2.2 Bio synthesis of nutritionally non essential amino acids and their biomedical importance
2.3 Catabolism of proteins, and amino acid - Bio Synthesis of urea – Detoxification of Ammonia
2.4 Catabolism of carbon skeletons of amino acids- metabolic disease of phenylalanine - Catabolism - Conversion of amino acids to specialized products

UNIT-III : Metabolism of lipids

3.1 General structure of lipids and classification.
3.2 Biomedical importance of lipids – Beta-oxidation of Palmitic acid - Biosynthesis of long Chain fattyacids.
3.3 Metabolism of unsaturated fatty acids and Eicosanoids – Biomedical importance – Clinical Aspects.
3.4 Lipid transportation and storage - Cholesterol synthesis - Excretion.

UNIT-IV : Metabolism of nucleotides

4.2 Metabolism of purine and pyrimidine nucleotides.
4.3 Regulation of pyrimidine nucleotide biosynthesis – Disorders of nucleotide catabolism – drugs and orotic aciduria.
4.4 Degradation of nucleotides – clinical disorders of nucleotide metabolism.

SUGGESTED READING MATERIAL

2. David L. Nelson and Michael M. Cox, Lehninger; Principles of Biochemistry, McMillan Lange Medical
UNIT-I : Internal organization of the cell:

1.1 Organization of Prokaryotic and Eukaryotic cell.
1.2 Membrane structure – Lipid bi layer and two dimensional structure – Fluidity of lipid bi layer – Assembly of lipid bi layer – Membrane proteins.
1.4 Vesicular traffic and Protein sorting: Translocation of proteins in to mitochondria – Endoplasmic reticulum and Golgi - Endocytosis – exocytosis.

UNIT-II : Cell signaling:

2.1 Models of cell-cell signaling (steroid receptors, Nitric oxide and Carbon monoxide).
2.2 Functions of cell surface receptors (G-protein coupled receptors, Tyrosine kinases, cytokine receptors, receptors liked to other enzymatic activities).
2.4 Pathways of intracellular signaling transduction (c-AMP pathways, cyclic c-GMP, phospholipids and Ca²⁺, Ras, Raf and MAP kinases).
2.5 Signaling in development and differentiation (the receptors tyrosine kinase, Ras, MAP kinase pathway in Drosophila, notch signaling).

UNIT-III : Cells and organs of the immune system

3.1 Cells of the immune system: Lymphoid cells, Mononuclear cells, granulocytic cells, Mast Cells.
3.2 Organs of the immune system- primary and secondary lymphoid organs, lymphatic system.
3.3 Antigens: Antigenic determinants or Epitopes, Immunogenicity, Haptens, Adjuvants
3.4 Innate (Non-specific ): Anatomical barriers, Phagocytosis, Physiological barriers, Inflammatory barriers.

UNIT-IV: Acquired immunity

4.1 Humoral immunity: Immunoglobulins (fine structure of immunoglobulins and Classes); the complement system, Classical and alternate pathway, Inflammation.
4.2 Cell mediated immunity: Mechanism of cell mediated immunity; brief account on Antigen Presentation, Major Histocompatibility complex
4.3 Antigen-antibody interactions: Affinity, Avidity, Cross-reactivity, precipitation reactions and Agglutination reactions and ELISA.
4.4 Brief account on immunological disorders:
   a) Tolerance to autoimmunity
   b) Transplantation
   c) Immunodeficiency diseases
   d) Immunization (active and passive immunity)

SUGGESTED READING MATERIAL

6. Immunology introductory textbook by Nandini Shetty, Wiley Eastern Ltd.
ZOO-203: GENETICS AND GENETIC ENGINEERING

UNIT-I : Genetics

1.1 Concept of gene: Alleles, Multiple alleles and Pseudoalleles (ABO blood grouping, Bombay phenotype and Rh factor).
1.2 Extensions of Mendelian Principles: Pleiotropy, genomic imprinting, Penetrance and expressivity, phenocopy, sex linked, sex limited and sex influenced characters.
1.3 Linkage and Crossing over; Complete and incomplete linkage; lod score for linkage testing, somatic or mitotic crossing over, germinal or meiotic crossing over.
1.4 Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping with somatic cell hybrids.

UNIT-II : Genetics

2.1 Mutation: Types (Spontaneous, Induced, lethal, conditional, biochemical) causes, loss of function, gain of function, insertional mutagenesis.
2.2 Microbial genetics: Methods of genetic transfers – transformation, conjugation, Transduction and sexduction, mapping genes by interrupted mating.
2.3 Human genetics: Pedigree analysis, genetic disorders (Brachydactyly, Huntington’s chorea, Sickle cell anemia).
2.4 Quantitative genetics: Polygenic inheritance, Types of quantitative traits (continuous, meristic and threshold); examples (skin color and height in humans), Mapping of Quantitative trait loci (QTL mapping).

UNIT-III: GENETIC ENGINEERING COMPONENTS

3.1 Molecular vectors: Cloning, Shuttle, Expression and Binary vectors.
3.2 Plasmids (PBR322, PUC18/19, Blue script), Viruses (λ gt 10, 11, λ ZAP ).
3.3 Restriction endonucleases: Types, Properties and applications.
3.4 DNA and RNA Polymerases, Nucleases, Kinases, Phosphatases and Methylases. And ethics and IPR

UNIT-IV: MOLECULAR CLONING STRATEGIES AND TECHNIQUES IN GENETIC ENGINEERING

4.1 Generation of DNA fragments, RF digestion, Mechanical shearing, Duplex cDNA synthesis and chemical synthesis.
4.2 Joining of DNA fragments to vectors: Homopolymer tailing, Cohesive and blunt end ligation, linkers and adapters.
4.3 Introduction of recombinant DNAmolecules into selected host cells: Biological and Non-biological methods. Screening Techniques: Immunological and genetic hybridization.
4.4 Polymerase Chain Reaction (PCR) and its applications. Ethics, Intellectual Property Rights, Genetically Modified Organisms. RFLP and RAPD profiles in identification of DNA. Sequencing of nucleic acids: Maxam and Gilbert chemical degradation and Sanger’s dideoxy chain termination method and site – directed mutagenesis for changing genes.

SUGGESTED READING MATERIAL

1. An introduction to modern genetics by Ch. Waddington
5. DNA cloning : Mammalian systems - A Practical Approach by D.M. Glover, B. D. Hames.
6. From Genes to clones Introduction to Gene technology by Ernst-L- Winnacker.
8. Genetic Engineering and its Applications by P. Joshi
14. Green; Sue. Klaphaloz; Richard M. Myers Jane Roskam.
UNIT-I : General Properties of Enzymes

1.1 Introduction to enzymes- Nomenclature, Classification, Isolation & Purification of enzymes
1.2 Properties of enzymes-specificity of enzymes.
1.3 Enzyme Assays
1.4 Enzyme catalysis-General principles of catalysis.

UNIT-II : Kinetic properties of Enzymes

2.1 Kinetic theory and Collision theory
2.2 Effect of reactant concentrations (Rate constant, First order, Second order & Zero order reactions; Ramachandran plot; slope)
2.3 Effect of enzyme concentration, pH and Temperature.
2.4 Effect of substrate concentration, Determination of Kinetic constants (Km and V max; Michaelis and Menten hypothesis).

UNIT-III : Regulation of Enzyme activity

3.1 Inhibition of enzyme activity (competitive, non-competitive, uncompetitive and mixed inhibition)
3.2 Kinetics of allosteric enzymes
3.3 Regulation of enzyme activity (Metabolic regulation), Catalytic efficiency of enzymes (Feed back inhibition, covalent modification)
3.4 Mechanism of enzyme action (Lock and Key; Induced fit model), catalytic site, Role of metal ions.

UNIT-IV Economic importance of enzymes

4.1 Enzymes in clinical diagnosis, Therapeutic enzymes
4.2 Immobilized enzymes and their applications
4.3 Isozymes, Ribozymes, Hybrid enzymes
4.4 Enzyme engineering, economic importance.

SUGGESTED READING MATERIAL


II. Nature of Values- Good and Bad, Ends and Means, Actual and potential Values, Objective and Subjective Values, Analysis of basic moral concepts- right, ought, duty, obligation, justice, responsibility and freedom, Good behavior and respect for elders, Character and Conduct.

III. Individual and society: 
   Ahimsa (Non-Violence), Satya (Truth), Brahmacharya (Celibacy), Asteya (Non-possession) and Aparigraha (Non-stealing). Purushartha (Cardinal virtues)- Dharma (Righteousness), Artha (Wealth), Kama (Fulfillment Bodily Desires), Moksha (Liberation).


V. Crime and Theories of punishment – (a) Reformative, Retributive and Deterrent. (b) Views on manu and Yajnavalkya.

Books for study:
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly: Introduction to Ethics
ZOO-301: COMPARATIVE ANIMAL PHYSIOLOGY

UNIT-I: Comparative Animal Physiology-I

1.1 Aim and scope of physiology; General physiological functions and principles.
   Validity of comparative approach of physiology
1.2 Feeding mechanisms and regulation: Nutrition, Autotrophs, Heterotrophs, Feeding
   Mechanisms, Digestion, Digestion in the mouth, Swallowing, Peristalsis, Digestion in the
   Stomach, Gastric secretion, Gastric juice, Regulation of Gastric secretion, Activities of
   Gastric Secretion, Digestion in the small intestine.
1.3 Comparative physiology of digestion: Mechanical treatment, Movement of gut contents,
   Chemical Action: intracellular digestion, extracellular digestion, The digestive tract and its
   Enzyme chain: Digestive enzymes: Carbohydrases, Lipases and Esterases, Proteinases, Other
   Digestive enzymes, Absorption.
1.4 Coordination of Digestive activities: Visceral Autonomic system, Gastrointestinal Hormones.

UNIT-II: Comparative Animal Physiology-II

2.1 Respiration and Metabolism: Types of respiration, Respiratory organs, Mechanism of
   Respiration
2.2 Circulation of body fluids: Major types of body fluids, Blood, General properties of blood,
   Composition of blood, Blood groups and Transfusions.
2.3 Patterns of nitrogen excretion among different animal groups: Introduction, Nitrogenous
   Waste Products, Morphology of the excretory system in different groups of animals,
   Mechanism of urine Formation.
2.4 Osmoregulation in different animal groups: Biological significance of water, Body
   compartmentation, Nature of the problem of osmoregulations in different environments,
   Invertebrate body fluid Regulation, Vertebrate body fluid regulation.

UNIT-III: Comparative Animal Physiology-III

3.1 Thermoregulation: Temperature as an environmental factor, Thermoregulation in
   Invertebrates, Thermoregulation in vertebrates.
3.2 Poikilothermic animals: Temperature relation in poikilotherms, Aquatic poikilotherms,
   Terrestrial Poikilotherms; Homoeothermic animals: Temperature relations of homeotherms,
   Physical heat Regulation, Chemical heat regulation.
3.3 Hibernation & Aestivation
3.4 Biological rhythms.

UNIT-IV: Comparative Animal Physiology-IV

4.1 Bioluminescence: Occurrence of bioluminescence among different animals, Mechanism of
   light Production, Control of bioluminescence, Functions of luminescence
4.2 Chromatophores and regulation of their function: Colour production, Chromatophore
   Pigments, Mechanism of action of chromatophore, Movement of pigment, Control of
   Chromatophores, Factors Influence in chromatophore system
4.3 Contractile elements in animals
4.4 Muscle structure and function – correlation.

SUGGESTED READING MATERIAL

5. W.S. Hoar. General and Comparative Animal Physiology
ZOO-302: NEUROBIOLOGY

UNIT-I: Neuronal Organization and Functional Neuroanatomy of Mammals

1.1 Anatomical techniques: Golgi Silver stain; Cobalt chloride Back-filling; HRP method; Procion yellow staining.
1.2 Neurons and associated structures; Microanatomy of neurons; Types of neurons and Glial cells.
1.3 Organization of the Central Nervous System (Spinal cord; Brain stem; Cerebral cortex).
1.4 Organization of the Peripheral nervous System (Sympathetic and Parasympathetic nervous system).

UNIT-II: Neurophysiological Mechanisms

2.1 Electrophysiological techniques (Voltage-clamp and Patch-clamp); Bioelectrical properties of Neurons-Neuronal excitability; The resting potential membrane potential; Nernst equation; Sodium and Potassium pump; Generation of the action potential; Propagation of nerve impulse.
2.2 Molecular mechanism of Excitation Carrier protein; Ion channels; Gating mechanisms.
2.3 Synapses: Structure and Integration; Morphology and Ultra structure of synapse; Types of Synapses; Chemical transmission; Electrical transmission.
2.4 Second messenger systems: Cyclic AMP and GMP; G-protein; IP3; Calcium and Calmodulin.

UNIT-III: Neurochemistry: Neurotransmitters and Neuromodulators

3.1 Chemical composition of the nervous system-Cerebro Spinal Fluid-CNS Barriers-Nerve Growth Factor.
3.2 Synthesis-storage-release and inactivation mechanisms and functions of the neurotransmitters. Viz. Acetylcholine & Catecholamines (Norepinephrine, Eponephrine, Dopamine and Serotonin).
3.3 Amino acid Neurotransmitters- Excitatory amino acids(Glutamate and Aspartate); Inhibitory Amino acids(GABA and Glycine).
3.4 Peptide Neurotransmitters: Oxytocin, Vasopression, Substance-P and Cholecystokinin.

UNIT-IV: Neuropsychopharmacology and Neurological disorders

4.1 Major drug classes-brief history-absorption-binding-tolerance-excretion-physiological and Behavioral Effects of the following drugs; Opium; Stimulants (Amphetamine, Cocaine, Nicotine and Caffeine)
4.2 Hypnotic and Anxyolytic drugs. (Barbiturates & Benzodiazepines); Mind altering drugs (Marijuana, LSD)
4.3 Drug abuse and treatment programs
4.4 Etiology, Pathology, Symptoms, Diagnosis and treatment strategies for the Neurological Disorders Viz.Schizophrenia, Depression; Epilepsy, Alzheimer’s and Parkinson’s Disease.

SUGGESTED READING MATERIAL

2. Introduction to Nervous system- T.H. Bullock, R Cork, A. Granner (1977); W.H Freeman&Co.
UNIT-I : Biology of different environments

1.1 A general account on Biomes and their environments.
1.2 Fresh Water: Classification and Characteristics, eutrophication, seasonal changes.
1.3 Marine: Classification and Characteristics.

UNIT-II : Energetics of Ecosystems

2.1 Trophic dynamic view of ecosystem and energy flow.
2.2 Ecological Energetics and productivity of ecosystems.
2.3 Impact of environmental factors on Energy flow.
2.4 Bioaccumulation and Biological magnification.

UNIT-III : Environmental pollution, Health hazards and Epidemiology

3.1 Air Pollution: Criteria and standards in India, health hazards and Toxicology – Green house gases and Green House Effect.
3.2 Water Pollution: Criteria and standards in India, health hazards and toxicology.
3.3 Role of environmental epidemiological studies and health indices in evaluation of environmental health hazards: environmental epidemiological episodes in India and Abroad.
3.4 Environmental Laws: Environmental Laws in India – legislation and Execution.

UNIT-IV : Environmental monitoring and Bioremediation

4.1 Biomonitoring, Biological monitoring programme.
4.3 Bioremediation: Need and scope of bioremediation, Environmental applications of bioremediation. Future out look of Bioremediation: Phytoremediation, Biotechnological cleaning up of the environment by plants.
4.4 Natural calamities and disaster management.

SUGGESTED READING MATERIAL

7. Ecotechnology for pollution control and environmental management, enviromedia, Karad, RK. Trivedi.
10. Environmental Physiology of desert organism. Ed.by N.F. Hadley - Dowden Hutchinson and Ross, Inc.Penn,USA.
19. Water Treatment and purification technology - W.J. Ryan, Agrobios (India), Jodhpur, 2002.
UNIT – I: Basic concepts of Toxicology

1.1 Introduction and scope of toxicology.
1.2 Classification of xenobiotics.
1.3 Toxicity evaluation (Dose response relationships) LD 50, LC 50, ED 50.
1.4 Factors affecting toxicity (factors pertaining to chemical, exposure, surrounding medium and Organism). Exposure of Toxicants (Routes and sites of exposure, duration and frequency of Exposure).

UNIT-II: Mechanism and action of Toxicants on vital organs

2.1 Mechanism of toxic action of pesticides (Receptor concept, nature of receptors, theory of Toxicant – receptor interactions and mechanism of action of some pesticides).
2.2 Toxic effects of pesticides (Local and systematic effects, immediate and delayed effects, reversible and irreversible effects, blockade of oxygen transport).
2.3 Toxic response of liver (Factors in liver injury: Mechanism of liver injury).
2.4 Toxic response of Kidney (susceptibility of the Kidney to Toxic injury : Mediators of renal cell injury).

UNIT-III: Translocation and bioaccumulation of xenobiotics

3.1 Translocation of toxicants (Membranous barriers, absorption of toxicants, sites of absorption, Distribution of toxicants, storage depots and excretion of toxicants).
3.2 Biotransformation of Xenobiotics (Biotransformation sites, biotransformation enzymes, Biotransformation reaction and bioactivation).
3.3 Bioaccumulation of Xenobiotics (Bioconcentration, Bioaccumulation and Biomagnification Biomagnification of lipophilic and recalcitrant substances).
3.4 Toxicity of heavy metals like Mercury, Lead, Cadmium and Arsenic.

UNIT-IV: Xenobiotic effects and therapy

4.1 Xenobiotic effect on basic metabolisms (carbohydrates, proteins and lipids)
4.2 Teratogens and teratology
4.3 Antidotal therapy (Types of antidotes and antidotal procedures)
4.4 Safety evaluation of chemicals (Process of risk assessment and safety evaluation programmes)

SUGGESTED READING MATERIAL:

4. Introduction to Biochemical Toxicology – E.Hodgson & F.E.Gutherie.
5. Pesticides action and Metabolism – O’Brien.
SEMESTER - IV

ZOO-401: EVOLUTION AND ANIMAL BEHAVIOUR

UNIT: I  An account on theories of organic evolution and mechanism of evolution

1.1 Critical review of Darwinism.
1.2 Neo-Darwinism.
1.3 Isolation and role of isolating mechanisms in evolution.
1.4 Speciation and models of speciation (Allopatric, sympatric and parapatric).

UNIT: II  Evolutionary Forces and Molecular Evolution

2.1 An account on the factors of evolution (i) Mutations (ii) Natural Selection (iii) Genetic Drift.
2.2 Basic patterns of evolution; Micro and Macro evolution.
2.3 Species and subspecies categories: (i) Morphological species  (ii) Biological species  
   (iii) Sibling species (iv) Sub species
2.4 Evolution of Proteins, Aminoacid sequence and examples of protein evolution

UNIT: III Animal Behaviour

3.1 Habitat selection-food selection; Optimal foraging theory, Antipredator defenses.
3.2 Parental care in Fishes, Amphibians, Reptiles, Birds and Mammals.
3.3 Homing and territoriality; bird migration; orientation and navigation.
3.4 Social organization; Insects and Primates

UNIT: IV Hormonal control of Behaviour

4.1 Conditioning Learning: Classical conditioning: Laws of classical condition, Extinction, 
   Discrimination; Operant conditioning: Skinners Experiment, Measures of Operant Strength, 
   Partial Reinforcement, Reinforcement Schedules, Shaping behavior.
4.2 Cognitive Learning: Reasoning, Physiology of Reasoning, Insight learning, Sign learning, 
   Latent Learning.
4.3 Neural basis of memory and theories and memory: Kinds of remembering redintegrative 
   Memory, Recall, Recognition, Types of memory phenomenon, Organisation of semantic 
   Memory, Two process Theory of memory: Long-term and Short-term memory.
4.4 The nature of forgetting and improving memory: Decay through discuse, Inference effect, 
   Proactive Inhibition, motivated forgetting, chemical process of memory.

SUGGESTED READING MATERIAL:

   Mass, USA.
   Sunderland, Mass. USA.
6. Dobzhansky, Th., F.J. Ayala, GL. Stebbins and J .M. Valentine Evolution: Surjeet publications, 
   New Delhi latest edition.
   York.
UNIT-I : Biodiversity an Introduction

1.1 Importance of wild life conservation - Need for biodiversity for present world.
1.2 Environmental pollution – Global environmental change – Biodiversity status – Biodiversity management.
1.3 Values of biodiversity – Threats of biodiversity changes in habitat – hunting – pollution etc.,
1.4 Conservation of biodiversity and modes of conservation.

UNIT-II : Biodiversity Conservation

2.1 Types of Biodiversity: Genetic biodiversity - species biodiversity - Domesticated Biodiversity.
2.2 In-situ and Ex-situ conservation.
2.3 Sanctuaries, National parks – wild life sanctuaries in Andhra Pradesh, Hot spots in India.
2.4 Indian case studies on conservation/ management strategy (Project tiger, Seshachalam Biosphere reserve).

UNIT-III : Concepts of Biodiversity

3.1 Remote sensing and GIS usage for conservation and case studies.
3.2 Role of government and non govt agencies in wild life management.
3.3 Human and animal conflicts and remedial measures.
3.4 Environmental impact assessment and methods of EIA in conservation.

UNIT-IV : Biodiversity Strategies

4.1 Study of signs and symptoms: Recording basic field observations, Foot prints, types of tracks, animal droppings, bird pellets etc.,
4.2 Wild life policy and legislation Indian board for wild life management protected areas network world heritage sites.
4.3 Wild life education and training – Voluntary organization involved in wild life conservation.
4.4 Wild life photography, bioethics bio safety protocols.

SUGGESTED READING MATERIAL:

1. A.K. Pandey - Taxonomy and Biodiversity.
10. T.I. Khan, YS. Shishodia, Biodiversity Conservation and Sustainable Development.
UNIT-I : Principles of developmental biology

1.1 Origin of germ line cells; Origin and mechanism of cell lineage; migration of germ cells to Genital ridges; Embryonic stem cells, Nuclear transplantation experiments.
1.2 Production of gametes and establishment of polarity and symmetry.
1.3 Leydig cells function; Endocrine regulation of vitellogenesis.
1.4 Fertilization; Cell surface molecules in sperm egg recognition; molecular events of post fertilization.

UNIT-II : Early development and cell communication

2.1 Cleavage, Blastula, Gastrulation in different animals. Molecular mechanisms determining germ layers formation; fate maps.
2.2 Potency, commitment, specification, Induction, competence, determination and differentiation.
2.3 Axes and patteren formation in Drosophila and Amphibia.
2.4 Cell aggregation and differentiation in Dictyostelium.

UNIT-III : Organogenesis in early development

3.1 Organogenesis and vertebrate development - vulva formation in Caenorhabditis elegans; Eye lens Induction.
3.2 Neural fold formation in vertebrates and limb development.
3.3 Regeneration – Types of regeneration, Axial patterning during regeneration.
3.4 Metamorphosis – Hormonal regulation of metamorphosis in insects and amphibians.

UNIT-IV : Sex determination, apoptosis and senescence during development

4.1 Environmental regulation of normal development
4.2 Sex determination in animals (The mechanism of mammalian primary sex determination Secondary sex determination; Hormonal regulation of the sexual phenotype)
4.3 Programmed cell death - Incidence of Apoptosis; Apoptosis during animal development; Apoptosis in metamorphosis and morphogenesis; Apoptosis during limb development: Biochemical & molecular mechanisms involved in Apoptosis.
4.4 Aging and Senescence- Reactive oxygen species and cell senescence; Dietary restriction and anti aging action; Genetic control of longevity; Age related diseases.

SUGGESTED READING MATERIAL:

2. Ethan Bier The Coiled Spring Harlsor Laboratory Press, NewYork
3. F.T. Longo, Fertilization, Chapman & Hall
5. R.G. Edwards, Human Reproduction
UNIT-I Endocrinology and gonadal hormones

1.1 Introduction to endocrinology-characteristic features of hormones
1.2 Anatomy, secretions and functions of endocrine organs pituitary, thyroid, adrenal and pancreas
1.3 Gonads and their hormones
1.4 Pheromones

UNIT-II Hormones and sexual cycles

2.1 Classification and chemical nature of hormones
2.2 Biosynthesis and secretion of hormones corticosteroid hormones-peptide hormones- catecholamines
2.3 Hormones regulation of female sexual cycles.
2.4 Hormonal regulation of spermatogenesis

UNIT-III Relationship of hormones and receptors

3.1 Nature of hormone action
3.2 Hormone receptors: receptor structure and evolution of population hormone receptors.
3.3 Structure and function of nuclear receptors.
3.4 Termination of hormone action, Hormonal related disorders- Pharmaceutical remedies.

UNIT-IV Hormones in industries

4.1 Growth hormones and factors-somatotropin and somatomedin-insulin prolactin placental Lactogen Neurotrophic growth factors-hematopoietic growth factors
4.2 Hormones and homeostasis (Ca^{2+}, glucose, PO4, water, temperature)
4.3 Hormonal regulation of carbohydrate, nitrogen and lipid metabolism
4.4 Hormones and metabolic disorders-pharmaceuticals and therapeutics.

SUGGESTED READING MATERIAL

UNIT-I: Genetic engineering and cloning vectors

1.1 General Introduction and Achievements of Biotechnology
1.2 Genetic Engineering and r-DNA technology (Restriction endonucleases, DNA ligases, Topoisomerases, Methylases, Nucleases, Polymerases, Reverse transcriptase and their Properties and functions).
1.3 Cloning vectors (plasmids, Bacteriophages, Cosmids, Yeasts Shuttle vectors, Viruses, PBR-322 and its derivatives, S.V 40 and other vectors) used in Gene cloning.
1.4 Cloning Strategies and Screening Analysis of recombinants (Single colony hybridization Technique), immunologic test, Southern blotting.

UNIT-II: Applications of biotechnology

2.0 Application of Biotechnology in veterinary sciences
2.1 Transgenic (Technology) animals, super bugs
2.2 Multiple ovulation in farm animals Genetic recombination in Mammalian cells and embryos production of cattle embryos in vitro; Artificial insemination, in vitro fertilization, Embryo Transfer technology
2.3 Application of Biotechnology in Medicine, Production of monoclonal antibodies (Hybridoma Technology), Production of vaccines, Production of Growth Hormone.
2.4 Gene therapy (Adenosine diaminase deficiency disease (ADA); Duchenne Muscular disease (DMD); Haemophilia; Phenyl ketonuria, alkaptonuria, Thalassemia, etc.

UNIT-III: Introduction to Microbiology and Microbial Diseases

3.1 History and Scope of Microbiology
3.2 Microbial nutrition, growth and their control
3.3 Normal microbial flora of Human Body- Skin, Nose, Oral cavity, Pharynx, Respiratory tract, Eye, Ear, Stomach, Intestine, Genitourinary tract.
4.1 Microbial diseases and their control
   a) Bacterial diseases - Tuberculosis, Plague, Anthrax, Tetanus, Cholera,
   b) Viral diseases - Influenza, AIDS, Rabies, Hepatitis, Poliomyelitis
   c) Fungal diseases - Superficial mycoses, Cutaneous mycoses, Subcutaneous mycoses & Systemic mycoses

UNIT-IV: Food and Industrial Microbiology

4.1 Microbiology of fermented food: Diary Products, Meat and Fish, Microorganisms as Sources of food
4.2 Industrial Microbiology: Types of fermentation process, Types of fomenters, Down stream processing, Alcoholic beverages
4.3 Manufacture of various chemicals: Lactic acid, Acetic acid and Citric acid.
4.4 Therapeutic compounds: Antibiotics (penicillin), Industrial enzymes (Amylase, Protease and Lactase).

SUGGESTED READING MATERIAL

UNIT-I: Hematological Disorders
1.1 Diseases of Red cells and bleeding disorders: Anemia and Hemophilia.
1.2 Diseases of white Blood cells, lymph node & spleen.
1.3 Inflammation: Acute and chronic – Granulomatous information & examples.
1.4 Mechanism of fever and wound healing: Injury repair

UNIT-II: Environmental and Nutritional Diseases
2.1 Major role of vitamins and deficiency syndromes
2.2 Nutritional excess & Imbalance (Obesity-Diet & system, diseases-Diet), Cancer, Health and exercise.
2.3 Inborn errors – Inborn errors of metabolic disorders
2.4 Congenital malformation, birth injuries

UNIT-III: Infectious Diseases
3.1 Categories of infectious agents: Influenza, Rabies, Encephalitis, Smallpox- Human viral Diseases & their pathogens
3.2 Bacterial Disease.
3.3 Respiratory infections: Gastro intestinal infections-Acidity, Amoebiosis, Ulcers pulmonary Disorders, Lung infection, Tuberculosis.
3.4 Sexually Transmitted Disease (STD), Infections of child hood & Adolescence – Meseals, Mumps, Poliovirus infections, wooping cough, diphertheria, Zoonotic and Vector born Infections-Malaria and Plague-Tropic infections, Leprosy and Filariasis

UNIT-IV: Diseases of various organs
4.1 Cardio vascular diseases & their tests Hypertension, Atherosclerosis, Angina, Arrhythmia.
4.2 Neuromuscular disorders & their tests paralysis, epilepsy, Algimers
4.3 Kidney & liver disorders – their tests nephrotoxicity, Kidney failure, Hepatotoxicity Hepatitis.
4.4 Skin and Orthopedic disorders & their tests, Skin Rash, Allergy, Rheumatoid Arthritics, Bone cancer, osteoporosis, Bone density.

SUGGESTED READING MATERIAL
ZOO-407: PATHOBIOLOGY

UNIT - I : Disease Concept
1.1 Disease and injury (communicable and non-communicable)
1.2 Local and systematic reactions of injury
1.3 Cellular reactions to injury
1.4 Inflammation and Immunological reactions

UNIT - II : Host Parasite Relations
2.1 Important human and veterinary parasites (Protozoan and helminthes)
2.2 Life cycle and biology of plasmodium, Trypanosoma, Ascaris, Schistosoma and Leishmania
2.3 Symptoms of the disease caused parasites
2.4 Host - Parasite interactions

UNIT – III: Vector Biology
3.1 Biology of house flies (Musca domastica) and mosquitoes (Culex, Anaphiles)
3.2 Arthropods as vectors of human diseases (Mosquitoes, Lice, Flies and Ticks)
3.3 Mode of transmission of pathogens by vectors
3.4 Vector Control methods- Chemical-, Physical-, Biological and Environmental control.

UNIT - IV : Haematology
4.1 Biochemical and microchemicals studies.
4.2 Changes in the blood during infection & disease
4.3 Types of anaemia, Biochemical and Microscopic changes.

SUGGESTED READING MATERIAL

ZOO-408: SERICULTURE

UNIT - I : The cultivation of mulberry
1.1 The Morphology and Physiology of mulberry plant.
1.2 Mulberry varieties.
1.3 Selection and Establishment of the mulberry field
1.4 Training and Harvesting methods & Management of mulberry field

UNIT - II : Rearing of Silkworms
2.1 Planning of Rearing of silkworm.
2.2 Preparation of Rearing, Rearing of young and advanced stage larvae.
2.3 Rearing and Environment
2.4 Mounting cocoons production and Harvesting of cocoons

UNIT - III: Diseases of Silkworm and Preventive measures
3.1 Viral diseases
3.2 Bacterial diseases
3.3 Fungal diseases
3.4 Other diseases of silkworm & Silkworm disease control measures

UNIT - IV : Silk Dying and Finishing
4.1 Machine & chemical finishing
4.2 Commonly used equipments and commonly used unit machines
4.3 Physical and Chemical testing methods for quality of products / semi finished products
4.4 Measurement of industrial effluents & Administration and improvement of
4.5 Sericulture Management

SUGGESTED READING MATERIAL:
I. Value Education - Definition – relevance to present day - Concept of Human Values – Self introspection – Self esteem. Family values - Components, structure and responsibilities of family Neutralization of anger – Adjustability – Threats of family life – Status of women in family and society – Caring for needy and elderly – Time allotment for sharing ideas and concerns.

II. Medical ethics - Views of Charaka, Sushruta and Hippocrates on moral responsibility of medical practitioners. Code of ethics for medical and healthcare professionals. Euthanasia, Ethical obligation to animals, Ethical issues in relation to health care professionals and patients. Social justice in health care, human cloning, problems of abortion. Ethical issues in genetic engineering and Ethical issues raised by new biological technology or knowledge.

III. Business ethics - Ethical standards of business-Immoral and illegal practices and their solutions. Characterics of ethical problems in management, ethical theories, causes of unethical behavior, ethical abuses and work ethics.

IV. Environmental ethics - Ethical theory, man and nature – Ecological crisis, Pest control, Pollution and waste, Climate change, Energy and population, Justice and environmental health.


Books for study:
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly: Introduction to Ethics
9. Manu: Manu Dharma Sastra or the Institute of Manu: Comprising the Indian system of Duties: Religious and Civil(ed.) G.C. Haughton.