



ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN
(Autonomous)

(Re-Accredited with 'A' Grade by NAAC)

(A Government Aided College - Affiliated to Mother Teresa Women's University, Kodaikanal)
CHINNAKALAYAMPUTHUR (PO), PALANI -624 615.

PG DEPARTMENT OF ZOOLOGY



SYLLABUS

M.Sc (ZOOLOGY) - 2016-2017

SEMESTER - I

PAPER -I

BIOCHEMISTRY

SUBJECT CODE :

CONTACT HOURS : 06/ week
CONTACT HOURS : 90

/semester

Unit : I Historical Background - Structure and properties of molecules 10 hrs

Association of Atoms into Molecules (Chemical bonds: Hydrogen bond - Vander Wall's bond). Water and Electrolytic dissociation: Acid - Base balance, Concept of pH and buffers, Acidosis and Alkalosis.

Unit : II Carbohydrates and Carbohydrate Metabolism 20 hrs

Structure and Classification. Carbohydrate metabolism - Glycolysis, Krebs's cycle, Electron Transport System, Hexose Monophosphate Shunt (Pentose phosphate pathway), Gluconeogenesis, Glycogenesis, Glycogenolysis. (Including the Energetics of all Metabolic Pathways). Cori's lactic acid cycle and Blood sugar level.

Unit : III Proteins, Amino acids and Metabolism 15 hrs

Protein - Structure and Classification. Amino acid - Structure, Classification, Isomerism. Deamination, Transamination and Transmethylation of Amino acids. Formation of Ammonia and Urea. Integration of Carbohydrate, Lipid and Amino acid metabolism.

Unit : IV Lipids and Lipid Metabolism 15 hrs

Structure and Classification of lipids. Oxidation of Fatty acids - α Oxidation, β Oxidation & Omega Oxidation. β - Oxidation of Palmitic acid and its Bioenergetics. Biosynthesis of Palmitic acid & Ketogenesis.

Unit: V Nucleic Acids 15 hrs

Watson & Crick model of DNA, Purine Metabolism, Pyrimidine Metabolism, Replication of DNA.

Unit : VI Enzymes & Hormones 15 hrs

Definition, Properties of enzymes. Factors influencing Enzyme activity. Enzyme inhibitors. Classification of Enzymes, Mechanism of Enzyme Action.

i) Coenzyme : Definition, Mechanism of Coenzyme Action, NAD, NADP, CoA, CoQ, FAD, Isoenzyme : Definition, LDH.

ii) Chemistry of Hormones: Protein and Steroid Hormones, Mechanism of Protein Hormone Action, Mechanism of Steroid Hormone Action.

Reference Books

1. Dr.Ambika Shanmugam (2003), Fundamentals of Biochemistry, Karthick Printers, Chennai.
2. Evic.E.Conn, paul, K,stumpf, George bruening Roy H.Do, (1976), Wiely easter, Delhi.
3. Jerenu.M.Bera, John.L.Tycoczki, Lubert stryer. (1975). Biochemistry, V Ed., W.M. Freeman and Company, Newyork.
4. Emil.Smith Rober.L.Hill, Principles of Biochemistry Mammalian Biochemistry, VII Ed., Mc G. Raw Hill Book Company ,New Delhi.
5. R.K.Murry , D.K.Granner, P.A.Mayes, (1988). Harper's Biochemistry, 25th Ed., Prentice- Hill of India Private limited, New Delhi.

SEMESTER -I
PAPER -II
CELL AND MOLECULAR BIOLOGY

SUBJECT CODE :

CONTACT HOURS : 06/week

CONTACT HOURS : 90 /semester

Unit :I Microscopy and Prokaryotes

16Hrs

Microscopy: Principles and applications - Electron Microscope (TEM and SEM), Phase Contrast Microscope, X-ray microscope and Fluorescent microscope. Prokaryotic cells - E.coli, Cyanobacteria and Mycoplasma, Structure of Viruses and Virion.

Unit: II Organelles and Cell cycle

15Hrs

Biomembrane: Structure and membrane potentials, Cell adhesion - intercellular junctions, Cell signaling, Structure and functions of Peroxisomes, Glyoxisomes, Ribosomes and Centrioles. Cell cycle components and Cell cycle regulation.

Unit: II Nucleus and Chromosomes

12 Hrs

Nucleus and Nucleolus – Structure and Functions.
Chromosomes - Ultrastructure and functions, Giant Chromosomes, Chromatin, Nucleosomes, Mobile DNA - Prokaryotes and Eukaryotes

Unit: IV DNA and RNA

16Hrs

DNA: Denaturation and Renaturation. Replication - Semiconservative method - experimental evidences, Enzymology of Replication, Bi-directional replication, Rolling circle replication. DNA damage and repair mechanisms. RNA - Types of RNA - mRNA, rRNA, and tRNA, - Structure and functions.

Unit:V Protein synthesis

16 Hrs

Protein synthesis - Transcription in Prokaryotes and Eukaryotes, Mechanism of transcription - initiation, elongation and termination. Transcription factors - Zinc fingers, Leucine zippers. Translation - initiation of protein synthesis - activation of

amino acids, aminoacylation of tRNA, elongation and termination of polypeptide chain. Enzymes and factors involved in protein synthesis.

Unit: VI Gene Expression

15Hrs

Regulation of gene expression - Lac operon - components, repressor mechanism. Ara operon, Arabinose metabolism in E.coli. trp operon - tryptophan metabolism. Cancer – Types and properties. Genetics of Cancer, Nanotechnology and Cancer.

Reference Books:

1. David Freifelder (2008) - Molecular Biology, Naras Publishing House Pvt. Ltd., New Delhi.
2. E.D.P. De Roberties and E.M.F. De Roberties, (2001) - Cell and Biology, Wolter's Klower (India) Pvt. Ltd, New Delhi
3. S.C.Rastogi, (2006) - Molecular Biology, CBS Publishers and Distributors, New Delhi.
4. Lodish, Berk, Zipursky, Matsudarie, Baltimore and Darnell, (2000) - Molecular Biology, Freeman and Company, Newyork.
- 5, P.C.Turner, A.G.Mclennan, A.D, Bates and M.R.H.White, (2002) - Molecular Biology, Viva Books Private Limited, New Delhi.

SEMESTER - I
PAPER -III
MICROBIOLOGY

SUBJECT CODE:

CONTACT HOURS: 06/week

CONTACT HOURS: 90 /semester

Unit: I History and Microbial Growth

15 hrs

History and scope of Microbiology

Microbial Culture: Sterilization, Aseptic transfer and Isolation.

Pure culture - Methods for isolation of Pure Culture - Streak Plate, Spread Plate and Pour Plate Technique.

Microbial growth - Culture media. Culture techniques - Batch culture, Continuous culture and Synchronous. Bacterial growth - Growth curve, Measurement of Bacterial Growth. - Cell count method and Turbidometric method. Staining Techniques - Simple, differential and Gram Staining.

Unit : II Microbial Metabolism

15hrs

Glycolysis, Pentose Phosphate Pathway (HMP), Entner-Doudoroff pathway,

TCA cycle, Glyoxylate cycle and Fermentation.

Bacterial Photosynthesis-Classification of photosynthetic Bacteria, Mechanism of photosynthesis.

Unit : III Food Microbiology

15hrs

Microbiology of Milk

Dairy Industry ; Dairy Products-Yoghurt, Butter Milk, Butter, Cheese.

Microbial Spoilage of food: Microbial Contamination and Spoilage of Poultry, Fish and Sea Foods.

Preservation of Food: Preservative Methods - Physical and Chemical Methods.

Unit IV : Medical Microbiology

15 hrs

Bacterial diseases: Air borne diseases- Diphtheria, Meningitis, Pertusis, Streptococcal Pneumonia.

Food and Water Borne Diseases- Cholera and Typhoid.

Soil Borne Diseases - Tetanus, Anthrax

Sexually Transmitted Diseases - Gonorrhoea and Syphilis

Contact Disease – Leprosy. Viral diseases - Influenza, Hepatitis - B, Rabies.

Unit: V Industrial Microbiology**15hrs**

Alcohol production – Ethanol

Production of Acids - Lactic acid and Vinegar,

Production of Antibiotics – Penicillin and Streptomycin

Production of Amino acid - L-lysine, L- glutamic acid.

Production and Application of Microbial Enzymes and Immobilization of Enzymes.

Unit : VI Agricultural and Environmental Microbiology**15 hrs**

Role of Ti Plasmid and Nif gene in Agriculture.

Biofertilizers and Biopesticides,

Bacterial Insecticides - *Bacillus thuringensis* and Viral Insecticides.

Potable water and Sewage treatment.

Water Pollution Management – Bioaugmentation and Bioremediation

Biodegradation – Microbial degradation of Xenobiotics and Super Bug.

Reference Books

1. Dr.R.C.Dubey .Dr.D.K.Maheswari, (2010), A Text book of Microbiology, S.Chand & CO Ramnager, New Delhi.
2. Ronald , M.Atlas, (1988), Microbiology Macmillan publishing company Newyork.
3. J.Pelczar, D,Reid. (1984), TATA Mc Graw Hill publishing company Ltd. Newyork.
4. Samuel Baron , Medical Microbiology, II Ed., Wesley publishing company, California

SEMESTER -I

PAPER – IV PRACTICAL – I

BIOCHEMISTRY, CELL & MOLECULAR BIOLOGY AND MICROBIOLOGY

SUBJECT CODE :

CONTACT HOURS: 6 / week

CONTACT HOURS : 72 / sem

Biochemistry

Effect of temperature on salivary amylase activity - Determination of Q_{10} .

Effect of pH on salivary amylase activity.

Effect of Enzyme Concentration on Salivary amylase activity

Influence of substrate concentration on Salivary amylase activity

Paper Chromatography – Ascending and Circular chromatography

Column Chromatography – Separation of pigments from varied leaves or flowers

Gel Electrophoresis – (Demonstration only)

Quantitative estimation - Estimation of Carbohydrates, Proteins and Lipids from fresh tissues
- Standard graphs.

Cell & Molecular Biology

Microscopy: Optical and Phase Contrast Microscope

Micrometry - Measurement of cells using Ocular and Stage micrometers - Length and Width

Counting of blood cells in Human blood - R.B.C and W.B.C

Identification of mitotic stages in Onion root tip.

Identification of meiotic stages in Tradescantia

Observation of Giant chromosome in Chironomous larva. (Visual Aid / Virtual Dissection)

Observation of osmosis in Onion epidermal cells (Demonstration only)

Models – Watson and Crick Model of DNA, Protein Synthesis, Replication in DNA – Semi-conservative

Microbiology

Sterilization of glassware and media

Preparation of Culture media

Serial dilution Technique

Aseptic transfer of Bacteria

Pure culture of Bacteria

Preservation and maintenance of Bacterial culture

Cultural characteristics of bacteria

Wet mount preparation and Hanging Drop technique

Microscopic measurement of microbes using Haemocytometer

Spotters:

- * Hot air oven
- * Autoclave
- * Pressure cooker
- * Agar Plate
- * Inoculation needle
- * Structure of Bacteria
- * Structure of Virus

SEMESTER – I

ELECTIVE -I

ORNAMENTAL FISH CULTURE

SUBJECT CODE :

CONTACT HOURS : 06 / week

CONTACT HOURS : 90 /semester

Unit: I Aquarium Tank

15Hrs

Construction of Home Aquarium: Design and Construction of Aquarium tank, Accessories used in Aquarium, (aerators, filters, types of filters and hand nets), Setting up of Aquarium tank (gravels / pebbles, plants, ornamental objects and fishes, selection of species). Aquarium plants and its importance.

Unit: II Aquarium Management

14Hrs

Cleaning the aquarium - Maintenance of water quality – Temperature, Water change, Ammonia, O₂/CO₂, Water hardness. Control of Snail and Control of algal growth in Aquarium tank.

Unit: III Taxonomy and Biology

18Hrs

Taxonomy and Biology of popular Ornamental fishes : Live-bearers (Ovo-viviparous) - Red Swordtail (*Labeo bicolor*), Platy (*Xiphophorus maculatus*), Guppy (*Poecilia reticulata*) and Molly (*Black molly*). Egg layers (Oviparous) - Gold fish (*Carassius auratus*), Siamese fighting fish (*Betta splendens*), Gourami (*Trichogaster leeri*), Angel fish (*Pterophyllumsalare*), Oscar (*Austronotus ocellatus*) and Koi carp (*Cyprinus carpio carpio*). Breeding and Spawning of Live bearers and Egg layers. Induced breeding and Production of Monosex fish.

Unit:IV Nutrition

14Hrs

Nutritional requirements of Ornamental fishes - Different kinds of feeds - Artificial and Live food. Culture of live food organisms -Infusorians, Rotifers, Cladocerans, Brine shrimp, Chironomus and Tubifex. Artificial feed - feed formulation. Balanced diets for Aquarium fishes.

Unit :V Diseases of Ornamental Fishes**14Hrs**

Common diseases of aquarium fishes - Protozoan, Fungal, Bacterial and Nutritional diseases. Their diagnosis and treatment, Problems of over feeding.

Unit: VI 15Hrs

Commercially important Marine Ornamental fishes. Purchase and Transport of Ornamental fishes. Use of Sedatives. Other Ornamental organisms - Anemones, Lobsters and Shrimps. Entrepreneurship development in Ornamental fish culture.

Reference Books

1. J.D. Jameson and R.Santhanam (1996) - Manual of Ornamental fishes and Farming Technologies - Fisheries College and Research Institute TANVASU, Tuticorin
2. Meenakshi Jindal, N.K.Yadava and R.K.Gupta (2000) - Freshwater Ornamental Fishes, Mangalam Publications, Delhi.
3. V.K. Venkataramani et al., (2004). Biodiversity and Stock Assessment of Marine Ornamental fishes. Department of Fisheries Biology and Capture Fisheries, Fisheries College and Research Institute, TANVASU, Tuticorin.
4. A.D.Dholakia, (2009) - Ornamental Fish Culture and Aquarium Management, Daya Publishing House, Delhi
5. H.S.Jagtap and S.N.Mukherjee and S.S.Nanware, (2009) - P.ractical Manual of Pisciculture and Aquarium Keeping, Daya Publishing House, New Delhi.

SEMESTER -II
PAPER - IV
DEVELOPMENTAL BIOLOGY

SUBJECT CODE :

CONTACT HOURS : 06/week

CONTACT HOURS : 90 /semester

Unit: I Theories of Embryology and Gametogenesis

15hrs

Theories of Embryology : Pre formation theories, Epigenetic theory, Von Baer's Law, Germplasm theory, Mosaic theory, Regulative theory, Concept of potency and totipotency, Gradient theory. Gametogenesis: Origin of primordial germ cells, Spermatogenesis- Formation of spermatid, Spermioteliolosis, Morphology of spermatozoan (mammal), Oogenesis – Proliferative phase, Growth phase - Pre-vitellogenesis, Vitellogenesis, Maturation of egg, Types of eggs.

Unit: II Fertilization

15hrs

Fertilization : Mechanism of fertilization - Encounter of spermatozoa and ova, Capacitation and contact, Acrosome reaction and penetration, Cortical reaction, Activation of Ovum - Change in ionic permeability and Potential of egg's plasma membrane, Transient intracellular rise in calcium ions, Transient intracellular increase in pH, Monospermy & Polyspermy, Theories of Fertilization, Migration of pronuclei and amphimixis, Ooplasmic segregation; Significance of fertilization.

Unit: III Cleavage & Gastrulation

20hrs

Cleavage - Peculiarities of Cell divisions in Cleavage, Patterns of Cleavage. The Nuclei of Cleaving cells, Distribution of cytoplasmic substances in the egg during cleavage, Role of egg cortex, The Morphogenetic gradients in the egg cytoplasm, Effect of yolk on Cleavage, Cleavage in Amphioxus, Frog, Chick and Mammal. Gastrulation - The fate map, Morphogenetic movement, Metabolism during gastrulation, Activity of gene during gastrulation, Gastrulation in Amphioxus, Frog, Chick and Mammal.

Unit: IV Organogenesis

15hrs

Formation of primary organ rudiments - Development of eye, brain, ear and heart in Frog, Developmental defects or abnormalities (Teratogenesis).

Unit: V Metamorphosis**15hrs**

Metamorphosis in Amphibia, Hormonal regulation of Amphibian metamorphosis, Tissue reactivity in Amphibian Metamorphosis. Metamorphosis in insects. Regeneration in Planarian and Amphibian.

Unit: VI Experimental & Applied Embryology**10hrs**

Embryonic induction, Organizer concept, Theories - Neural induction, Nucleocytoplasmic Interaction, Birth control, Artificial insemination, Test tube baby, Role of genes in development.

Reference Books

1. B.I. Balinsky (1981), An Introduction to Embryology, V Ed., Saunders College Publishing, Newyork.
2. Dr.R.C. Delela and R.Verma., (1986-87), A Text book of Chordate Embryology, V Ed., Jai Prakashnathan & co, Meerut city, India.
3. P.S.Verma and V.K. Agarwal (1975) Chordate Embryology X Ed., S.Chand & Co Pvt Ltd, Ramnager, New Delhi.
4. Bradley M.Pattern., (1957), Early Embryology of the Chick IV Ed., McGraw- Hill Book company, Newyork.
5. Bradley M.Pattern., (1948), Embryology of the pig III Ed., McGraw- Hill Book Company Newyork.

SEMESTER –II

PAPER - V

ENVIRONMENTAL BIOLOGY AND BIODIVERSITY

SUBJECT CODE :

CONTACT HOURS : 06/ week

CONTACT HOUR : 90 /semester

Unit: I Environment and Ecosystem

15Hrs

Environment : Segments of environment, Atmosphere - Structure, Air as an ecological factor. Hydrosphere: Hydrological cycle, Physico- chemical aspects -River and Sea.

Lithosphere- Process of soil formation, Soil profile, Soil texture and major soil types of India.

Dynamics of Ecosystem: Primary and Secondary productivity, Energy flow and Ecological energetics.

Unit: II Resources and Energy 15Hrs

Renewable resources - Solar energy, Biogas, Wind energy, Ocean energy and Geothermal energy. Petroplants for future fuel and Bioenergy from waste.

Non-Renewable resources - Fossil fuels, Nuclear fuels, Petroleum and Natural gas

Unit: III Environmental Pollution

16Hrs

Pesticide pollution, Radioactive pollution, Carbon monoxide Pollution, Plastic pollution and Oil pollution. Acid rain, Greenhouse effect and Global warming. Novel methods for Pollution control - Vermitechnology, Phytoremediation and Biotreatment of wastes by Genetically Engineered Microbes. Hospital Waste Management. Biological indicators and their role in environmental monitoring, Environmental Impact Assessment.

Unit: IV Environmental management 14Hrs

Environmental Policy : National and International, Anti-Pollution Laws.

Environmental awareness - Environmental education. Bio products for environmental health - Biopesticides, Biofertilizers, Biodegradable and ecofriendly products.

Unit: V Biodiversity**15Hrs**

Definition, Biodiversity indices, levels and loss. Biodiversity hotspots, Prioritization of taxa for conservation, Endemicity and Keystones. IUCN - IUCN Categories of Threat, Remote Sensing and GIS in Biodiversity, Biodiversity and climate change.

Unit: VI Conservation Strategies**15Hrs**

In-situ conservation – National Parks and Sanctuaries, Sacred groves. Ex-situ conservation - Gene banks and Cryopreservation. Earth summit and Post-Rio scenarios. Project Tiger and Project Elephant. Wild life management in India.

Reference Books

1. Asthana, D.K. and Meera Asthana,(1999) - Environment - Problems and Solutions, S.Chand and Company Ltd, New Delhi
2. Sharma, P.D. (1999) - Ecology and Environment, Rastogi Publications, Meerut.
3. Agarwal, K.C. (1996) - Biodiversity, Agro Botanical Publishers (India).
4. Asish Ghosh, (2008) - Environmental Conservation - Challenges and Actions, APH Publishing Corporation, New Delhi.
5. Kumar, H.D (2003) - Biodiversity and Sustainable Conservation, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

SEMESTER -II
PAPER - VI
BIOINFORMATICS

SUBJECT CODE :

CONTACT HOURS : 06/week

CONTACT HOURS : 90 /Semester

Unit : I Basics of Bioinformatics

10 hrs

Introduction to Bioinformatics, Objectives and Scope, Symbols used in databases, Fields related to Bioinformatics, Applications of Bioinformatics in various fields.

Unit : II Sources of Bioinformatics

15 hrs

Computers: Architecture – Milestone and early developments (Generations I - V), Computers as a source of Bioinformatics – Browsers used in Biology – Internet, e-mail. Number system – Binary, Decimal and Octal number system.

Unit : III Genomics

20 hrs

Genomics: Genome databases - Objectives of biological databases, Structure of Nucleotide databases, Nucleotide sequence databases –EMBL, Gen Bank – Gen Bank submission format, DDBJ, NCBI & TIGR. Human Genome Project – Companies involved in HGP – Potential benefits of HGP – Genes located in different Chromosomes- Year wise publications. Gene expression analysis – Microarray.

Unit : IV Proteomics

15 hrs

Proteomics: Protein sequence Databases – SWISS PROT, TrEMBL, and PIR. Protein structures – Primary, Secondary & Tertiary – Protein Structure Predictions: a). Ab – initio modeling and Identification of conserved and variable regions. b) Comparative modeling – homology modeling and protein threading. Protein structure prediction software available in the web.

Unit : V Sequence Alignment

15 hrs

Sequence Alignment: Homology and Similarity searching Tool (BLAST, FASTA and CLUSTAL W)– Molecular visualization tools – Rasmol, chime, Dis – MOL, Web lab viewer, Sequencing methods – Pairwise sequence alignment - (Dot matrix, Dynamic Programming & word or K tuple method). Multiple Sequence Alignment- (Dynamic, progressive and Iterative method).

Unit :VI Pharmacogenomics**15 hrs**

Molecular Docking : Protein – Protein Docking, Drug designing – Objectives, rational drug design – examples of designed drugs – drug development – Pharmacogenomics – uses of Pharmacogenomics.

Reference Books:

1. S.Ignacimuthu ., (2005), Basic Bioinformatics, III Ed., Narosa Publishing House Pvt. Ltd.
2. Prakash S Lohar., (2009), Bioinformatics, I Ed., MJP Publishers.
3. BG Curran., (2010), Bioinformatics , I Ed., CBS Publishers & Distributers.
4. M.Rajadurai (2010) – Bioinformatics A Practical Manual – I Ed., PBS Book Enterprises.
5. T K Attwood & D J Parry Smith., (2008), Introduction to Bioinformatics, I Ed., Himalaya Publishing House.

SEMESTER -II
PRACTICAL- II
DEVELOPMENTAL BIOLOGY,
ENVIRONMENTAL BIOLOGY & BIODIVERSITY AND BIOINFORMATICS

SUBJECT CODE :

CONTACT HOURS : 06/week

CONTACT HOURS : 90 /semester

DEVELOPMENTAL BIOLOGY

- 1 .Early Embryonic development of Frog – Observation of 2 cell, 4 cell, 8 cell, 16 cell, Blastula, Gastrula and Yolk plug stages.
2. Temporary Mounting of Chick Blastoderm
- 3 .Early Hours of Chick development – Observation of various stages 24,48,72 and 96 hrs of chick blastoderm.
4. Induced Ovulation in Frog. (Demonstration only)
5. Effect of Thyroxine Hormone on Amphibian Metamorphosis (Demonstration only)

Spotters :

Types of eggs & sperms.

Development of Brain, eye, heart and ear in Frog.

ENVIRONMENT BIOLOGY

- 1 .Estimation of primary productivity by using aquatic plants - Light and Dark bottle method.
2. Estimation of Secondary productivity - Long term study on biomass production in fish.
3. Analysis of Water samples - Estimation of dissolved Carbon dioxide, Carbonate and Bicarbonate.
4. Analysis of Soil Samples - Determination of Soil moisture, Soil Texture, Humus and Chloride.
5. Biodiversity measurement -Estimation of species richness in a small ecosystem – Margalef / Menhnick Index.
6. Measurement of biodiversity – Alpha and Beta diversity Indices.
7. Pollution bioindicators – Chironomus larva, Mosquitoe larva, Leech, Pila and Tilapia.

BIOINFORMATICS

1. Nucleic acid Databases

NCBI

EMBL

Gen Bank

2. Protein Sequence Data bases

SWISS – PROT

Tr- EMBL

3. Browsing of Internet

4. E-mail

5. Downloading the biological websites

6. Genome fragment Identification – DNA Microarray

7. Sequence Alignment

Pairwise Alignment – FASTA , BLAST

Multiple Sequence Alignment – CLUSTAL W

Unit: VI Research Methods and Thesis writing 15hrs

Identification, Selection and Scope of research problems – Methods of literature collection and review – Planning and execution of investigation – Thesis writing – Preparation and presentation of research paper for Journals, Conferences – Preparation of short communications and review articles.

Reference Books:

1. Jayaraman, J - (1972) Laborarotary manual in biochemistry New age International Pvt., Ltd., Publisher, New Delhi.
2. Oser, B.L., Hawk's physiological chemistry 14th ed., McGrow – Hill book co., New Delhi.
3. Plummer, T.D., (1971). An Introduction to Biochemistry 3rd ed., Hill book co., New Delhi.
4. Sadasivam, S, & Manickam A, biochemical methods – Wiley Eastern ltd, New Delhi.
5. Daniel, W.W, (1978 – Biostastics. A foundation for Analysis in the Health Sciences. (Wiley Series in Probability and Statistics) 9th Ed., New York.
6. Willard, HH (1986) Instrumental methods of Analysis, 6th Ed., CBS Publication, New Delhi.

SEMESTER -III
PAPER - VII
ANIMAL PHYSIOLOGY

SUBJECT CODE : **CONTACT HOURS : 06/ week**
CONTACT HOURS : 90/ semester

Unit: I Cell Membrane, Homeostasis and Digestion **15hrs**

Properties of Cell Membrane: Transport across cell membrane and Ionic basis of Cellular Excitability.

Homeostatic Mechanisms: Biological control systems –Neural, Chemical and Endocrine control system.

Digestion and Absorption

Unit: II Respiration & Circulation **15hrs**

Respiration: Respiratory organs, Respiratory pigments, Transport of Respiratory Gases, Oxygen as a limiting factor in the environment.

Circulation: Body Fluids, Mechanism of Blood coagulation and Hemodynamic

Heart - Structure, Origin and Conduction of Heart beat.

Unit: III Excretion, Osmoregulation and Thermoregulation **20 hrs**

Excretion: Organs of Excretion, Structure of Nephron - Juxtaglomerular apparatus of Nephron. Physiology of Urine Formation & Counter Current mechanism. Renal regulation of Acid - Base balance.

Osmoregulation: Maintaining Water and Electrolyte balance – Living in Isosmotic, Hyposmotic, Hyperosmotic and Terrestrial Environments. Hormonal regulation of water and Electrolytes.

Thermoregulation: Temperature and rate of biological activities, Temperature compensation in Poikilotherms and Homeotherms.

Unit: IV Nervous Integration **15hrs**

Transmission of nerve impulse: Excitation, Conduction Interneuronal transmission - Ephatic and Synaptic transmission, Chemical synapses and Neuro muscular junction. Neurotransmitters.

Unit:V Muscle and Receptors**15hrs**

Muscle: Ultra structure of Muscle, Mechanisms of Muscle contraction – Excitation, Contraction & Coupling (ECC) , Energetics of Muscular contraction.

Receptors: Photoreceptor, Chemoreceptor, Mechanoreceptor and Thermoreceptor.

Unit: VI Endocrine regulation on reproduction**10hrs**

Vertebrate controls: Hypothalamic hormones – Gonadotrophins, Gonadal steroids – Estrogen & Progesterone. Regulation of Breeding cycle – Oestrous & Menstrual cycles. Placental Hormones , Relaxin and the hormones associated with Parturition.

Reference Books

1. William S. Hoar, General and Comparative Physiology Prentice - Hall of India (private) Ltd, New Delhi.
2. C.Ladd. Prosser, Frank A. Brown, Comparative Animal Physiology , II Ed., W.B. Saunders company, London.
3. Kurt Schmidt- Nielsen, (2013), Animal physiology: Adaptation and Environment- III Ed., Press syndicate of the University of Cambridge, London.
4. Elaine ,N. Marieb,(2006), Human Anatomy & physiology, VI Ed., Dorling Kindersley (India) Pvt.Ltd.,
5. Christopher D. Moyes & Patricia M.Schulte., (2007), Principles of Animal Physiology, Dorling Kindersley (India) Pvt.Ltd.,

SEMESTER – III

PAPER - VIII

SERICULTURE

SUBJECT CODE :

CONTACT HOURS : 06 / week

CONTACT HOURS :90/semester

Unit : I Moriculture

15hrs

Scope of Sericulture, Classification of Mulberry, Popular varieties in India, Draught Resistant varieties. Methods of Cultivation, Methods of Propagation, Irrigation, Manuring and Pruning. Harvesting and Storage, Pests and diseases – Fungal, Bacterial and Viral diseases.

Unit : II Silkworm biology

14hrs

Taxonomy, Morphology, Anatomy, Life cycle of *Bombyx mori*, Role of Hormones in Metamorphosis.

Unit : III Grainage Technology

16hrs

General account on grainages, Breeding stations (P4, P3, P2 and P1). Grainages : Procedures in grainages – Rearing of Parental Seed cocoon, Seed Cocoon Preservation, Separation of Sexes, Moth Emergence, Pairing and Ovipositions, Methods of Industrial Egg Production, Mother Moth Examination. Voltinism, Diapausing and Non – diapausing egg, Artificial hatching of Diapause eggs - Hot Acid Treatment and Cold Acid Treatment, Acid treatment after Chilling, Incubation.

Unit : IV Silkworm Rearing

16hrs

Rearing House and Rearing Appliances. Rearing operations -brushing, Care during rearing, Feeding. Optimum environmental conditions, and Selection of ripe worms, Spinning, Mounting, Harvest, Identification and separation of defective and diseased cocoons, Storage and Transport of cocoons.

Rearing methods : Chawki worms Rearing and Rearing of late age worms.

Diseases of Silkworm : Viral, Bacterial, Fungal and Protozoan diseases – Pathogens, Mode of infection, Prevention and Control measures. Pests of Silkworm, Non-Mulberry Silkworms.

Unit : V Silk Reeling

15hrs

Steps to be followed before Reeling - Stifling, Drying and Storing, Cooking and Boiling, Deflossing and Ridding, Reeling appliances. Method of reeling - Charka, Cottage basin and Filatures

Genetics – Breeding, Heterosis and Sex determination.

Economics of Sericulture, Physical characteristics of Cocoon and Cocoon marketing.

Unit : VI**14hrs**

Sericulture farm management: Training for farmers – Subsidy and loan for farm development.

Silkworm as a model animal for biotechnological studies – Transgenic studies and gene expression studies.

Reference Books

1. G.Ganga., (2003), Comprehensive Sericulture, Oxford and IBH Pub., Co., Pvt., Ltd., New Delhi
2. S.Krishnaswamy *et al.*, (1972), Sericulture manual -1 (Mulberry cultivation), Manual -2 (Silkworm rearing) and Manual -3 (Silk reeling), Food and Agriculture Organization of the United Nations, Rome.
3. Hiroo, Sibuya Ku., (1975) Text book of Tropical Sericulture, Japan Overseas Corporation , Volunteers 4-2, 24, Tokyo, Japan.
4. Venkata Narasaiah (2003), Sericulture in India, Ashish Publishing House, New Delhi.
5. Silk Production, (2004), Dr.N.G.Ojha, Dr.P.N.Panday APH Publishing Corporation, New Delhi.

SEMESTER -III

PAPER IX

EVOLUTION

SUBJECT CODE :

CONTACT HOURS: 06 / week

CONTACT HOURS: 90 / semester

Unit : I

12Hrs

Historical development and concept of evolution - Theory of special creation. Theory of spontaneous generation or Abiogenesis, Biogenesis. Biochemical Origin of Life, Urey and Miller's Experiment.

Unit : II Evidences and Fossils

15Hrs

Evidences from Morphology, Comparative anatomy and Palaeontology. Fossils – Definition, formation of Fossils, Fossilization – Petrification, preservation – foot prints or trails, moulds and casts, impressions, preservations in resins and ambers, dating of fossils – radioactive clock methods. Radioactive Carbon method, Potassium – Argon method. Significance of study of fossils.

Unit : III Theories of Evolution

13Hrs

Lamarckism, criticism of Lamarckism, Neo – Lamarckism, Darwinism, criticisms of Darwinism, Neo- Darwinism, certain generalizations about Evolution – Atavism, Williston's Rule, Cope's Rule and allometry.

Unit : IV Mechanism of Evolution

15Hrs

Variations - kinds of variation, sources of variation. Hybridization in Evolution – Introgressive hybridization. Polyploidy in Evolution. Isolating mechanisms – Prematic mechanisms and posmating mechanisms. Role of isolation in Evolution. Natural selection – Nature of natural selection – differential reproduction, Types of Natural selection. Mutation as raw materials for Natural Selection.

Unit : V Speciation

15Hrs

Species – Morphological, Genetic and biological species concept, sibling species, monotypic and polytypic speciation. Subspecies categories – Clines and Demes, Orgin of species – factors causing Genetic Divergence in the population of species Patterns of speciation – Allopatric, Sympatric, Quantum and Parapatric speciation.

Unit : VI Evolution of Man**20Hrs**

Human Evolution- place of origin, time of origin, causes of Evolution of Man, characteristics of Man. Evolutionary trends, Evolution of Man as seen in fossil record - Propliopithecus, Dryopithecus, Oreopithecus, Ramapithecus and Australopithecus (first Man – Ape), Homoerectus – Java and Peking Man. Homosapiens – Heidelberg Man, Neanderthal Man, Solo man, Rhodesian Man, Cro- Magnon Man (Homo sapiens sapiens) Culture and Control of Evolution – learning society and culture, relative rates of culture of Biological Evolution and Social Darwinism.

Reference books:

1. Paul Amos Moody, 1978, Introduction to Evoution, Kalyani Publishers, New Delhi.
 2. Theodosius Dobzhansky, Francisco J. Ayala, G. Ledyard Stebbins, James W. Valentine, 1973, Evolution, Surject Publications, New Delhi. E.Peter Volpe, 1989, Understanding Evolution, Universal Book Stall, New Delhi.
 3. Mohan, P. Arrora, 2000, Organic Evolution Himalayan Publishing House, New Delhi.
 4. G.L Stebbins, 1979, Process of Organic Evolution, Prentice Hall India, New Delhi.
- Monroe.W.Strickberger,2000 Evolution, Jones & Barlett publishers, Boston.

SEMESTER - III

PRACTICAL - III

ANIMAL PHYSIOLOGY, SERICULTURE AND EVOLUTION

SUB CODE :

CONTACT HOURS : 06 / week

CONTACT HOURS : 90 /

semester

ANIMAL PHYSIOLOGY

1. Effect of Temperature on Oxygen consumption of fish & calculation of Q10
2. Effect of Temperature on Opercular movements of fish & calculation of Q10
3. Effect of salinity on Oxygen consumption of fish
4. Effect of salinity on Opercular movement of fish
5. Estimation of Salt loss in a fish
6. Estimation of Salt gain in a fish
7. Mounting of Haemin crystals.
8. Blood pressure recording
9. Estimation of Blood sugar.

SERICULTURE

1. Morphology of Egg, larva. Pupa and adult moth
2. Life cycle of Silk worm
3. Mouth parts of Silkworm
4. Silk gland of Silkworm
5. Digestive system of Silk worm
6. Rearing House
7. Rearing appliances
8. Eggcard
9. Mountages
10. Identification of Diseased worms

11. Identification of Non Mulberry Silkworm
12. Reeling appliances: three pan system, Jettebout, Croissure,
13. Field visit Report

EVOLUTION

1. Variation – Finger prints
- 2.. Use of Models to study selection in large and small population and principles of genetic drift
3. Homologous & Analogous organs
4. Vestigial organs
5. Fossils
6. Embryos of various Vertebrates
7. Examples of evolutionary importance - Peripatus, Limulus.
8. Animals with adaptive colouration - Leaf insect, Stick insect, Chameleon

SEMESTER – III
ELECTIVE - III
BIOTECHNOLOGY

SUBJECT CODE :

CONTACT HOURS : 06 / week

CONTACT HOURS : 90 / semester

Unit : I rDNA Technology

15hrs

Introduction, Tools of Genetic Engineering-Restriction enzymes, Methods of Gene Cloning, Shotgun Cloning. Cloning vectors - Plasmids, Phages, Cosmids, Animal Viral Vectors - SV 40, BPV, Bacculo Virus, Vaccinia Virus, Adeno virus and Retro virus.

Unit : II Biotechniques

15hrs

Polymerase Chain Reaction (PCR) - Methods and applications. Blotting techniques- Southern, Northern and Western Blotting. Construction and Screening of gene libraries-DNA and cDNA library. DNA sequencing methods-Gilbert and Sanger's method. Molecular markers and their applications.

Unit : III Gene transfer techniques and Transgenesis

15hrs

Transgenic techniques- Transfection, Liposome mediated Gene transfer, Biolistics, Retroviral method and Microinjection method. Transgenic animalfish, Mice, Sheep and Cow. Transgenic animals and its applications.

Unit : IV Animal Tissue Culture

15hrs

Culture techniques, Primary culture, secondary Culture. Cell lines – evolution & maintenance of cell lines. Large scale culture of cell lines. Stem cell biology-Embryonic stem cell and Adult stem cell. Organ culture- Methods of organ culture, Artificial Skin and Cartilage.Cryopreservation techniques.

Unit :V Biotechnology and Human Welfare

15hrs

rDNA in Medicine – Insulin, Interferon, Blood products - Thrombolytics (tPA), Blood clotting factor (Factor VII). Gene therapy - Somatic cell Line therapy and germ line gene therapy, different tissues involved in gene therapy. Gene Expression analysis and microarray.

Unit : VI Applied Biotechnology**15hrs**

Use of DNA finger printing in forensic Science. Intellectual property rights and patent. Role of Microbes in Biotechnology, Bioweapons, and Issues related to rDNA technology. Nanotechnology-Nanomaterial Synthesis, Characterization & Applications.

Reference Books

1. R.C. Dubey, (1993), A Text book of Biotechnology. III Ed., S.Chand & company Ltd.
2. H.K.Das, (2004), Text book of biotechnology III Ed., Wiley India (P) Ltd.
3. V.Kumaresan, (1994), Biotechnology VI Ed., - Himalaya Publishing house.
4. S.C.Rastogi ., (2007), Biotechnology - Principles and Applications- I Ed., Narosa Publishing house.
5. Mohan P. Arora., (2003), Biotechnology, I Ed., Himalaya Publishing house.

SEMESTER-IV
PAPER – X
GENETICS

SUBJECT CODE :

CONTACT HOURS : 06 / week
CONTACT HOURS : 90 / semester

Unit:I

20hrs

Basics of Genetics : Gene interactions - Allelic - Complete dominance, Incomplete dominance, Co- dominance, Lethal genes, Pleiotropism. Non-allelic - Complementary factors, Supplementary factors, Epistasis- Dominant, Recessive and Duplicate recessive Epitasis, Duplicating factors. Polygenic Inheritance - Skin colour in Man. Multiple Alleles - A, B, O, MN and Rh blood group inheritance.

Unit :II

15hrs

Role of genes in Metabolism - Metabolic disorders (Disorders of Phenyl alanine metabolism only). Prenatal diagnosis – AFP, Aminocentesis, CVS and Ultrasound scanning. Sex Linked Inheritance in Man – Colour blindness and Haemophilia, Sex limited and Sex influenced genes in Man.

Unit:III

15hrs

Molecular mechanism of Mutation , Mutagens ; Radiation and Chemical , Mutation Detection ; ClB technique , Chromosomal Mutation ; Changes in structure, Ploidy – Euploidy, Aneuploidy and Syndromes. Extra Nuclear Inheritance.-Kappa particles in Paramecium , Shell coiling in snail Limnaea.

Unit : IV

15hrsEugenics

- Positive and Negative. Euthenics - Cure for Inherited diseases, Missing enzyme intake, Gene therapy. Studies on Twins - Mono and dizygotic twins.

Unit :V

15hrs

The Hardy - Weinberg Law. Algebraic proof for Hardy - Weinberg Equilibrium. Factors affecting Hardy - Weinberg Equilibrium.

- a. Meiotic drive b. Genetic drift
c. Migration d. Selection
e. Mutation f. Non – random mating

Applications of Hardy - Weinberg Law

Unit : VI**10hrs**

Pedigree Chart. Mendelian Traits in Man. Human Karyotype Analysis.

Sex determination - Sex Determination in Man, Drosophila, Fowl, Butterfly, Grasshopper and Honey bee. Transposable genetic elements or Mobile gene.

Reference Books

1. Eldon John Gardner *et al.*, (1991) Principles of Genetics, VIII Edition John Wiley and son's .Inc, Newyork.
2. W. Strickberger, (1976), Genetics, III Edition, Macmillan Publishing Co., Newyork.
3. William D. Stansfield, (1969), Theory and problems of Genetics, McCraw- Hill Book Company, Newyork.
4. Mckusick, V.A., (1968) Human Genetics, Prentice- Hall of India Private Limited, New Delhi.
5. Lewin.B., (1999) 'Genes' , VI Ed., Oxford University Press, Oxfold.

SEMESTER –IV
PAPER - XI
IMMUNOLOGY

SUBJECT CODE:

CONTACT HOURS : 06/week

CONTACT HOURS : 90//semester

Unit: I Basics of Immunology

10hrs

Introduction, History of Immunology, Types of Immunity: Innate & Acquired Immunity, Humoral and Cell mediated Immunity.

Unit: II Cells and Tissues of the Immune system

20hrs

. Histology of Lymphoid organs - Primary and Secondary lymphoid organs. T and B lymphocytes. T- lymphocytes – T cell types, T cell Receptors, T cell surface markers -T cell regulation- T- cell maturation. B- lymphocytes - B cell types - B cell receptors- B- cell activation –proliferation –maturation. Difference between T and B lymphocytes. Null cells, Macrophages, Polymorphonuclear leucocytes (PMN).

Unit: III Immune responses of Antigen and Antibody

15hrs

Antigen : Characteristics of Antigen, types of Antigen and factors influencing antigen. Antibody: Structure of Immunoglobulin, types and characteristics of Immunoglobulins. Synthesis of Immunoglobulin and Genetic basis of Class Switch, Disorders of Immunoglobulin synthesis. Immunodiagnostics.

Unit: IV Antigen and Antibody Reactions

15hrs

Antigen and Antibody reactions: Precipitation – Precipitation reactions in gel (Immunodiffusion) – Applications of Precipitation . Agglutination,- Agglutination reactions – Coombs test, Positive Agglutination, Agglutination inhibition. Immunofluorescence and Flow cytometry. Complement System -Complement Fixation - Role of Complements in Immune Response. Hypersensitivity Reactions.

Unit: V Vaccines and Health

15hrs

Major Histocompatibility Complexes (MHC) in man and mouse. Haematopoiesis and differentiation: Gene regulation of Haematopoiesis.

Vaccines: Active and Passive immunization, Principles and types of vaccines: Viral and bacterial vaccines used in human, DNA Vaccine, Autoimmune diseases.

Unit: VI Immunity to Infectious diseases

15hrs

Transplantation Immunology, Tumour immunology, AIDS and other Immuno deficiency diseases. ELISA - types. Western Blotting. Hybridoma Technology - Monoclonal Antibodies.

Reference Books:

1. Kuby ., (1992), Immunology, IV Ed., - W.H. Freeman and company.
2. Evan M.Roitt., (1988), Essentials Immunology- VI Ed., ELBS imprint. Shailendra Kumar Sinha., (2009) Serial dilution Technique
3. Immunology and Medical Zoology- I Ed., - Oxford Book Company.
4. David male., (2008), Immunology VII Ed., Elsevier Health sciences.
5. I.Kannan., (2007), Immunology I Ed., - MJP Publisher .

SEMESTER-IV
PRACTICAL – III
GENETICS AND IMMUNOLOGY

SUBJECT CODE :

CONTACT HOURS : 06 / week

CONTACT HOURS : 90 / semester

GENETICS

1. Mendel's law of segregation with beads of two different colours.
2. Mendel's law of Independent Assortment with beads of four different colours.
3. Probability-tossing of coins.
4. Correlation of length and width of leaves.
5. Karyotype and chromosomal disorders in man (Down's Syndrome, Turner's Syndrome Klinefelters Syndrome).
6. Observation of simple Mendelian traits.
7. Spotter- Barr body, Sex linked inheritance in man, Twins, ABO Blood group and Rh factor, Dextral and Sinistral Shell coiling in Snail and Kappa particles in Paramecium, Pedigree chart.

IMMUNOLOGY

1. Histology of Lymphoid organs.
2. Isolation of Lymphocytes and enumeration.
3. Bleeding and preparation of complement and antisera.
4. Haemagglutination and haemolysis titration.
5. Ammonium Sulphate Precipitation- Method of Antibody Production.
6. Ouchterlony technique – Immunodiffusion (Demonstration only).
7. Immuno Electrophoresis of Human serum and Anti-Human Serum (Demonstration only).
8. ABO Blood Grouping and Rh typing.
9. Serum separation.
10. Qualitative detection of Antibodies to HIV-1 & HIV-2 in Human serum/ Plasma
(Visit to immunology Lab.)