PSG College of Arts & Science

An Epitome of Quality Learning

Since 1947

M.Sc. ZOOLOGY

2017 - 2019

MSc ZOOLOGY PROGRAMME
SCHEME OF EXAMINATIONS
(*for students admitted from 2014 – 2015 and onwards*)

(Regulations as applicable to students admitted in PG programmes offered by the College)

Code No.	Subject	Duration (Hrs)	Max. Marks			Credit Points
			CA	CE	Total	
First Semester						
14ZOP01	Animal Phylogeny and Palaeontology	3	25	75	100	4
14ZOP02	Molecular Genetics	3	25	75	100	4
14ZOP03	Fishery Biology	3	25	75	100	4
14ZOP04	Environmental Biology	3	25	75	100	4
--	Zoology Practical - I	--	--	--	--	--
--	Zoology Practical - II	--	--	--	--	--
Second Semester						
14ZOP05	Experimental Embryology	3	25	75	100	4
14ZOP06	Animal Physiology and Biochemistry	3	25	75	100	4
14ZOP07	Immunology	3	25	75	100	4
14ZOP08	***Core Elective- I*** **:** Poultry Farming	3	25	75	100	5
14ZOP09	Zoology Practical - I	3	40	60	100	5
14ZOP10	Zoology Practical - II	3	40	60	100	5
14ZOP11	Field Visit	--	40	60	100	4
14SBP01	**Skill Based Subject** **:** Cyber Security	---	100	---	100	2

Cont …

Code No.	Subject	Duration (Hrs)	Max. Marks			Credit Points
			CA	CE	Total	
Third Semester						
14ZOP12	Microbiology	3	25	75	100	4
14ZOP13	Biotechnology	3	25	75	100	4
14ZOP14	Endocrinology	3	25	75	100	4
14ZOP15	***Core Elective – II*** : Sericulture	3	25	75	100	5
14ZOP16	Zoology Practical – III	3	40	60	100	5
14ZOP17A 14ZOP17B 14ZOP17C	**CLUSTER IDC** Food and Medicinal Resources (IDC – BO) OR Nutrition for Lifestyle Disorders (IDC – CN) OR Foods, Genes and Diseases (IDC – BT)	3	25	75	100	4
Fourth Semester						
14ZOP18	Apicultre	3	25	75	100	4
14ZOP19	Biostatistics and Research Methodology	3	25	75	100	4
14ZOP20	Project and Viva	--	80	120	200	7
			TOTAL CREDITS			**90**

CLUSTER IDC

14BOP16A/14CNP19B/ 14BTP18B Biotechnology	SILK WORM REARING (for MSc Botany, MSc Clinical Nutrition & MSc

14ZOP01 ANIMAL PHYLOGENY AND PALAEONTOLOGY (60 Hours)

FIRST SEMESTER

OBJECTIVES:

To acquire knowledge of the systematic position, origin and evolutionary principles of Invertebrates and Chordates

UNIT I (13 hours)

The Geological Time Scale
Fossils – Formation, Kinds and Uses
Origin and Phylogeny of Protozoa
Origin and Phylogeny of coelenterata
Origin and Phylogeny of Annelida

UNIT II (13 hours)

Origin and Phylogeny of Arthropoda
Origin and Evolution of Mollusca
Origin and Phylogeny of Echinodermata
Affinities of Entoprocta and Phoronida
Affinities of Chaetognatha and Rotifera

UNIT III (12 hours)

Origin of Fishes
Origin of Amphibians - Terrestrialisation
Origin of Reptiles, Dominance and Decline of Mesozoic reptiles

UNIT IV (12 hours)

Rhynchocephalians
Origin of Birds and Flight
Origin of Mammals
Metatheria

UNIT V (10 hours)

Phylogeny and Evolutionary Significance of Bipedalism
Origin and Evolution of Man
Futurology of Human Evolution

REFERENCES

1. Hyman, L.H. Invertebrate Series Vol. 1 to VI Mc Graw Hill.
2. Pat Willmer. Invertebrate Relationship. Cambridge University Press 1990.
3. Barnes. R.D. Invertebrate Zoology ($5^{th,}$ Edition) Saunders Companv.
4. De Beer. G.R. The Evolution of Metazoa (1954).
5. Hanson. E.D. The Origin and Early evolution of Animals. Pitman. London, 1977.
6. Colbert. E.H. Evolution of Vertebrate. John Wiley & sons, Eastern Ltd. New Delhi.
7. Lull. R.S. Organic Evolution. Light Publishers. New Delhi.
8. Purler, J. S and Haswell, W.A. A Textbook of Zoology, Vol. II. Mc.Millan Co. Ltd
9. Romer, A.S. Vertebrate Paleontology. Cambridge University Press.

14ZOP02 MOLECULAR GENETICS (60 hours) FIRST SEMESTER

OBJECTIVES

1. To impart knowledge about the functioning of cell at molecular level
2. To make the students to understand the biological secrets of Life.

UNIT – I (12 Hours)

1). Structure of DNA: Chemical and Physical Nature – Organization of DNA in Eukaryotic cell

2). Prokaryotic DNA replication: Semi Conservative DNA Replication – Meselson and Stahl's Experiment – Models of DNA Replication – Prokaryotic and Eukaryotic DNA Polymerases

UNIT – II (12 Hours)

1). DNA Repair Mechanisms
2). Fine structure of Gene
3). Repetitive DNA
4). Split Gene, Overlapping Genes (self study)
5). Gene synthesis using mRNA (self study)

UNIT – III (12 Hours)

1). Genetic code
2). Transcription in Prokaryotes
3). Transcription in Eukaryotes
4). RNA processing: RNA splicing

UNIT – IV (12 Hours)

1). Structure of tRNA and activation of amino acids
2). Initiation, Elongation and Termination of polypeptide
3). Regulation of Gene expression in Prokaryotes: Operon model – lac operon

UNIT – V (12 Hours)

1). Molecular basis of mutations and nucleotide sequences: Effect of chemical mutagens – Effect of dyes (frame – shift mutations) – Effect of radiations
2). Mutations and amino acid sequences in protein

REFERENCES

1. Gupta, PK.2008, Cell and Molecular Biology, Rastogi Publications, Meerut.
2. Freifelder, D. 2006, Molecular Biology, Jones and Bartlett Publishers
3. Lewin, B. 2007, Genes, Oxford University Press, UK
4. Weaver, R.F.2004, Molecular Biology, WCB Mc Graw Hill

14ZOP03 FISHERY BIOLOGY (60 Hours)

FIRST SEMESTER

OBJECTIVES:

1. To understand the morphology, classification and identification of fishes and the fisheries and fishery resources of India
2. To understand about the biology of fishes, management of fishery resources and their sustainable utilization
3. As fishes constitute perishable commodity, preservation and processing are also quite essential

UNIT I (12 hours)

Biology of Fishes and Classification:

General Morphology and outline classification of fishes- Major groups of fishes and their characteristics- Morphometric and Meristic characters of Elasmobranchs and Teleost fishes.

Basic Anatomy of fish-Digestive, Circulatory, Respiratory, Nervous and Reproductive systems

Food and Feeding habits, Maturity, Fecundity, Spawning and Survival of Indian fishes.

UNIT II(12 hours)

Growth and Population dynamics:

Length – Weight relationship and factors influencing Growth conditions, Age determination

Theory of fishing, Unit stock, Recruitment, Growth, Mortality, Migration, Fish tagging and marking

UNIT III (12 hours)

Inland capture and marine capture fisheries of India:

Fishery zones and type of fisheries in India

Revirine, Estuarine, Cold water, Reservoir and pond fisheries

present status and scope of Inland capture fisheries-their fishery characteristics, distribution and importance

Present status and scope of marine capture fisheries – Crustaceans (Prawn / Shrimp, Lobster and Crabs), Molluscs(Clamp, Cockle, Mussel, Oyster, Cephalopods) and fishes – Their fishery characteristics, Distribution and Importance.

UNIT IV (12 hours)

FISHERY SURVEY METHODS:

Methods of surveying the fishery resources – Acoustic method, Aerial method, Survey of fish eggs and larvae, Analysing population features- Growth mortality selection

UNIT V(12 hours)

CRAFTS AND GEARS:

Principal methods of exploitation of fishes – Indigenous and modern gears and crafts

Principal methods of fish preservation and processing in India

Types of spoilage, Causative factors – Marketing and Economics

REFERENCES

1. Day, f. 1981. Fishes of india, vol. I & vol.ii. William sawson & sons. Ltd., london.
2. Jhingran, c. G.1981. Fish and fisheries of india. Hindusthan publishing co., india.

3. Maheawari, k. 1993. Common fish diseases and their control. Institute of fisheries education, powakads, m.p.
4. Santhanam,r.1980. Fisheries science. Daya pubhlishing house, new delhi.
5. Yadav, b.n. 1997. Fish and fisheries. Daya pubhlishing house, new delhi.
6. Pandey, k. And shukla, j.p. 2005. Fish and fisheries. Rastogi publications, meerut.
7. Fao volumes for fish identification.
8. Bal d.v. And rao, k.v. 1990. Marine fisheries of india. Tata mc graw hill publishing co. Ltd., new york.
9. Biswas, k.p. 1996. A text book of fish, fisheries and technology. Narendra publishing house, delhi.
10. Srivastava, c.b.l. 1999. Fish biology. Narendra publishing delhi.

14ZOP04 ENVIRONMENTAL BIOLOGY (60 Hours) FIRST SEMESTER

OBJECTIVES

To generate up-to-date knowledge on environmental conservation and management through a comprehensive understanding of the components of ecosystem, biological cycles, habitat ecology, resource ecology, pollution and its management.

UNIT-I: ECOSYSTEM AND COMMUNITY (12 hours)

Review of concept of ecosystem - Natural and Man-Made Ecosystem, with examples. energyflow - Trophic structure and levels - Pyramids, Food chain and web - Ecological efficiencies, and productivity and its measurement.

Definition, nature and flux of energy through communities. Influence of competition, Pradation and Disturbances - Community succession - Homeostasis.

UNIT-II: POPULATION AND BIOLOGICAL CYCLES (12 hours)

Structure and distribution - Growth curves - Groups, Natality, Mortality - Density indices, Life study tables - Factors affecting population growth - Carrying capacity. Population regulation and human population control. Complete and Incomplete BioGeochemical cycles - Sedimentary cycle - Recycle pathway of elements - Cycling of Non - Essential and Organic nutrients.

UNIT-III: HABITAT AND RESOURCES ECOLOGY (12 hours)

Biomass, Adaptations with reference to physico - chemical features of environment of coastal ecosystems.

Renewable and Non - Renewable resources - Animal resources. Conventional and Non - Conventional energy sources.

UNIT-IV: ENVIRONMENTAL CONSERVATION AND MANAGEMENT (12 hours)

Principles of conservation - Rain water harvesting - Soil health and fauna inputs in agriculture biosphere reserves - Wildlife conservation and management. Biodiversity - Germplasm conservation and cryopreservation. social forestry - Tribal welfare.

UNIT-V: POLLUTION AND MANAGEMENT (12 hours)

Environmental pollution and its biological effects. Air, Water, Soil and Noise pollution. Biological indicators and their role in environmental monitoring.

REFERENCE BOOKS

1. Odum. E.P. 1996 Fundamentals of Ecology. Nataraj Publishers, Dehra Dun.
2. Trivedi, P.R.and Gurdeepraj, K. 1992. Environmental Biology. Akashdeep Publishing House New Delhi
3. Berwer. A.1988 .The Science of ecology. Saunder's college publishing.
4. Bandopadhyay, J.1985. India's Environment Crisis and response. Nataraj Publishers,Dehra Dun.
5. Smith, R.L.1986. Elements of Ecology. Harpet and Row Publishers, New York.
6. Ismail, S.A.1997. Vermicology, Biology of Earthworms. Orient Longman, Chennai.
7. Alpha Soli, I. Arceivala.1998. Wastewater treatment for pollution control - Second Ed. Tata McGraw Hill Publication Company Ltd., New Delhi.
8. Asthana, D.K. and Asthana, M.2001. Environmental Problems and Solutions. S. Chand and Co., New Delhi.

14ZOP05 EXPERIMENTAL EMBRYOLOGY (60 Hours) SECOND SEMESTER

OBJECTIVES:
To imbibe the current knowledge pertaining to the development of animal embryos of diverse taxonomic groups through experimental analyses based on modern biological tools.

UNIT I (12 hours)
Egg cortex and development,
Polarity, Symmetry, Gradients,
Nucleus and Development,
Role of gene in development.

UNIT II(12 hours)
Definition of organizer and types of organizers,
Experiments of organizers,
Mechanism of induction,
Competence — Definition, Differentiation and types of differentiation

UNIT III (12 hours)
Antigen and ANTIBODY INTERACTION.
Tissues transplantation.
Embryo transplantation.

UNIT IV (12 hours)
Nucleo - Cytoplasmic interactions
Role of Rh factor in foetus development.
Human welfare and embryology
A. Birth control
B. Infertility
C. Test tube babies-Ethics in techniques
D. Congenital abnormalities
E. Government programs in childcare
F. Studies on twins
G. Cryopreservation of embryos and organs

UNIT V (12 hours)
Regeneration in planaria.
Regeneration in Amphibia.
Basic concepts of teratology and their causal analysis.

REFERENCES

1. Balinsky., An Introduction of Embryology, Saunders and co..
2. Berrill, N.J. Development Biology, "Tata Mc Graw Hill..
3. Raven Ch.P. An Outline of Development Physiology.
4. Willier, B.H. and Jane J.M. Foundation of Experimental Embryology. Prentice Hall Ltd.
5. Phillip, Biology of Development Systems, Rinehart.

14ZOP06 ANIMAL PHYSIOLOGY AND BIOCHEMISTRY (60 Hours)
SECOND SEMESTER

OBJECTIVES:

1. To derive knowledge of the functions of animals, organs and their behavior and understanding of their nutrition, respiration, circulation, excretion and physico-chemical coordination.
2. To comprehend the chemical consitutents of food stuffs, the energy changes associated with these transformation and hormonal regulation.

ANIMAL PHYSIOLOGY

UNIT-I(12 hours)

1. Blood-Physiology of blood clotting
2. Circulation- Pacemaker -conducting system - Electrical excitation of heart - ECG
3. Respiration-Respiratory pigments-Gaseous transport
4. Temperature regulation in homeotherms

UNIT-II(12 hours)

5. Excretion-Types of excretory products - Patterns of excretion - Nephron Structure- Physiology of urine formation
6. Osmotic and ionic regulation
7. Biological rhythms (Circadian, Biological Clock)
8. Bioluminescence - Physiology and significance

UNIT-III(12 hours)

9. Nerve impulse propagation — Synaptic transmission- Neurotransmitters.
10. Ultrastructure of muscle - chemical basis of muscle contraction
11. Physiology of Vision
12. Physiology of hearing

BIOCHEMISTRY

UNIT-IV (12 hours)

13. Study of structure, classification and metabolism of carbohydrates, Protein and lipids

UNIT – V(12 hours)

14. Classification of enzymes
15. Mechanism of enzyme action
16. Isoenzymes and Coenzymes

REFERENCES

1.Hoar, W. S. 1983. General and Comparative physiology. Prentice Hall of India. New Delhi.

2.Harper, H.A., Rodwell., V. N. and Mayes, P.A., 1979. Review of physiological Chemistry) 17lh edn. Large Medical Publication, Los Atlos. California.

3.Prosser, C.L. 1973. Comparative Animal Physiology. Vol .I and Vol. II. Saunder. Philadelphia.

4.Parameswarn, R., Ananthasubramanian, K.S. 1989. Outline of Animal Phsiology. S.Viswanathan Pvt.

5. West, S.E., Tedd, R.W.Masom, S.M. and Bruggen. V.T.T. Texl book of Biochemistry.Collier, Mecmillan, 1966.
6.Lehninger,A.L. Biochemistry. Worth Publishers 1981.
7.Leubert Stryer, Biochemistry. W.H. Frest Company, 1981.

14ZOP07 IMMUNOLOGY (60 Hours) SECOND SEMESTER

OBJECTIVES: To Understand the Structural and functional basis of immunoglobulins, the mechanism, mediators, detection and application of antigen-reaction in the immune system.

UNIT-I: (12 hours)
IMMUNE BIOLOGY
The cellular constituents of the lymphoreticular system-phagocytic cells-polymorpho nuclear neutrophils, mononuclear phagocytes, eosinophils and lymphocytes

UNIT-II: (12 hours)
IMMUNOGLOBULINS
Immunoglobulins-structure, isotypes and biological function. Antigenic determinant on immunoglobulin-isotype, allotype and idiotype. Immunoglobulin superfamily, monoclonal and polyconal antibodies. organization and expression of immunoglobulin genes. Synthesis of immunoglobulin and disorders of immunoglobulin synthesis.

UNIT-III: (12 hours)
DETECTION AND APPLICATION OF ANITGEN ANTIBODY REACTION
Precipitation - agglutination - complement fixation - immunoassay using labelled reagents.

UNIT-IV: (12 hours)
MECHANISM OF IMMUNE SYSTEM
Antigen-antibody interaction and immunodiagnostics. MHC- Restriction organization and inheritance of MHC, Antigen processing and presentation.

UNIT-V: (12 hours)
MEDIATORS OF IMMUNE SYSTEM
B-cell Receptors, T-cell receptors, cytokine, adhesion molecules, complements, hypersensitivity reaction, transplantation immunology.

REFERENCE BOOKS
1. Roitt,I.M.1994. Essential Immunology. Blackwell Scientific, Oxford.
2. Richard A.Goldsby, Thomas T.Kindt and Barbara A. Osborne. 2000. Kuby Immunology.Freeman and Co., New York.
3. Stites,D.P.,Terr,A.I. and Parsloio,T.G. 1997.Medical Immunology. Prentice Hall, New Jersey.
4. Janeway,C.A and Travers,P. 1997.Immunobiology.Current Biology Ltd., London.
5. Paul,W.E.M.1989. Fundamentals of Immunobiology. Raven Press, New York.
6. Srivastava,R.,Ram,B.P. and Tyle,P.1991. Molecular Mechanism of Immune Regulation. VCH Publishers, New York.
7. Champion,M.D. and Cooke,A.1987.Advanced Immunology. J.B.Lippincott Ltd., Philadelphia.
8. Kannan,I.2007. Immunology. MJP Publishers, Chennai.

14ZOP08 CORE ELECTIVE – I POULTRY FARMING (60 Hours)
SECOND SEMESTER

OBJECTIVES: To acquire knowledge of basic principles of the subject. To realize the economic importance of the subject and to utilize the knowledge for the day-to-day life.

UNIT – I(12 hours)
Introduction and Poultry industry in South India. A brief account of Broiler and White Leghorn and their advantageous feature, poultry housing, the deep-litter system, cage rearing, egg and poultry manure.

UNIT –II(12 hours)
Practical aspects of chick rearing, management of layers and broilers, light and temperature, summer and winter management and debeaking.

UNIT – III(12 hours)
Poultry nutrition: Protein and amino acids, vitamins, essential inorganic elements. Feed additives (non-nutritive),feed stuffs for poultry, feed formulation.

UNIT –IV(12 hours)
A brief account of diseases of poultry
Viral diseases: Ranikhet, Chickenpox
Bacterial diseases: Fowl Cholera, Salmonelloses
Fungal diseases: Aspergillosis, Aflotoxicosis
Animal Parasites: Coccidiosis, Worm infections, Ticks & Mites
Vaccination programme and Methods

UNIT – V(12 hours)
Factors affecting egg size, storage and preservation methods of eggs, marketing, grading.

REFERENCES

1.Biesters, H.E & Schwarte, 1989. Diseases of Poultry. Oxford and IBH, Publishing.
2. Chauhan, Poultry diseases, diagnosis and treatment.
3.Gnanamani, M.R.2003. Modern aspects of commercial poultry keeping. Giri Publications, Madurai.
4. Jull, M.A. 1972. Poultry Husbandry. Tata Mc Graw Hill.

14ZOP09 ZOOLOGY PRACTICAL – I
FIRST AND SECOND SEMESTER

Animal Phylogeny and Paleontology

Identification and study of Invertebrate Fossils.

Molecular Genetics

Measurement of cell diameter using micrometer
Squash preparation of onion root tip to show the stages of mitosis.
Squash preparation of grasshopper testis to show the stages of meiosis.
Identification of sex chromatin in buccal smear.
Mounting of giant chromosomes in chironomous larva.
Spotters-DNA & RNA.
Identification of finger prints and their pattern of inheritance.

FISHERY BIOLOGY

Spotters-Marine, Inland and Ornamental fishes
Morphometric and Meristic chjaracters of fish
Analysis of gut content of fish.
Study of Length-Weight relationship in fish and calculation of 'K' value.
Study of fish blood – RBC, WBC, Haemoglobin Estimation
Study of scales by temporary mounting
Demonstration of Induced breeding techniques

ENVIRONMENTAL BIOLOGY

Determination of phosphate, silicate, nitrate, nitrite, calcium, in water samples.
Plankton collection and identification- Quantitiative and qualitative estimation of planktons.
Study of soil fauna.
Study of adaptive features in Amphibia, Reptiles, Aves and Mammals
Animal association-Parasitism, Mutualism

14ZOP10 ZOOLOGY PRACTICAL –II FIRST AND SECOND SEMESTER

EXPERIMENTAL EMBRYOLOGY

Vital staining and mounting of chick embryos at various stages
Observation of the following developmental stage of chick-24, 48, 72 & 96 hours.

ANIMAL PHYSIOLOGY

Patterns of osmotic response of Earthworm in hetero-osmotic media.
Influence of temperature on oxygen consumption of fish
Qualitative analysis of excretory products
Estimation of salt loss and salt gain in a fresh water fish.
Spotters-Incubator, centrifuge, pH meter, Spectrophotometer

BIOCHEMISTRY

Study of salivary amylase in relation to temperature and pH.
SGOT and SGPT estimation.
Quantitative estimation of glucose in urine.
Quantitative estimation of tissue protein.
Quantitative estimation of tissue carbohydrate.
Quantitative estimation of tissue lipids.

IMMUNOLOGY

SPOTTERS: T.S Spleen, Thymus, Lymph nodes and Bone
Demonstration of Immunoelectrophoresis
Demonstration of Double Immunodiffusion

POULTRY FARMING

Observation of poultry rearing appliances.

14ZOP12 MICROBIOLOGY (60 Hours) THIRD SEMESTER

OBJECTIVES:
To acquire a basic knowledge of the microbes in general and of the environmental, medical and industrial important microbes in particular in order to have an integrated approach in biology. Also, to know the basics of sterilization and culture methods.

Unit: 1 (12 hours)
Introduction
Basics of microbiology: Microbiology in India; Methods in Microbiology, Morphology of Microbial cell, Bacterial Chromosomes.

Unit: 2 (12 hours)
Microbiology of Milk, Dairy and food
Microbiology of Milk and Diary Industry. Microbial contamination and spoilage of poultry, fish and sea food, Oriental foods.

Unit: 3(12 hours)
Medical Microbiology
Bacterial diseases: Air borne disease (Diphtheria, Meningitis, Pertusis, Streptococcal pneumonia). Food - borne and water -borne disease (Cholera & Typhoid fever): Soil - borne disease (Tetanus, Anthrax); Sexually transmitted and contact diseases (Gonorrhea & Leprosy,); Viral diseases: Air - borne viral diseases (Influenza), Direct contact disease (Viral hepatitis, hepatitis B, Rabies.)

Unit: 4 (12 hours)
Industrial microbiology
Alcohol'production - Ethanol
Production of Acid - lactic acid, Vinegar
Production of antibiotics - Penicillin, Streptomycin
Production of Amino acid - L-lysine, L- glutamic acid organic acid production, antibiotic production,
Production and application of microbial enzymes, Immobilization of enzymes.

Unit 5: (12 hours)
Agricultural and Environmental Microbiology
Roie of Ti Plasmid and Nif gene in agriculture.
Biofertilizers & Biopesticides, Bacierial insecticides - Bacillus thurgenesis. Virus insecticides. Potable water, Sewage treatment. Water Pollution Management - Bioaugmentation, Use of enzymes in waste water treatment.
Biodegradation- Microbial degradation of Xenobiotics

REFERENCES:
1. Pelzar M.J., (1982), Microbiology McGrawHill Book Company, NewYork.
2 Ronald M.Atlas (1988), Microbiology fundamentals and applications.
3. R.C. Dubey. A Text book of Microbiology.

14ZOP13 BIOTECHNOLOGY (60 Hours) THIRD SEMESTER

OBJECTIVES

To familiarize the use of the data and techniques of engineering and technology in biology for the study of living organisms, or derivatives of thereof, to make or modify products or processes for specific use. Also, to find solution of problems concerning human activities including agriculture, medical treatment, industry and environment

UNIT-I: (12 hours)

RECOMBINANT DNA TECHNOLOGY Gene cloning - the basic steps - various types of restriction enzymes - ligase linkers and adaptors - c DNA - transformation - Selection of recombinants. Hybridization techniques chemical synthesis of oligonucleotides.

Gene probe - Molecular finger printing (DNA finger printing) - RFLP - the PCR techniques - Genomic library - Blotting techniques - Southern blotting - Northern blotting - Western blotting

UNIT-II: (12 hours)

CLONING VECTORS

Plasmid biology - cloning vector based on E. coli PBR 322 and bacteriophage. Cloning vector for yeast. Cloning vector for Agro bacterium tumefaciens. Cloning vector for mammalin cells - Simian virus 40 - Gene transfer technologies.

UNIT-III: (12 hours)

ANIMAL BIOTECHNOLOGY

Cell culture - Organ culture - whole embryo culture - Embryo transfer - In vitro fertilization (IVF) technology - Dolly - embryo transfer in human. Transgenic animal. Human gene therapy. Cryobiology.

UNIT-IV: (12 hours)

MICROBIAL BIOTECHNOLOGY

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

UNTI-V: (12 hours)

ENVIONMENTAL BIOTECHNOLOGY AND APPLICATIONS OF BIOTECHNOLOGY

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 & biosafety - IPR.

REFERENCE BOOKS

1. Purohit, S.S. and S.K.Mathur. 1999. Biotechnology Fundamentals and Application. Agro Botanica, New Delhi.
2. Alan Scragg. 1999. Environmental Biotechnoogy, Longman Publication.
3. R.C.Dubey 2001 A text book of biotechnology. Rajendra Ravindra Printer. New Delhi.
4. T.A. Brown 2004 Gene cloning and DNA analysis. Blackwell Science, Osney Mead, Oxford.
5. Dawson, M.T., Powell .R, and Gannon, F. 1996. Gene Technology. Bios Scientific Publishers.

6. Chopra, V.L. and Nanin, A.1992. Genetic Engineering and Biotechnology. Oxford and I BH Publishing Co., New Delhi.
7. Marx, J.L.1989 A Revolution in Biotechnology. Cambridge University, Press, Oxford.
8. Old, R.W.and Primrose, S.B.1985 Principles of Gene Manipulations. An introduction to Genetic Engineering. Oxford Blackwell Publishers, London.
9. Winnacker, E.L. 2003. From Genes to Clones. Panima Publishing Corporation, New Delhi.
10. Gupta, P.K. 2004. Biotechnology and Genomics. Rastogi Publications, Meerut.
11. Das, H.K. 2004. Text Book of Biotechnology. Wiley Dreamtech India Pvt. Ltd., New Delhi.

14ZOP14 ENDOCRINOLOGY (65 Hours) THIRD SEMESTER

OBJECTIVES

To make the students to learn the objectives and scope of comparative endocrinology, anatomy, morphology and histology of endocrine tissues of vertebrates, crustacean and insect endocrine organs and their functions.

UNIT-I: (13 hours)

INTRODUCTION TO ENDOCRINOLOGY

Introduction, objectives and scope of endocrinology - modern concepts and problems in Endocrinology - endocrine glands in crustaceans, insects and vertebrates. Experimental methods of hormone research - general classes of chemical messengers.

UNIT-II: (13 hours)

PITUITARY AND THYROID GLANDS

Pituitary gland - characteristics, structural organization - hormone secretion and its functions - Hypothalamic control.

Thyroid gland - structural organizations, metabolic effects of thryroid - effects on reproduction - parathyroid its structure and functions.

UNIT-III: (13 hours)

PANCREAS AND ADRENAL GLANDS

Structure of pancreas, pancreatic hormones and their functions.

Structural organizations of adrenals, functions of cortical and medullary hormones.

UNIT-IV: (13 hours)

INSECTS AND CRUSTACEAN ENDOCRINOLOGY

Concepts of neurosecretions - endocrine systems in crustaceans - endocrine control of moulting and metamorphosis - neuroendocrine system in insects - endocrine control of moulting - metamorphosis and reproduction.

UNIT-V: (13 hours)

VERTEBRATE REPRODUCTIVE ENDOCRINOLOGY

Structure of mammalian testis and ovary - male and female sex accessory organs - hormones of testis and ovary - estrous and menstrual cycle - hormones of pregnancy - parturition - hormonal control of lactation. Hormonal control of metamorphosis in an anuran amphibian.

REFERENCE BOOKS

1. Haris, G.W. and B.T. Donovan. 1968. The Pituitory Gland. S. Chand and Co.,
2. Bentley, P.J. 1985. Comparative vertebrate endocrinology, Second Edition, Cambridge University Press. Cambridge.
3. Mac Hadley. 1992. Endocrinology, 3rd Edition. Prentice - Hall Inc. A Simon & Schuster Company, Englewood Cliffs, New Jersey. USA.
4. Ingleton, P.M. and J.T. Bangara. 1986. Fundamentals of comparative vertebrate endocrinology, Kluwer Academic Publishers.
5. Turner, C.D. and J.T. Bangara. 1986. General endocrinology. Saunders International Student edition. Toppan Company Limited. Tokyo.
6. Barrington, E.J.W. 1985. An introduction to general and comparative endocrinology. Claredon Press Oxford.

14ZOP15 CORE ELECTIVE - II SERICULTURE (60 Hours)

THIRD SEMESTER

OBJECTIVES: To acquire knowledge about the biology of silkworm and the various rearing techniques. To know above the various techniques of propagating mulberry plants and to know about the various disease of mulberry and silkworms.

UNIT – I(12 hours)

Scope and importance of sericulture – species of silkworm – Description of mulberry plant-Propagation of mulberry plant-A brief account of mulberry varieties and planting methods, Irrigation methods.

UNIT – II(12 hours)

Macro, micro and bionutrients of mulberry- Deficiency diseases with particular reference to N, P, K, Fe and Bo.

Mulberry disease and Pests: Causative agents, symptoms and management of Root-rot, Powdery mildew, Tukra and Leaf miner.

UNIT – III(12 hours)

Morphology of mulberry silkworm: Egg, larva, pupa and adult.

Structure of silk gland and silk proteins.

Life –cycle of silkworm.

UNIT – IV(12 hours)

Silkworm seed production and incubation.

Rearing: Model rearing house, rearing appliances and mountage.

Rearing young age silkworm. Rearing Late-age silkworms.

UNIT – V(12 hours)

Disinfection of rearing house and equipments.

Silkworm diseases: Pebrine, Flacherie and Grasserie.

Silkworm: A brief account of life-cycle and management.

Cocoon types. Shell-ratio, Renditta and price fixation.

Cocoon marketing. A brief account on reeling process

By-products of sericulture.

REFERENCES:

1. Krishnasamy, S. New Technology of silkworm rearing. Central Sericulture Research and Training Institute, Mysore.
2. Krishnamsamy, S. Mulberry Cultivation in South India. Central Sericulture Research and Training Institute, Mysore.
3. Madan Mohan Rao, 1978. A Text Book of Sericulture. B.S. Publishers. Hyderabad.
4. Yoshemaro Tanaka, Sericology, Central Sericulture Research and Training Institute, Mumbai.
5. Ganga. G.2003. Comprehensive Sericulture Vol.II: Silkworm rearing and silk reeling. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

14ZOP16 ZOOLOGY PRACTICAL –III THIRD SEMESTER

MICROBIOLOGY

Micro measurement of yeast.
Culture Techniques
Isolation of microorganisms from soil
Isolation of microorganisms from water
Gram staining of bacteria
Hanging drop preparation of motile bacteria
Microbial analysis of spoiled food
Biochemical characteristic analysis of bacteria-4 tests
SPOTTERS – Laminar Air flow hood, Colony counter, Culture media

BIOTECHNOLOGY

Isolation and Estimation of DNA from samples (tissue & yeast)
Isolation and Estimation of RNA from samples (tissues)
Blotting Techniques (Southern, Western, Northern)
PCR Technique – Demonstration only
Artificial Seed Technology
SPOTTERS –

ENDOCRINOLOGY

SPOTTERS – T.S of Pituitary Gland, T.S. of Thyroid Gland, T.S. of Pancreas Gland, T.S. of Adrenal Gland, T.S Mammalian Testis, T.S. of Mammalian Ovary, T.S. of Thymus.
Dissection of pituitary, thyroid, adrenal, pancreas and gonads in any one suitable vertebrate.
Dissection of reproductive system in any one suitable vertebrate.
Dissection of reproductive system in insects.
Dissection of Neuroendocrine complex in insect.

SERICULTURE

Dissection and display of silk gland from silkworm.
Determination of cocoon characters
Estimation of shell ratio percentage
Determination of denier
Estimation of renditta.
Vegetative propagation of mulberry: Stem grafting, bud grafting
SPOTTERS:
Rearing appliances, Various species of mulberry, Life cycle of Bombyx mori, Diseases of silkworm larva-Pebrine, Grasserie, Flacherie, Tukra,
Pest of silkworm larva:Uzy fly

14ZOP17A **FOOD AND MEDICINAL RESOURCES**
CLUSTER IDC

45 hours

Aim: To gain the knowledge of morphology, distribution, active principles, and therapeutic uses
of indigenous medicinal plants.

Unit-I

Conservation of Food Crops and Medicinal Plants, Assessment of Best Germplasms. Germplasm Multiplication. Botanical Status, Distribution, Mode of Consumption, Proximate Composition, Nutritional and Antinutritional factors of less known Pulses - *Bauhinia vahli* and *Mucuna pruriens.* **9 hours**

Unit-II

Botanical Status, Distribution, Mode of Consumption, Proximate Composition, Nutritional and Antinutritional Components of less known -

Millets – *Elucine indica.*

Vegetables - *Canavalia gladiata.* **9 hours**

Unit – III

Traditional Systems of Medicines, Classification of Medicinal Plants, Collection and Preparation of Natural Drugs for Marketing. Adulterants and Substitutions in Medicinal Plants. **9 hours**

Unit – IV

A General Account of Bioactive Substances - Basic Structural and Functional Aspects of Digestive and Cardiovascular Systems of Man. Botanical Identity, Distribution, Active Principle and Therapeutic uses of

Carminative and Gastro Intestinal Tract Regulators – *Coriandrum sativum* and *Piper nigrum.*

Cardiotonics and Antihypertensives – *Digitalis purpurea* and *Terminalia arjuna* **9 hours**

Unit – V

Basic Structural and Functional Features of Respiratory System and Urino Genital System of Human Beings. Botanical Identity, Distribution and Therapeutic uses of

Antitussives and Expectorants – *Justicia adhatoda* and *Ocimum sanctum,*

Diuretics – *Tribulus terrestris* and *Boerhaavia diffusa.*

Antidiabetics – *Gymnema sylvestre* and *Cassia auriculata.* **9 hours**

REFERENCE / TEXT BOOKS

1. Trease and Evans (1978) Pharmacognosy, Cassell & Collier Macmillan publications, New Delhi.
2. Kumar, N.C An introduction to Medicinal Botany and Pharmacognosy. Emkay publications, New Delhi.
3. Gokhalae, S.B, Kokate, C.K and Purohit, A (2000). Pharmacognosy, Nirali prakhasam, Pune.
4. Atal C.K and B.M Kapur (1982). Cultivation and Utilization of Medicinal plants, RRL (SIR), Jammu Tawi.
5. Jain. J.L (1992) Fundamentals of Biochemistry. S. Chand & Co, New Delhi.

6. Stryer – Biochemistry- W.H. Freeman Company.

14ZOP17B **Nutrition for Life Style Disorders**

Cluster IDC (4 hrs / week)

Objectives

To enable the students to

1. Study the importance of lifestyle disorders
2. Know the causative factors of lifestyle disorders and
3. Learn the importance of nutrition for prevention and management of lifestyle disorders

UNIT 1

NUTRITION AND LIFESTYLE DISORDERS (12 hours)

Definition of Nutrition, balanced diet, Nutritional status, assessment of body composition, biology of adiposity, nature of foods, nutrients, RDA, energy balance, foods that lead to life style disorders.

UNIT 11

NUTRITION AND WEIGHT MANAGEMENT (12 hours)

Malnutrition- Under weight and Obesity- Nutrients for Underweight conditions, Nutrition for management of obesity, Anorexia Nervosa and Bulimia nervosa, Hazards of Obesity, Obesity in Children, Strategies to overcome Obesity.

UNIT 111

NUTRITION AND CARDIOVASCULAR DISEASES (12 hours)

Cardiovascular diseases- Atherosclerosis, Coronary Heart Diseases and Congestive Heart Failure, Hypertension, Hyperlipidemia and Dyslipidemia- Role of antioxidants, nutraceuticals and functional foods in cardiovascular diseases. Dietary management of cardiovascular diseases.

UNIT 1V

NUTRITION AND DIABETES MELLITUS (12 hours)

Definition of Diabetes Mellitus- Types- Etiological factors, Diagnosis and Complication of Diabetes Mellitus. Role of Nutraceuticals and functional foods in of Diabetes Mellitus. Dietary management of Diabetes Mellitus.

UNIT V

NUTRITION IN CANCER (12 hours)

Definition of Cancer- Types- Causative factors, Nutrients and Cancer- Detection and Treatment of Cancer- Role of antioxidants, Nutraceuticals and Functional foods in Cancer. Dietary treatment in cancer

References

1. L. Kathleen Mahan, Sylvid Escott- Stump: Karause's Food, Nutrition and Diet therapy, 2000, 10th edition, W.B.Saunders Company.
2. Laura E. Matarese, Michele M. Gottschlich, Contemporary nutrition support practice: a clinical guide, 2003,I edition, Saunders Elsviers Science, Missouri

3. Scott A. Shikora, George L. Blackburn, Nutrition Support: Theory and Therapeutics, 1996, I edition, International Thomas Publishing (ITP) online publishing –thomson.com
4. NIN, RDA for Indians, 2001
5. NIN, Nutritive value of Indian foods, 2001
6. Shills E. M., Olseon J.A and Skike M., Modern nutrition in health and disease, vol. I & II, 1994 and Febiger.
7. Antia F.P, Clinical nutrition and dietetics, 1997, Oxford University press.
8. Michele M. Gottschlich, The Science And Practice Of Nutrition Support: A Case-Based Core Curriculum, 2007, I edition, American Society of Parenteral and enteral Nutrition (aspen)
9. Annalynn Skipper, Dietitian's Handbook of Enteral and Parenteral Nutrition, 1996, I edition, An ASPEN Publication

14ZOP17C FOODS, GENES AND DISEASES 4 hrs/week **III Semester**

Objectives:

- to study the relationship between food and health
- to understand the role of common dietary compounds on gene expression
- to understand dietary intervention based on knowledge of nutritional requirement, nutritional status, and genotype

Unit I
(9hours)

Foods and genes: Genetics and epigenetic of bioactive foods, conventional and Indian traditional foods and food components, vitamins and minerals- antioxidant potentials; their role in preventing diseases, incidence of diet related diseases, influence of genes on dietary preference and tolerance, mucosal tolerance, Role of Selenium in oxidant and inflammatory process

Unit II
(9hours)

Health Biomarkers: Identification and validation of compounds in tissues, blood and fluids; genetic screening for predisposition and occurrence in inflammatory diseases; genetic markers associated with increased risk for chronic disease, metabolic dysfunction.
Case Study: IGF rs680 polymorphisms in height variation in preadolescent children

Unit III
(9hours)

Gene approaches for diseases: Nutrigenetics of myocardial infarction, Nutrient regulation of insulin gene, genetics in Crohn's disease, genetics and nutritional control of lipid metabolism, nutrigenetic approach to study obesity

Unit IV
(9hours)

Diagnostics for diseases: Nutrigenomics for cancer detection, nutrigenomics in ageing, DNA polymorphisms, Microarrays to study gene expression , gene-nutrient interaction, Dietary signatures

Unit V (9hours)

Personalized medicine: Dietary indications for population health and wellness, vitamin and supplement products, genetic counseling, clinical trials to test food effects to demonstrate efficacy of food-health claims

Reference:

1. Nutritional Genomics: Discovering the path to personalized nutrition , Edited by Jim Kaput, 2013, Wiley
2. Nutrigenomics and Nutrigenetics in functional foods and personalized nutrition, Edited by Lynnette R Ferguson,2013, CRC Press
3. Genomics and proteomics in nutrition Edited by Carolyn D Berdeiner and Namia Moustaid Moussa, 2004, CRC Press

4. Dietary modulation of Cell Signaling pathways by Zigang Dong and Young Joon Surh, 2008, CRC Press

14ZOP18 APICULTURE (60 Hours) FOURTH SEMESTER

OBJECTIVES: To acquire knowledge about the colonial and social life of Honeybee. To develop skill for self-employment in Bee-Keeping and Honey extraction.

UNIT – I(12 hours)

Significance of Apiculture: Products, Crop yield, Hobby, Cottage Industry
Types of honeybees: Rock bee, Little bee, Dammer bee, Indian bee and Italian bee.
Structure, development, lifecycle and functions of Queen bee, Worker bee, Drone.

UNIT – II(12 hours)

Social life in honey bee
Rearing appliances:
Beehives: Newton Hive, Longstroth Hive, BIS Hive and Transport Hive
Bee escape board, Queen excluder sheet, Comb foundation sheet, Embedder, Hive tool, Dummy division board, Bee brush, smoker, Queen gate, Drone trap, Bee veil and gloves, decaping knife, Honey extractor, Pollen trap, Swarm trap.

UN IT – III(12 hours)

Pollen and nectar yield plants. Starting Honey bee rearing: Knowledge of bee, selection of types, site selection. Methods of getting colony. Inspection of bee hives. Maintenance during dearth period.

UNIT – IV(12 hours)

Maintaining bee colony: Maintenance during nectar season, Winter season, Rainy and Summer season.
Natural enemies of honey bee: Wax-moth, Yellow-banded wasp.
Diseases of honey bees and their control methods.

UNIT – V(12 hours)

Bees and crop pollination.
Products of Apiculture: Honey- Extraction of Honey and equipments used, Chemical composition of honey, Nutritive and medicinal values of honey. Bee – wax and its uses. Royal jelly, Pollen, Porpolis, Bee venom.

REFERENCES;

1. Gosh, G.K., 1994 Bee keeping in India, Ashish Publishing House, New Delhi.
2. Phillips, E.P., 2001. Beekeeping, Agrobios (India), Jodhpur.
3. Mishra, R.C., 2002. Perspectives in Indian Apicultire, Agrobios (India), Jodhpur.
4. Winston, M.L.1991.The Biology of the Honey Bee. Harvard University Press, Cambridge.

14ZOP19 BIOSTATIST1CS AND RESEARCH METHODOLOGY (60Hours)

FOURTH SEMESTER

OBJECTIVES:

To understand the basic concepts of Biostatistics in order to analyze and solve biological problems in more systematic way.

To imbibe the principles of physics involved in the modern physical instruments for the exploration of knowledge in biology.

BIOSTATIST1CS

UNIT I **(12 hours)**

Collection of data—primary and secondary.

Diagrammatic and graphic representation of data.

Frequency distribution.

Measures of central tendencies. Measure of dispersion - coefficient of variation - standard error of sample and populations.

UNIT II(12 hours)

Probability (Binomial only

Correlation and regression

Test of Significance - Student's t- test, DMRT, Analysis of Variance (ANOVA)

Chi - square test.

RESEARCH METHODOLOGY

UNIT III **(12 hours)**

Microtechniques - Fixation, Mounting and Staining.

Microscopy – Interference, Electron Microscopy – Transmission and Scanning

Centrifugation and Ultracentrifugation

UNIT IV **(12 hours)**

Principles and application of Chromatography (Paper, Thin Layer, Column and GLC)

Spectroscopic techniques (UV, Visible spectroscopy, X-ray crystallography, NMR, IR, Fluoresence Atomic absorption)

UNIT V **(12 hours)**

Preparation of index cards-Reference collection - preparation of thesis - preparation of Scientific paper for publication in a Journal. Internet and e-journals. Computer aided techniques for data analysis, data presentation and slide preparation

REFERENCES:

1. Gupta, S.P. 1976. Statistical methods. Sultan Chand and Sons. New Delhi.
2. Gupta, C.B. 1976. An Introduction to statistics methods. Vikas Publishing. New Delhi.
3. Bailey, N.J. 1965. Statistic for Biological Sciences. Addition Wesley.
4. Palanichamy, S. and Manohar, Statistics for Biologist, Palani Paramount Publications, Palani., Tamilnadu.
5. Standard methods, 1975. Publications by American Public Health Associatiion.Washington, D.C.

6. Vogal, Inorganic Analysis, Instrumental methods of analysis Elbs.
7. Varly, Practical Clinical Biochemistry. Ed. Alan H. Gowen Lock., Neinemann Medical Books.,
8. Smith, I Seakins, J.W.J. Eds. 1976, Chromatographic and Electrophoretic Techniques. Vol.1., William Heinemann Medical Books.
9. Jayaraman, J. 1987. Techniques in Biochemistry IBH, Oxford.
10. Palanichamy, S. and M. Sunmugavelu. Principles of Biophysics, 2002
11. Subranianian. Biophysics — Principles and techniques,
12. Dr. R.N. Roy. A text book of biophysics.
13. Anderson, Durston and Polle.1970. Thesis and Assignment writing. Wiley Eastern Ltd., New Delhi.
14. Comir and Peter Wood Ford.1979. Writing scientific papers in English.
15. Pitman Medical Publishing Co., London.
16. Gurumani, N. 2006. Research Methodology for Biological Sciences.
17. MJP Publishers, Chennai.

14ZOP20 PROJECT AND VIVA FOURTH SEMESTER

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

14BOP16A/14CNP19B/14BTP18B

CLUSTER IDC – SILKWORM REARING (45 Hours)

(for MSc Botany, MSc Clinical Nutrition & MSc Biotechnology

THIRD SEMESTER

OBJECTIVES: To acquire knowledge about the biology of silkworm and the various rearing techniques. To know above the various techniques of propagating mulberry plants and to know about the various disease of mulberry and silkworms.

UNIT – I (9 hours)

Scope and importance of sericulture – species of silkworm – Description of mulberry plant-Propagation of mulberry plant-A brief account of mulberry varieties and planting methods, Irrigation methods.

UNIT – II (9 hours)

Macro, micro and bionutrients of mulberry- Deficiency diseases with particular reference to N, P, K, Fe and Bo.

Mulberry disease and Pests: Causative agents, symptoms and management of Root-rot, Powdery mildew, Tukra and Leaf miner.

UNIT – III (9 hours)

Morphology of mulberry silkworm: Egg, larva, pupa and adult.

Structure of silk gland and silk proteins.

Life –cycle of silkworm.

UNIT – IV (9 hours)

Silkworm seed production and incubation.

Rearing: Model rearing house, rearing appliances and mountage.

Rearing young age silkworm. Rearing Late-age silkworms.

UNIT – V (9 hours)

Disinfection of rearing house and equipments.

Silkworm diseases: Pebrine, Flacherie and Grasserie.

Silkworm: A brief account of life-cycle and management.

Cocoon types. Shell-ratio, Renditta and price fixation.

Cocoon marketing. A brief account on reeling process

By-products of sericulture.

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4. Yoshemaro Tanaka, Sericology, Central Sericulture Research and Training Institute, Mumbai.