

GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY M.Sc., Zoology
Revised Course Structure under CBCS (for 2018 -2019 batch onwards)

Sem	Course	Course code	Course Title	Inst, Hrs / Week	Credit	Exam Hrs	Marks		Total
							Int	Ext	
I	Core Course - I (CC)	P18ZC101	Functional Morphology and Paleontology of Invertebrates and Chordates	6	5	3	25	75	100
	Core Course- II (CC)	P18ZC102	Immunology	6	5	3	25	75	100
	Core Course- III (CC)	P18ZC103	Genetics	6	5	3	25	75	100
	Core Course- IV (CC)	P18ZC104P1	Practical I	6	4	5	40	60	100
	Elective- I (EC)	P18Z1EC10	Aquaculture	6	4	3	25	75	100
				30	23				
II	Core Course- V (CC)	P18ZC205	Biochemistry	6	5	3	25	75	100
	Core Course- VI (CC)	P18ZC206	Animal Physiology	6	5	3	25	75	100
	Core Course- VII(CC)	P18ZC207	Immunology	6	5	3	25	75	100
	Core Course- VIII (CC)	P18ZC208P2	Practical II	6	5	5	40	60	100
	Elective- II (EC)	P18Z2EC2	Bioinformatics and Computer Applications	6	4	3	25	75	100
			TOTAL	30	24				
	NCGPA	INT	INTERNSHIP	-	2	-	-	-	-

III	Core Course- IX (CC)	P18ZC309	Developmental Biology and Evolution	6	5	3	25	75	100
	Core Course- X (CC)	P18ZC310	Biotechnology	6	5	3	25	75	100
	Core Course- XI (CC)	P18ZC311	Microbiology	6	5	3	25	75	100
	Core Course- XII(CC)	P18ZC312P3	Practical III	6	4	5	40	60	100
	Elective- III (EC)	P18Z3EC3	Biostatistics and Research Methodology	6	4	3	25	75	100
			TOTAL	30	23				
IV	Core Course- XIII (CC)	P18ZC413	Ecology and Ethology	6	5	3	25	75	100
	Core Course- XIV (CC)	P18ZC414P4	Practical IV	6	5	5	40	60	100
	Core Course- XV (CC)	P18PWZO415	Dissertation 80 Marks (2Reviews- 20+20=40marks Report Valuation 40Marks) Viva 20Marks	12	6	-	-	-	100
	Elective- IV (EC)	P18Z4EC4	Biodiversity and Conservation	6	4	3	25	75	100
				30	20				
			Grand Total	120	90				1900

CORE COURSE I - FUNCTIONAL MORPHOLOGY AND PALEONTOLOGY OF INVERTEBRATES AND CHORDATES

Objectives: To imbibe the current knowledge on the functional morphology and paleontology invertebrates and chordates with respect to anatomical features and comparative study.

A. INVERTEBRATES

UNIT - I Organization

Symmetry in animal organization: Asymmetry, radial, biradial and bilateral symmetry -Significance.

Coelom: Evolution of coelom. Acoelomate, pseudocoelomate, coelomate groups (Schizocoel and Enterocoel) - Significance.

Metamerism: Pseudometamerism, cyclometamerism, corm theory, embryological theory - Significance.

Locomotion: Movement in Protozoan and Annelids.

Nutrition: Filter feeding in Polychaetes and Prochordates.

Respiration: Gills and trachea in Arthropods.

Circulation: Circulation in Arthropods and Molluscs.

UNIT - II

Excretion: Different types of excretory organs in invertebrates

Nervous System: Primitive types - Coelenterates, Advanced types - Nervous system in Molluscs.

Chemical Co-ordination: Endocrine glands in Crustaceans and Insects - Pheromones and allelochemicals.

UNIT - III

Reproduction: Pattern of sexual and asexual reproduction - Echinoderm larval forms and their phylogenic significance.

Invertebrate Fossils: Evolutionary trends and phylogenetic importance of Trilobites, Ammonoids, Belemnoids and Nautiloids.

Minor Phyla: Organisation and affinites of 1.Chaetognatha 2.Rotifera 3.Phoronida.

B. CHORDATES - Comparative study functional Morphology of vertebrates.

UNIT - IV

Integumentary System: Exoskeletal structures and their modifications.

Digestive System: Alimentary canal and associated glands

Respiratory System: Gill respiration in cyclostomes and fishes - Pulmonary respiration in tetrapods.

Circulatory System: Types and evolution of heart and aortic arches.

Excretory System: Types and evolution of kidneys.

UNIT - V

Nervous System: Brain and spinal cord - cranial nerves, spinal nerves and visceral nerves.

Reproductive System - Accessory reproductive glands.

Vertebrate Fossils- Evolutionary significance of Ostracoderms, Placoderms, Crossopterygians, Labyrinthodonts, Archaeopteryx and Mesozoic Reptiles.

Recommended Text Books

INVERTEBRATES

1. Barnes R.D (1982). Invertebrate Zoology. IV Ed., Holt Saunders International Edition.
2. Barrington E.J.W (1979). Invertebrate Structure and Functions. II Ed., ELBS and Nelson.
3. Moore R.C., Lolicke and Fischer, A.G (1952). Invertebrate Paleontology. McGraw Hill Book Co., Inc., N.Y.

CHORDATES

1. Waterman A.J (1971). Chordate Structure and Function. The Macmillan Company.

References Books:

INVERTEBRATES

1. Highnam K.C and L. Hill (1979). The Comparative Endocrinology of Invertebrates, ELBS and Edward Arnold (Publishers) Ltd., London.
2. Hyman G.H. The Invertebrates, Vol. I to VII, McGraw Hill Book Co., Inc., N.Y.
3. Vasantika Kashyap (1997). Life of Invertebrates, Vikas Publishing House Pvt. Ltd., New Delhi.
4. Kotpal R.L. Minor Phyla. Rastogi Publication, Meerut.
5. Nigam. Comparative anatomy of Invertebrates.

CHORDATES

1. Colbert H. Edwin (1989). Evolution of the Vertebrates. II Ed., Wiley Eastern Limited, New Delhi.
2. Harrey Pough, John B. Heisher and William N. Mcfarland (1990). Vertebrate Life. Macmillan Publishing Co., N.Y.
3. Jollie M (1962). Chordate Morphology. Reinholt Publishing Corporation, N.Y.
4. Kent G.C (1976). Comparative anatomy of the Vertebrates. McGraw Hill Book Co., Inc., New York.
5. Romer A.S (1974). The Vertebrate Body. W.B. Saunders, London.
6. Romer A.S (1979). HYMAN's Comparative Vertebrate Anatomy. III Ed. The University of Chicago Press, London.
7. Weichert C.K (1965). Anatomy of the Chordates. McGraw Hill Book Co., N.Y.
8. Newman N.H (1961). Phylum Chordate. The University of Chicago Press, Chicago.

CORE COURSE II – CELL AND MOLECULAR BIOLOGY

Objectives: To understand the structure and molecular basis of cellular components, ultra structure, chemical composition, regulation of gene expressing cell, division, ageing and cancer cells.

UNIT - I

Cell theory: Extended, modern version and exception.

Plasma membrane: Fluid mosaic model, intercellular space, specialized structures, membrane permeability, membrane transport (passive diffusion, active transport and ion pumps, translocation, vesicular transport) Cell communication - General principles and cell adhesion molecules.

Endoplasmic reticulum: Occurrence, Morphology, Types and Functions.

Golgi apparatus: Occurrence, Distribution, Morphology and Functions.

Cytoskeleton: Microtubules and Microfilaments.

UNIT- II

Mitochondria: Historical background, Distribution, Morphology, Structure, Functions, Mitochondrial DNA and ribosomes. ATP synthesis - Chemiosmotic coupling hypothesis

Nucleus: Occurrence, Ultra structure -Nuclear membrane, nuclear pores, nucleolus, nucleoplasm, chromatin fibers.

Chromosomes: Historical background, Chromosomal number, Morphology, Structure, Hetero chromatin, Euchromatin, L and M Chromosomes.

UNIT- III

Lysosome: Occurrence, Morphology, Polymorphism and Functions.

Ribosomes: Occurrence, distribution, Types and Ultra Structure.

Cell division: Mitosis, Meiosis and their regulation, Cell cycle, regulation of cell cycle

Ageing: Sub cellular changes due to ageing, Theories for causes of ageing.

Apoptosis: Purpose, mechanism, regulation and significance.

Cancer: Types, Characteristics of Cancer cells - Gene involved in transformation of cells.

UNIT- IV

DNA: Chemical composition, Chargaff rule, Watson and Crick's model, Forms of DNA, Denaturation, Renaturation, Hybridization, Replication and functions of DNA.

RNA: Kinds of genetic and non genetic RNA, mRNA, rRNA and tRNA.

UNIT- V

Protein Synthesis: Central dogma, Transcription, Genetic Code - Characteristics.

Post transcriptional modifications, Translation and Post translational modification.

Regulation of gene Expression (Action) in Prokaryotes: Constitutive genes and inducible genes, Transcriptional control mechanism, Operon model - Lac operon and Trp operon models.

Text books:

1. Verma P.S and Agarwal V.K. Cell Biology. S. Chand and Company Pvt. Ltd. I edition 2016.
2. Verma P.S and Agarwal V.K. Cytology. S. Chand and Company Pvt. Ltd. 2008.

References Book:

1. De Robertis E.D.P and De Robertis E.M.F (1987). Cell and Molecular Biology. VIII Ed., Lea and Febiger, Philadelphia.
2. David Freifelder (1998). Molecular Biology. II Ed., Narosa Publishing House, New Delhi.
3. Lewis, Keleinsmith and Valeris M. Kish (1988). Principles of Cell Biology. Harper and Row Publications, New York.
4. Powar C.B (1983). Cell Biology. Himalaya Publishing House, Bombay.
5. Watson *et al.*, (1987). Molecular Biology of the Gene. The Benjamin Cummings Publishing Co., Inc., California.

CORE COURSE III – GENETICS

Objectives: To comprehend the fine structure of genetic materials, gene interaction, fine structure of genes, microbial genetics, mutation and human genetics including various types of disorders.

UNIT - I

Classical genetics: Mendel's law - Gene interaction: Co dominance, Supplementary, Complementary, Dominant Epistasis, Pleiotrophism, Penetrance, Expressivity - Sex linked Inheritance in man, Sex influenced genes, Sex limited genes - Genomic imprinting, X inactivation in mammals .

UNIT – II

Allele- Multiple Allele : ABO Blood grouping - Pseudo allele
Linkage and Crossing over in Drosophila - Mechanism and Chromosomal mapping. Homologous recombination - Holiday model, Non - Homologous Recombination.
Fine structure of gene - cistron, muton, recon, exon and split genes. House keeping genes, luxury gene.

UNIT – III

Sex determination: Grasshopper, Bonellia, Free-martin (Cattle), Pigeon, Sacculina.
Extra nuclear inheritance by cellular organelles - Mitochondria and Chloroplast. Microbial Genetics: Methods of gene transfer: Transformation, conjugation, sex-duction and transduction.

UNIT –IV

Mutation: Types chromosomal mutation: Numerical and Structural changes in chromosomes - Edward's syndrome, Cri du chat syndrome, Klinefelter's syndrome and Turner syndrome. Molecular basis of gene mutation, Spontaneous and Induced Mutation - DNA repair mechanism.

UNIT - V

Human Genetics: Pedigree analysis - Karyotypes, Chromosomal banding, Inborn error in metabolism, Genetic disorders of Human beings - Sickle cell anemia, Thallesemia, Diabetes mellitus, Brachydactyly and Huntingtons chorea.
Population genetics: Hardy Weinberg law, Eugenics, Euthenics, Euphenics, Inbreeding increases homozygosity.

Recommended Text Books:

1. Verma P.S and V.K. Agarwal (2008). Genetics. S. Chand and Company Private. Ltd. New Delhi.

Reference Books:

1. Watson J.D., Hopkins N.H., Roberts J.W., Steitz J and A.M. Weinter (1987). Molecular Biology of Genes (4th edition).The Benjamin/Cummings publishing Company inc., Joky.
2. Lewin B (1997). Genes VI. Oxford University Press, Oxford, New York, Tokyo.

ELECTIVE COURSE – AQUACULTURE

Objectives: To gain the current perspectives on the aquaculture principles and practices, water quality management and fish harvest technology and to understand the capture fisheries and culture fisheries.

UNIT-I

Inland Fisheries: Present status and scope of Inland fisheries - commercially important fishes - Food and feeding habits of Indian major carps - Age and growth - Scale method and length - weight relationship.

UNIT-II

Culture Fisheries: Present status and scope of culture fisheries - Biology of important cultivable fishes - *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*, *Channa punctatus*, *Chanos chanos*, *Tilapia*, *Mugil* and *Lates calcarifer*. Marketing of cultured fishes- Major diseases - symptoms and treatments.

UNIT-III

Aquaculture Principles and Practices: Aquaculture-types of culture - fish farm - types of ponds-maintenance and management - eradication of algal bloom - predators -induced breeding - hypophysation - factors of induced spawning- transport of fish seed.

Unit-IV

Water Quality Management: Physical Factors-Visibility-temperature- Chemical Factors - dissolved oxygen, Carbondioxide, Salinity and pH, Turbidity - Biological oxygen Demand - Biological Factor - Plankton - Nutrients - Nitrogen-Potassium -Phosphorus - Assessment of water Quality - Discolouration of water - Mass mortality of fishes.

Unit-V

Fish Harvest Technology: Inland Fishing crafts and gears, handling, Processing and preservation of fish - fishery by-products - marketing and economics.

Reference Book:

1. Pillay T.V.R (1995). Aquaculture principles and practices. Fishing new Books, Blackwell Science Ltd., Oxford.
2. Jhingran V.J (1991). Fish and Fisheries of India. Hindustan Publishing Corporation, New Delhi.
3. Santhanam, Sugumaran and P. Natarajan (1997). Manual of Fresh water Aquaculture. Oxford and 1BH Pub, co., Ltd., New Delhi.

CORE COURSE IV - PRACTICAL – I

COMPARATIVE FUNCTIONAL MORPHOLOGY AND PALEONTOLOGY OF INVERTEBRATES AND CHORDATES, GENETICS, CELL AND MOLECULAR BIOLOGY AND AQUACULTURE

A. INVERTEBRATES and CHORDATES

1. Taxonomy

A list of at least two representative animals belonging to major classes of each invertebrate phyla and major orders of 5 classes of Chordata can be prepared by the college and the animals shown to the students. A student has to identify and describe the salient features and assign them to the order, class and phylum to which they belong.

2. Mounting

Mounting of different insect mouthparts (Mosquitoes, Housefly, Cockroach, Honeybee).

3. Dissections

1. Pila, Earthworm- Nervous and Reproductive systems.
2. Virtual dissections for chordate systems.

3. Spotters

Echinoderm larval forms - Microscopic slides.
Invertebrate fossils - Ammonoids, Belemnoids and Nautiloids.
Minor Phyla - Chaetognatha, Rotifera and Phoronida.

B. GENETICS

1. Drosophila culture.
2. Identifications of sexes.
3. Identifications of mutants.
4. Blood groups ABO and Rh factors and their genetic significance.
5. Pedigree analysis.
6. Human karyotyping.
7. Chromosomal abnormalities.
8. Hardy Weinberg law and Calculation of gene frequencies for dominant, recessive and codominant traits and Multiple alleles.

C. CELL AND MOLECULAR BIOLOGY

1. Micrometry - Measurement of Buccal epithelium.
2. Camera Lucida.
3. Cell division (Mitosis and Meiosis).
4. Cytochemical detection of Carbohydrates, Proteins, Lipids.

D. AQUACULTURE

1. Meristic and Morphometric Characters of fish.
2. Identification of Indian major carps.
3. Age determination using scale meth

CORE COURSE V - BIOCHEMISTRY

Objectives: To make the students to learn about the chemical constituents of living organisms including the nature of atomic weight, molecular weight, bonds, and the water and to understand the basic principles and chemical nature of carbohydrates, protein, lipid and enzymes with reference to various metabolic activity and hormonal control of biochemical reactions.

UNIT- I

Atoms- atomic number and atomic weight, molecules, molecular weight.

Bonds- ionic, covalent, metallic, hydrogen bonds and vander Waal's.

Water as universal solvent - Physical properties, Structure, Weak, interaction in aqueous solutions, pH - definition and pH scale, buffer system.

UNIT- II

Carbohydrates- Structure, Classification and functions of monosaccharides, disaccharides polysaccharides and Derivatives of carbohydrates.

Lipids and fatty acids - classification, properties and biological significance.

Proteins - classification, Structure and biological significance.

Amino acids - structure, classification and properties.

UNIT - III

Carbohydrate metabolism - Glycolysis, Krebs cycle, Energetics of Krebs cycle- Glycogenesis, glycogenolysis, Gluconeogenesis, HMP Shunt pathway and Cori's Cycle.

UNIT - IV

Protein and amino acid metabolism - Oxidative deamination, transamination, decarboxylation and transmethylation reactions, Lipid metabolism - Metabolism of fatty acids - Glycerol and Cholesterol - Theories of Oxidation of fatty acids.

UNIT - V

Enzymes - Nomenclature and classification, chemical nature and properties of enzyme, factors affecting enzyme activity, Active site, Enzyme inhibition, Enzyme specificity, Mechanism of enzyme action - Michaelis Menten Hypothesis. Regulation of enzyme activity, Non protein enzymes - coenzymes and Iso enzyme. Hormones: Biochemical classification.

Text books:

1. Lehninger, Albert. David. L Nelson and Michael M. Cox (1993). Principles of Biochemistry. CBS Publishers and Distributors, Delhi.
2. Stryer, L (1988). Biochemistry W.H. Freeman and Co.
3. Cooper, T.G (1977). The tools of Biochemistry. Wiley Inter science Publication, John Wiley and Sons; NY.

Reference Books

1. Robert K. Muray, Daryl K. Granner, Peter A. Wayes and Victor W. Rodwell (1993). Harper's Biochemistry (24th Edition) Prentice Hall International Inc., London.
2. Voet. D and Voet. J (1995). Biochemistry. John Wiley and Sons, New York.

CORE COURSE VI - ANIMAL PHYSIOLOGY

Objectives: To acquire knowledge on the function of animals, their organs and behaviours & their importance and role nutrition, respiration, evolution, muscles and reproduction on the living organism.

UNIT - I

Organization of gastro intestinal tract - Digestion and absorption of proteins, carbohydrates and lipids. Assimilation. Role of gastrointestinal hormones in digestion.

Vitamins and minerals: Sources, functions and deficiency diseases.

UNIT - II

Respiration: Structure of lungs, Lung air volumes, Respiratory pigments and their functions - Exchange of gases (Transport of O₂ and CO₂) - Regulatory mechanisms.

Circulation: Components of blood and their functions - cardiac cycle - Blood pressure- ECG - Cardiovascular diseases: Myocardial infarction.

UNIT - III

Excretion: Patterns of excretion in relation to different habitats, ultrastructure of kidney and urine formation, Micturition. Detoxification pathways of ammonia, Renal control mechanism.

Homeostatic mechanisms - Ionic and osmoregulation in Crustaceans and Fishes.

UNIT - IV

Muscles: chemical composition of muscles, Mechanism of muscle contraction: Sliding filament theory, Chemistry of muscle contraction, Mechanical properties of muscles.

Nervous co-ordination: Propagation and transmission of nerve impulse-synaptic transmission, Neurotransmitters, Reflex action - Autonomous nervous system.

Bioluminescence and its significances. Biological rhythms.

Receptors - Types of receptors - Photoreceptors: Structure of retina, Physiology of Vision- Phonoreceptor - mechanism of hearing.

UNIT-V

Hormones from Hypophysis, thyroid, parathyroid, adrenal, pancreas, gonads and their functions - molecular mechanism of hormonal action.

Reproductive cycle and its hormonal control.

Reference Books:

1. Agarwal R.A, Anil K. Srivastava Kaushal Kumar (1998). Animal physiology and Biochemistry –S. Chand and Company Ltd. New Delhi.
2. Rastogi S. C. Essentials of Animal Physiology - Wiley Eastern Limited New Delhi.

CORE COURSE VII – IMMUNOLOGY

Objectives: To invite the basic and current knowledge on the immune system, their structure and functions of immunoglobulin's, antigen – anti body reaction, immunity mechanism, tumour immunology and the application of immuno techniques.

Unit I:

Organs of immune system: Primary - Thymus, Bone marrow, Secondary - Spleen, Lymphnodes, Tonsils, GALT and MALT.

Cells of immune system: Haematopoetic stem cells, cells of lymphoid lineage - Lymphocytes, NK cells, K cells, myeloid lineage - granulocytes, Neutrophils, Eosinophils, Accessory cells.

T cells: Differentiation and maturation of T cells - Positive and Negative selection, Surface markers and Receptors of mature T cells, Types of T cells (T cell subsets) and their function.

B Lymphocytes: Surface markers, Development and maturation of B cells.

Unit II:

Antigens: Factors determining immunogenicity, Types of Antigens, Epitopes - B cell and T cell epitopes.

Humoral Immune response: Antigen processing and presentation - class I and class II MHC pathways T cell activation, B cell activation - T dependent and independent, T cell - B cell conjugate (Immunological synapse), B cell maturation (Affinity mechanism and class switching, Plasma cells and memory cells, Immunological memory, Immune response - Primary and Secondary).

Immunoglobulins: Structure, General function, Classes of Ig (properties and biological functions).

Unit III:

Antigen - Antibody reaction: Immune complex, Binding forces, Types of Antigen-antibody reactions - precipitations, Agglutinations, cytolysis, complement fixation, opsonization.

Complements (Classical and Alternate pathways)

Cytokines

Cell mediated Immune response

Unit IV:

Hyper sensitivity: Types and Mechanism of anaphylaxis.

Auto immunity - Causes, Auto immune disease - pernicious anemia, Rheumatoid arthritis, Graves disease.

Transplantation Immunology - Types of graft, Mechanism of Allograft rejection, Graft versus Host reaction, Prevention of graft rejection.

Unit V:

Tumour Immunology - Tumours antigens, Immune response to tumours - immune surveillance - Escape mechanism from immune response, Immunotherapy for tumours.

Immune prophylaxis: Types of vaccines.

Immunotechniques: Double Immune diffusion - Radioimmuno electrophoresis - Rocket electrophoresis, ELISA, Agglutination (ABO, Rh, Widal, Coombs Test).

Recommended Text Books:

1. Gupta S.K (1999). Immunology. Narosa Publishing House, New Delhi.
2. Ivan Roitt (1994). Essential Immunology (8th Edition). Blackwell Scientific Publication. Immunology W.H. Freeman and Company.
3. Weir D.M and Stewart J (1997). Immunology. 8th Edn., Churchill Livingstone, New York.

References Books:

1. Ashim K and Chakravarty. Immunology and Immunotechnology. Oxford Publications.
2. Abbas A.K., Lichtman A.K., Jordan S and J.S Pober (1997). Cellular and Molecular Immunology. Harcourt Brace and Co., Asia Pvt. Ltd., Singapore.
3. Champion M.D and Cooke A (1987). Advanced Immunology, J.B. Lippincott Philadelphia.
4. Clark W.R (1983). The Experimental Foundations of Modern Immunology. John Wiley and Sons, New York.
5. Coleman, Lombard and Sicard (1992). Fundamentals Immunology. W.M.C. Brown Publishers.
6. Kuby J (1994). Immunology. W.H. Freeman and Co., New York.
7. Nandhini Shetty (1996). Immunology: Introductory Text Book. New age International Pvt. Ltd. New Delhi.
8. Ramakrishnan S and RajiSwamy (1995). Text Book of Clinical Biochemistry and Immunology. T.R. Publications, Madras.
9. Roitt M.I (1994). Essential Immunology. Blackwell Science Ltd., U.K.
10. Srivastava R., Ram B.P and P. Tyle (1991). Molecular Mechanisms of Immune Regulation. VCH Publishers Inc., New York.
11. Sells S (1987). Basic Immunology. Elsevier Science Publishing Co., New York.
12. Tizard I.R (1995). Immunology – An Introduction. IV Ed., Saunders College Publications, Philadelphia.

CORE COURSE IX - PRACTICAL II - BIOCHEMISTRY, ANIMAL PHYSIOLOGY, IMMUNOLOGY, AND BIOINFORMATICS

A. BIOCHEMISTRY

1. Quantitative estimation of amino acids, protein, carbohydrate and lipids in tissue samples.
2. Preparation of solutions - Molarity, Normality and Percentage.
3. Calculation of moles, millimoles, micromoles and nanomoles.
4. Buffer preparation - determination of pH using pH meter.
5. Beer lamberts law verification
6. Separation of amino acids by paper and thin layer chromatography - Unidirectional.

B. ANIMAL PHYSIOLOGY

1. Quantitative estimation of amylase activity.
2. Rate of salt loss and salt gain in fish using different experimental media.
3. Estimation of blood chloride.
4. Estimation of haemoglobin.
5. Blood - Clotting time, bleeding time
6. Effect of osmolarity on erythrocytes

C. IMMUNOLOGY

1. Identification of lymphoid organs in rat / mouse.
2. Preparation of antigen and raising antibody -for BSA and SRBC.
3. Blood collection and serum separation
4. Immuno - diffusion.
5. ELISA

Spotters: ELISA reader, Micropipette, lymphoid organs

D. BIOINFORMATICS

1. Sequence analysis - Human insulin - Fasta - Blast
 2. Molecular Docking.
- Spotters** -homepages of NCBI, Swiss-Prot and PDB,

ELECTIVE II - BIOINFORMATICS AND COMPUTER APPLICATIONS

Objectives: To gain the current trends on the various applications of computers including Ms office applications and usage of statistical software's and to understand the basic concepts of bioinformatics- database network on protein sequence and structural visualization and importance of bioinformatics tools.

UNIT - 1

Introduction to Bioinformatics, Databases-Nucleic acid databases, Protein sequence databases, Databases of structures, Specialized databases, Bibliographic databases. Outline of Genomics and Proteomics.

Steps involved in Drug Discovery.

UNIT: 2

Structure based Protein classification, Protein structure databases-PDB, NCBI. Visualization databases - Rasmol, Swiss-PDB and PDBsum. Structure visualization data bases

UNIT - 3

Bioinformatics Tools: UniProt/ SwissProt, FASTA, BLAST, Pair-wise alignment techniques, Multiple sequence alignment, Clustal W, Phylogenetic tree analysis.

UNIT - 4

Computer Applications: Basic concepts of computers- Generations of computers- Computer organization: Functional Units- Storage Unit- Memory- Hard Disk- Input / Output Devices.

UNIT - 5

MS word, MS excel and MS power point, Information Networks, Statistical softwares - SPSS.

References Books:

1. Jin Xiong (2006). Essential Bioinformatics. Cambridge University Press.
2. Rastogi S.C Mendiratta N. Rastogi P (2011). Bioinformatics Methods and Applications. PHI private Limited.
3. Basic Concepts of Computer.

EXTRA CREDIT COURSE

INTERNSHIP

SUBJECT CODE: INT Credit: 2 credits (Extra credits)

The curriculum includes the internship for students for 30 hours during the summer vacation after the second semester of all PG programs.

OBJECTIVES

The following are the intended objectives of internship training:

- To Enhance the employability skills of the students.
- To expose students to the industrial/Societal environment, which cannot be simulated in the classroom hence creating competent professionals for the industry and other organizations.
- To Provide possible opportunities to learn, understand, and sharpen the real-time technical/managerial skills required at the job.

Duration: 30 hours at the minimum

Period: During the summer vacation which could be completed within the third semester.

Assessment:

1. The assessment of the internship will be based on the feedback given by the internship provider and the report submitted by the student by the mentor.
2. After completion of the internship, the mentor has to make arrangements to get a proper training certificate from the industry/institution.
3. An abstract for details of the internship in the prescribed format has to be submitted by the departments to the COE on time.
4. Two credits are provided for the Internship as extra credits included under the Non-CGPA course for all PG programs.

LETTER FORMAT

GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM

REQUEST LETTER FROM THE COLLEGE TO INTERNSHIP PROVIDER

To

.....
.....
.....

Subject: REQUEST FOR INSTITUTIONAL/INDUSTRIAL TRAINING of
M.A./M.Com/M.Sc Degree Programme,

Dear Sir/Madam,

You must be aware that our College has made internship mandatory for all M.A./M.Com/M.Sc students.

In view of the above, I request your good self to allow following students of our college for practical training in your esteemed organization. Kindly accord your permission and give at least 30 hours of training for the students to complete the internship.

S.NO	NAME OF THE STUDENT	REG.NO	DISCIPLINE

If vacancies exist, kindly plan for Campus/Off Campus Interviews for _____ batch passing out students in above branches.

A line of confirmation will be highly appreciated.

With warm regards,

Yours sincerely,

Head of the Department.

FORM - 1

INTERNSHIP DETAILS (THIS WILL BE PREPARED IN CONSULTATION WITH FACULTY MENTOR AND TO BE MAINTAINED BY the department)

Student

Name: _____ Reg.No. _____ Class _____

Campus Address: _____

Phone: _____ Email: _____

Internship Provider

Name: _____

Title: _____

Company/Organization: _____

Internship Company Adress _____

Phone: _____ Email: _____

Faculty Mentor

Name: _____ Phone: _____

Designation: _____ Department: _____

Academic Credit Information

Internship Title: _____

Date of Initiation: _____ Date of Completion: _____

Total Hours: _____

FORM - 2

STUDENT'S DAY WISE LOG ENTRY

Name and Reg.No. of the Student: Name and address of the Internship

Provider:

Period of Internship: From:			To:	
Date	Hours	Details of work done	Signature of the Student	Signature of the Supervisor

Signature of the Mentor:

Signature of the Internship Provider:

FORM -3

SUPERVISOR EVALUATION OF CANDIDATE

Student Name: _____ Date:_____

Work Supervisor:_____ Title:_____

Company/Organization:_____

Internship Address:_____

Dates of Internship: From _____ To _____

Please evaluate your candidate by indicating the frequency with which you observed the following behaviors:

Parameters	Needs improvement	Satisfactory	Good	Excellent
Interest in work				
Punctuality				
Reliability				
Responsibility				
Communication				
Team work				
Overall performance				

Additional comments, if any:

\

Signature of Internship Provider

FORM - 4

STUDENT FEEDBACK OF INTERNSHIP (TO BE FILLED BY STUDENTS AFTER INTERNSHIP COMPLETION)

Student Name: _____ Class: _____

Internship Provider: _____

Address: _____

Title of Internship : _____

Supervisor Email: _____

Faculty Mentor: _____

Indicate the degree to which you agree or disagree with the following statements.

This experience has	Strongly Agree	Agree	Disagree
Given me the opportunity to explore a career field			
Allowed me to apply classroom theory to Practice			
Expanded my knowledge			
Helped me develop my written and oral communication skills			
Given me a chance to improve my interpersonal skills			
Provided me with contacts which may lead to future employment			
Helped me clarify my career goals			

Considering your overall experience, how would you rate this internship?

(Tick one).(Satisfactory/ Good/ Excellent)

Signature of the Student

FORM - 5

EVALUATION SHEET (FOR MENTOR)

S.NO	NAME OF THE STUDENT	REG.NO	NO. OF ACTUAL INTERNSHIP HOURS	GRADE*

* Evaluation based on report submitted by the student and evaluation by Internship provider. (Excellent/ Very good/ Good)

Signature of the Head of the Department

Signature of the Mentor

CORE COURSE IX - DEVELOPMENTAL BIOLOGY AND EVOLUTION

Objectives: To Comprehend the various developmental biological events like gametogenesis, fertilization cleavage, metamorphosis and regeneration in living organism and to understand the basic concepts of animal evolution through its mechanism of speciation, process and adaptive radiation.

UNIT- I

Gametogenesis: Spermatogenesis - Formation of Spermatids, spermiogenesis, factors containing spermatogenesis, structure of spermatozoan variations, significance of spermatogenesis, seasonal and non seasonal breeders. Oogenesis- multiplication phase, growth pre-vitellogenesis, vitellogenesis, Types of eggs, polarity and gradient, Maturation, significance of oogenesis.

UNIT- II

Fertilization: Physiological events and Biochemical changes during fertilization.

Parthenogenesis: Types, Natural and Artificial and its significances.

Cleavage: Types of cleavage- peculiarities - chemical changes - patterns of cleavage - planes of cleavage, Role of egg cortex in sea urchin

Embryonic induction of lens and competence. Differentiation - Types and levels; Homeotic genes; Nuclear transplantation experiment.

UNIT - III

Gene activity and general metabolism during gastrulation - Morphogenetic movements - Organogenesis of eye in Frog.

Metamorphosis: moulting and metamorphosis in insects - mechanism of action in insect hormones.

Regeneration: regenerative ability in planaria, Stimulation and suppression of regeneration - polarity and gradients in regeneration.

Infertility, Super ovulation, ICSI, GIFT, Embryo cloning, IVF and Test tube baby; Embryo culture- Methods of Embryo culture.

EVOLUTION

UNIT - IV

Origin of basic biological molecules - chemical evolution, Evolution of prokaryotes and eukaryotes, Evolution of Anaerobic metabolism, photosynthesis and aerobic metabolism.

Darwinism and Modern synthetic theory of evolution.

UNIT - V

Darwinism – Natural selection, Variation, Adaptation. Modern Synthetic theory of Evolution - Mutation, Isolation, Gene pool, Gene frequency, Genetic drift, Hardy-weinberg law, Speciation –Trends in Evolution and Extinction.

Recommended Text Books

Developmental Biology:

1. Balinsky B.L (1981). An Introduction to Embryology. V Ed., Saunders Co., Philadelphia.
2. Berrill N.J (1986). Developmental Biology. Tata McGraw Hill, New Delhi.

Evolution:

1. Sanjibchattopadhyay (2009). Evolution on Adaptation and Ethology Books and Allied (p) ltd, Kolkata.
2. Strickberger M.W (1996). Evolution. Jones and Barlett publishers Inc., London.
3. Dobzhansky T., Ayala F.J., Stebbins G.L and Valentine J.W (1975). Evolution. Surjeet Publications.

Reference Books:

Developmental Biology:

1. Berrill N.J and Karp G. (1976). Developmental Biology. McGraw Hill Inc. New York.
2. Browder L.N (1980). Developmental Biology, Saunders College. Philadelphia.
3. Deuchar E.M (1976). Cellular interaction in Animal Development. Chapman and Hall, London.
4. Gilbert S.F (1995). Developmental Biology. II Edn., Sinamer Associates Inc., Publishers, Saunderland, Massachusetts, USA.
5. Saunders A.W (1982). Developmental Biology. Patterns / Principles / Problems. Macmillan Publishing Co., NewYork.
6. Stevan B and Oppenheimer (1980). Introduction to Embryonic Development. Alley and Bern.
7. Timiras P.S (1972). Developmental Physiology and Aging. The Macmillan Company, New York.
8. Willer B.H and Oppenheimer J.M (1964). Fundamentals of Experimental Embryology, Prentice Hall

Evolution:

1. Dodson E.O and Dodson P (1976). Evolution: Process and Product (II Edn). Van Nostrand Company, New York.
2. Dowdeswell W.H (1963). The Mechanism of Evolution. Arnold-Heinmann India, Delhi.
3. Joha A.P (1992). Gene and evolution. The Macmillan Co., New Delhi.
4. Merrel D.P (1962). Evolution and Genetics: The Modern theory of Evolution. Holt, Rinehart and Winston Inc., New York.

CORE COURSE X- BIOTECHNOLOGY

Objectives: To acquire knowledge as the application of biotechnology as various fields – gene cloning, gene transfer technique, cell culture, fermentation and bioremediation for the industrial wastes.

UNIT-I

Scope and achievements in Biotechnology

Gene cloning - the basic steps - various types of restriction enzymes - ligase, linkers and adaptors - Selection of recombinants. Hybridization techniques chemical synthesis of oligonucleotides. cDNA and Genomic library.

Gene probe - Molecular finger printing (DNA finger printing) - RFLP - the PCR techniques - Blotting techniques - Southern blotting - Northern blotting - Western blotting. Nucleic acid sequencing - Maxim and Gilbert method.

UNIT-II

Plasmid biology - cloning vector based on *E.coli*, PBR 322, bacteriophage yeast Artificial Chromosome, *Agrobacterium tumefaciens*, Simian virus 40 - Gene transfer technology - Particle bombardment - Micro injection techniques.

UNIT-III

Basic principles of Cell culture, Tissue culture and Organ culture. Whole embryo culture - Embryo transfer in human. Transgenic animals - mice, fishes and Dolly - Gene therapy - Cryopreservation.

UNIT-IV

Fermentation - bioreactor - Microbial products - Primary and Secondary Metabolites - enzyme technology - single cell protein (SCP). Biopolymers, Biopesticides and Biofertilizers.

UNIT-V

Bioremediation - bioremediation of hydrocarbons - Industrial wastes - Heavy metals - Xenobiotics - bioleaching - biomining - biofuels.

Applications of biotechnology in agriculture, medicine and food science. Genetically modified organism (GMO'S) - GM foods.

Biotechnology and biosafety – Ethics and Intellectual Property Rights (IPR).

Recommended Text Books:

1. Dubey R.C (2008). A text Book of Biotechnology. S. Chand and Company, New Delhi.
2. Sathyanarayana U (2005). Biotechnology. Books and Allied P. Ltd. Kolkata.

References Books:

1. Brown C.M., Campbel I and Priest F.G (1988). Introduction to Biotechnology. Blackwell Scientific Publications, UK.
2. Primrose S.B (2000). Modern Biotechnology. Blackwell Scientific Publications, Oxford, London.
3. Keshav Trehan (1996). Biotechnology. New Age International Pvt. Ltd. Publishers, New Delhi.
4. Watson *et.al.*, (1999). Recombinant DNA. Freeman and Company, New York
5. Ignacimuthu S (1998). Basic Biotechnology. Tata McGraw Hill Publishing Co., New Delhi.

CORE COURSE XI - MICROBIOLOGY

Objectives: To learn the basics of microbes along with the applied values of microbes an environment, medical and industry.

UNIT - I

Scope and history of microbiology - Classification of microorganisms - Microbial diversity, general methods of classifying bacteria, fungi, algae and virus. Morphology and fine structure of bacterial cells - cell wall and peptidoglycan in Gram positive and Gram negative bacteria - Reproduction of bacteria, and viruses (lytic and lysogenic cycles).

UNIT- II

Bacterial growth and nutritional requirements, nutritional media and growth conditions; methods for culturing microbes - culture media - microbial growth; Isolation of pure culture. SPC and MPN techniques.

UNIT - III

Industrial microbiology - Biochemistry of fermentation, fermentation products, , production of ethanol, Pharmaceuticals - antibiotic, vitamins, microbial enzymes and vaccines.

Food microbiology - Food spoilage and food preservation techniques.

UNIT- IV

Environmental microbiology - nitrogen fixation (symbiotic and non-symbiotic) mechanism of nitrogen fixation, carbon, nitrogen, sulphur and phosphorous cycle.

Water microbiology - bacteriological examination of domestic water, purification of water, sewage and its disposal, Aeromicroflora of hospitals.

UNIT - V

Medical microbiology - Microorganisms and infectious diseases Epidemiology, symptoms, clinical types and therapy of Fungal (Mycoses and Mycotoxicoses), Bacterial (Tuberculosis, typhoid) and viral (Dengue, Hepatatitis, HIV) diseases.

Recommended Text Books:

1. Pelczar M.J., Reid R.D and Chan E.C.S (1996). Microbiology. V Ed., TataMcGraw Hill Publishing Company Ltd., New Delhi.
2. Ananthanarayanan T and Jayaram Paniker C.K (2000). Text Book of Microbiology. VI Ed., Orient Longman Ltd., Madras.

References Books:

1. David Freifelder (1998). Microbial Genetics. Narosa Publishing House, NewDelhi.
2. Powar C.B and Diginawala H.F (1982). General Microbiology. Volume I and II, Himalaya Publishing House, Bombay.
3. Michael T. Madigan, John M. Martinkl and Jack Parker (1997). Biology of Microorganisms. VIII Ed., Prentice Hall International Inc., USA.

CORE COURSE XII - PRACTICAL- III

DEVELOPMENTAL BIOLOGY AND EVOLUTION, MICROBIOLOGY, BIOTECHNOLOGY, BIostatISTICS AND RESEARCH METHODOLOGY

A. DEVELOPMENTAL BIOLOGY

1. Whole mount of chick embryo – 24hrs, 36 hrs, 72hrs and 96 hrs
2. Observation of prepared slides for developmental stages
3. Effect of thyroxine on metamorphosis of tadpoles
4. Observation of regeneration in tail of tadpoles

B. EVOLUTION

1. Observation of forelimbs or hind limbs of vertebrates (Frog, Calotes, Bird and Mammal) to demonstrate the common pattern of pentadactyl limb and common ancestry of vertebrates.
2. Report on evidences for evolution based on your observation.
3. Observation of leaf insects and stick insects in the museum to demonstrate adaptation by cryptic colouration and natural selection.
4. Observation of Monarch and Viceroy butterflies to demonstrate Batesian mimicry.
5. Spotters: Archeoptery, Grand Canyon, Limulus, peripatus and fossils.

C. BIOTECHNOLOGY

1. Isolation of genomic DNA
2. Agarose gel electrophoresis of DNA
Spotters: PCR, southern blotting, vectors, transgenic animals

D. MICROBIOLOGY

1. Culture techniques – culture of bacteria
2. Bacterial growth curve
3. Enumeration of bacteria by serial dilution
4. Enumeration of bacteria by counting method
5. Antibiotic susceptibility test.
6. Milk purity test by MBR method
Spotters: Laminar air flow, inoculation needle, Autoclave, Incubator

F. BIostatISTICS

1. Collection of data (Height, Weight, Blood group, Hb, BMI) from class,
2. Analysis of data using Microsoft excel

G. RESEARCH METHODOLOGY

1. Preparation of bibliography for research paper

ELECTIVE COURSE III - BIOSTATISTICS AND RESEARCH METHODOLOGY

A. BIOSTATISTICS

Objectives: To understand the importance of Statistics through presentation of data, in biological processes and to learn the research methodology for scientific writing and also to know the basic principles of microscopes and biotechniques.

UNIT-I

Introduction - scope and definition, functions and limitations of statistics. Collection, organization (classification and tabulation of data) and presentation (graphical representations) of data. Measures of central tendency - mean, median and mode. Measures of dispersion - range, inter quartile range, mean deviation, standard deviation and Standard error.

UNIT - II

Skewness and kurtosis, measures of skewness, Karl-Pearson's coefficient of skewness, Bowley's measures of skewness, types of coefficient of skewness, types of kurtosis, Correlation analysis (Karl-Pearson's) - types and methods, Regression analysis - regression line and regression equation.

UNIT - III

Hypothesis testing, Chi-square test, One-way Analysis of variance, Student t-test. Probability theory - Normal, Binomial and Poisson distributions (theory only).

B. RESEARCH METHODOLOGY

UNIT-IV

Literature collection: Source, preparation of Index card, Details of books, edited volumes, peer reviewed journals, e-journals, biological abstracts and Magazines. Online browsing of research articles: infonet and inflibnet. Preparation of research dissertation - components of thesis, proof reading, preparation of bibliography. Preparation of Scientific paper for publication in a peer reviewed Journal. Details of impact factor, citation index and h-index.

UNIT -V

Principles and their application of Electron Microscope (SEM and TEM), Centrifuge (ultracentrifuge), Electrophoresis (SDS-PAGE), Chromatography (TLC, GC and HPLC) Spectroscopy (UV, Infrared and NMR).

Recommended Text Books:**BIOSTATISTICS**

1. Milton J.S (1992). Statistical methods in Biological and Health Sciences. McGraw Hill Inc., New York.
2. Gupta S.P (1988). An easy approach to statistics. Chand and Co., New Delhi.

RESEARCH METHODOLOGY

1. Gurumani N (2006). Research Methodology for Biological Sciences MJP Publishers.
2. Daniel M. Basic Biophysist - student Edition.
3. Prescott. Harley. Klein. Microbiology
4. Jain J.L., Sanjay Jain and Nitin Jain. Fundamentals of Biochemistry. S. Chand publication.

Reference Books:

1. Anderson, Durston and Polle (1970). Thesis and Assignment writing. Wiley Eastern Ltd., New Delhi.
2. Comir and Peter Wood Ford (1979). Writing scientific papers in English. Pitman Medical Publishing Co., London.
3. Day R.A (1994). How to write and publish a scientific paper. Cambridge University Press, London.
4. Palanichamy S and M. Shanmugavelu (1997). Research methods in biological sciences. Palani Paramount Publications, Tamil Nadu, India.
5. Wilson and Walker (2000). Practical biochemistry - principles and techniques. Cambridge University Press.

CORE COURSE XIII - ECOLOGY AND ETHOLOGY

Objectives: To learn the fundamentals of environment Components, functions and biogeochemical cycles and pollution impacts which influence the animal behaviour including territorial, aggressive, mating and dominance in living organism.

UNIT- I

Ecology: Scope of Ecology - kinds of Ecosystem; Structure of Ecosystem - Abiotic (Temperature and Soil) and Biotic component. Liebig's law of Minimum, Shelford law of Tolerance. Ecological pyramids - Pyramids of numbers, biomass, energy. Function of an Ecosystem - productivity of Ecosystem, Food chain, Food webs - Energy flow in Ecosystem. Biogeochemical cycle - Carbon and Nitrogen.

UNIT- II

Population Ecology: Density, Dispersion, Age structure, Natality, Mortality, Dispersal, Dispersion, Regulation of population density, Population interactions - Animal associations.

Community Ecology: Structure, Stratification, Periodicity, Interdependence, Ecological niche, Ecotone, Edge effect, Succession, Climax.

UNIT -III

Pollution - Ecological Aspects of Pollution, kinds of pollution - (Air,water,Soil,Noise, Thermal, Radiation, Plastics and Pesticides,) and their source, effects and control measure. Acid Rain- Green house effect- Ozone and its importance- Global warming. Environmental Impact Assessment - Need, Methods.

UNIT - IV

Animal behaviour: Definition of Ethology - Approaches to behavioural study (Field and Laboratory methods). Types of behavior: Innate - Reflexes, Taxes Instincts, Acquired behaviour - Habituation, Imprinting, learning (Conditioning , trial and error, insight or reasoning).

UNIT-V

Animal behaviour: Feeding and Anti predator behaviour, Aggressive behaviour, Sexual behaviour and Selection, Family and group behaviour, Dominance behaviour.

Animal Communication: Visual, Olfactory, Auditory, Tactile and Chemicals.

Reference Books:

1. Veer Bala Rastogi and Jayaraj M.S. Animal Ecology and distribution of animals - Eighth edition- Kedar Nath Ramnath Publications, Meerut.
2. Gundevia H.S and Hare Govind Singh (1998). A text book of Animal Behaviour - S. Chand and Company Ltd, New Delhi.
3. Sharma P.D (2008-2009). Ecology and Environment-Rastogi Publications. New Delhi.
4. Verma P.S and Dr. Agarwal .V.K (1983). Environmental Biology- S. Chand and Company Pvt. Ltd – New Delhi.
5. Mathur Reena (1998). Animal behavior. Rastogi Publications, Meered.

COURSE XIV - PRACTICAL - IV

ECOLOGY, ETHOLOGY AND BIODIVERSITY

APPLIED ECOLOGY

1. Maintenance of microcosms.
2. Determination of pH, dissolved oxygen, salinity, and free CO₂ in water.
3. Determination of carbonates and bicarbonates in water.
4. Estimation of chlorides in water.
5. Estimation of dissolved solids in water, plankton and Insects.
6. Visit to drinking water treatment plants.
7. Visit to nearest Forest ecosystem.
8. Study of a Pond ecosystem - Mahamaham tank and write a report on its biodiversity.
9. Effect of pollutants on primary productivity.

SPOTTERS

Secchi disc, Water analyzer.

ETHOLOGY

1. Observation of habituation in Pila.
2. Observation of taxis in earthworms.

BIODIVERSITY

1. calculation of shanon index.
2. calculation of plankton biodiversity.

ELECTIVE COURSE -IV BIODIVERSITY AND CONSERVATION

Objectives: To understand the importance of biodiversity and conservation methods through concepts, reasons for loss of biodiversity, current practices in conservation, management of biodiversity and biotechnological role and impacts of biodiversity in india.

UNIT - I

Biodiversity: Concept and definition - Scope of Biodiversity science - Types of biodiversity - Genetic, Species, Ecosystem and Agrobiodiversity. Biodiversity values and uses - Ethical, Aesthetic, Ecological, Cultural Benefits. Methodologies for valuation of Biodiversity (Changes in productivity method, Contingent valuation method and Hedonic pricing method), diversity assessment (Shannon Weiner Index).

UNIT - II

Loss of Biodiversity: Genetic diversity - Factors causing for loss, Founder effects, Demographic Bottlenecks, Genetic Drift, Inbreeding depression. Species diversity- extinction, population size. Ecosystem diversity- Factors affecting Ecosystem degradation and loss. Agrobiodiversity – loss of Biodiversity as an Economic process-Hot spots of Biodiversity.

UNIT - III

Conservation of Biodiversity: Current practice in conservation -*In -Situ* Conservation; Sanctuary, National parks and Biosphere reserves. *Ex-Situ* Conservation: Zoological park, Botanical Garden, Germplasm collections (Seed banks, Test-tube Gene banks, Pollen banks, Field Gene bank, DNA Bank). *in-vitro* Conservation methods – Ecosystem restoration. Social Approaches to conservation - Sacred Groves, Sthalavrikshas, Chipko movement. Role of Educational Institution in Biodiversity and Conservation.

UNIT -IV

Management of Biodiversity: IUCN, UNEP, UNESCO, WWF, ICSU, FAO, CAB International WCMC, ISBI, GEF, WHF. Biodiversity Legislation and Conservations (International and National-Laws) CITES, Ramsar Conservation, UPOV, ITTA and ITTO. IUCN threat categories. Red data book. Remote sensing-basic concepts and applications in environmental conservation.

UNIT - V

Biotechnology and its role and impacts in Biodiversity - Ecoterrorism, Data and Information Relating to Biodiversity of India, Protected areas in India- The silent valley movement- Biopiracy-Biodiversity information networks in India. Problems and prospects in participatory management of Biodiversity.

Recommended Text Books:

1. Krishnamoorthy K.V (2004). An Advanced text Book on Biodiversity. Oxford and IBH Publishing Co. Pvt. Ltd New Delhi
2. Sharma P.D (2008-2009). Ecology and Environment- Rastogi Publications, New Delhi.
3. Verma P.S and Agarwal V.K (1983). Environmental Biology. S. Chand and Company Pvt. Ltd, New Delhi.

CORE COURSE – XV PROJECT / DISSERTATION WITH VIVA VOCE

Objectives: To promote original thinking, insemination of knowledge, modulation and innovation of thought, as an exercise, in order to transport the young minds to the expanding horizon of their chosen area of knowledge and transform them into knowledge generators.

Project / Dissertation	80 Marks
2 Reviews	20+20 = 40marks
Report Valuation	40 Marks
Viva voce	20 Marks