

**DEPARTMENT OF ADVANCE
ZOOLOGY AND BIOTECHNOLOGY**

**B.Sc. Advance Zoology and
Biotechnology**

UG PROGRAMME

SYLLABUS

Effective from the Academic Year 2012-2013



**Loyola College (Autonomous)
Chennai- 600 034**



**U.G. & RESEARCH DEPARTMENT OF ADVANCED ZOOLOGY AND
BIOTECHNOLOGY, LOYOLA COLLEGE**

B.Sc., ADVANCED ZOOLOGY AND BIOTECHNOLOGY
Restructured curriculum effective from 2012 -'13

Code	Subject name	Category	Cr	Hr	C/Sem h/Week
I Semester					
AZ 1506	Invertebrata	MC	4	4	
AZ 1507	Invertebrata lab course	MC (P)	2	2	9C (9h)
AZ 1508	Economic Entomology	MC	3	3	
II Semester					
AZ 2504	Chordata	MC	4	4	
AZ 2505	Chordata lab course	MC (P)	2	2	9C (9h)
AZ 2506	Basic Biotechnology	MC	3	3	
AZ 2104	Animal diversity	AR	3	4	
AZ 2105	Animal diversity Lab course	AR (P)	1	2	4C (6h)
III Semester					
AZ 3200	Agricultural Entomology (To Plant. Biol.)	AO ₁	3	4	4C (6h)
AZ 3201	Agricultural Entomology Lab course (,)	AO ₁ (P)	1	2	
AZ 3301	Clinical Techniques	EG ₁	1	3	1C (3 h)
AZ 3508	Animal Physiology and Biochemistry	MC	4	4	9C (9h)
AZ 3509	Animal Physiology & Biochemistry Lab course	MC(P)	2	2	
AZ 3510	Developmental Biology	MC	3	3	
IV Semester					
AZ 4200	Bioinformatics (To Phy., Chem., Plant. biol.)	AO ₂	3	4	4C (6h)
AZ 4201	Bioinformatics Lab course (,)	AO ₂	1	2	
AZ 4301	Human Health and Hygiene	EG ₂	1	3	
AZ 4505	Organic Evolution	MC	3	3	9C (9h)
AZ 4506	Environmental Biology	MC	4	4	
AZ 4507	Environmental Biology Lab Course	MC(P)	2	2	
V Semester					
AZ 5402	Instrumentation and Chemical techniques	ES	4	6	4C (6h)
AZ 5403	Medical Laboratory Techniques	ES	4	6	
AZ 5516	Cell and Molecular Biology	MC	4	4	
AZ 5517	Immunology	MC	4	4	
AZ 5518	Principles of Genetics	MC	4	4	
AZ 5519	Animal Biotechnology	MC	4	4	24C (24h)
AZ 5520	Genetic Engineering	MC	4	4	
AZ 5521	Molecular Biology, Genetics & Biotech Lab course	MC (P)	4	4	
VI Semester					
AZ6603	Environmental Biotechnology	MS	8	6	20C (15h)
AZ6604	Bioinformatics	MS	8	6	
AZ6605	Facets of Bioethics	MS	4	3	
AZ6651	Poultry and Dairy Science	SK	15	15	15C (15h)
From Department of Plant Biology (Allied optional)					
PB 3210	General Microbiology	AO ₁	3	4	4C (6h)
PB 3211	Allied (O) Practical: I	AO ₁	1	2	
PB 4210	Microbial Biotechnology	AO ₂	3	4	4C (6h)
PB 4211	Allied (O) Practical: II	AO ₂	3	4	



AZ 1506 – INVERTEBRATA

SEMESTER : I CREDITS : 04

CATEGORY : MC NO. OF HOURS / WEEK : 04

Objectives: To impart knowledge on invertebrate animals and their phylogenetic significance.

UNIT I: PROTOZOA TO ANNELIDA

Organization: *Paramecium* - *Ascon* sponge – *Obelia* – *Ascaris* - earthworm – *Hirudinaria*.

UNIT II: ARTHROPODA TO ECHINODERMATA

Organization: *Penaeus* – *Periplaneta* - Scorpion – *Pila* – *Sepia* -Starfish.

UNIT III: TAXONOMIC STATUS

Diagnostic characters and classification of each phylum upto class level with examples.

UNIT IV: COMPARATIVE STUDY

Parasitic protozoans any five, Canal systems in sponges, Coral and coral reefs, Parasitic adaptations, Nematode parasites of man and water vascular system in Echinoderms.

UNIT V: PHYLOGENY

Affinities of *Peripatus*, Metamerism and Coelom, Mouth parts in insects, Social life in Insects and Larval forms of Echinoderms

TEXT BOOKS

1. Ekambaranatha Ayyar and T.N.Ananthkrishnan, 1995 A Manual of Zoology Vol.I (Part 1,2) S.Viswanathan, Chennai.
2. Barnes, 1995 Invertebrate Zoology, W.B.Saunders, Philadelphia.
3. Kotpal, R.L. 2005. Invertebrates, Rastogi, Meerut.
4. Nayar, N.C., S. Leelavathy., N. Soundarapandian., T. Murugan and N. Arumugam, 2004. A Text Book of Invertebrates. Saras, Nagercoil.



AZ 1507 - INVERTEBRATA LAB COURSE

SEMESTER : I CREDITS : 02

CATEGORY : MC (P) NO. OF HOURS / WEEK : 02

Objectives: To observe the anatomy and structural modifications in invertebrates and to develop dissection skill.

UNIT I: MAJOR DISSECTION

Cockroach: Digestive system, Circulatory system, Nervous system, Reproductive system -*Pila*: Nervous system - Leech / Earthworm: Nervous System, Reproductive system -Prawn: Nervous system (including Appendages).

UNIT II: MINOR DISSECTION

Earthworm: Viscera, Lateral hearts - *Pila*: Digestive system (Including radula) - Freshwater Mussel: Digestive system

UNIT III: MOUNTING

Earthworm: Body setae; Pineal setae - *Pila*: Radula - Freshwater muscle: Pedal ganglia –

UNIT IV: MOUNTING

Cockroach: Salivary apparatus, Mouth parts - Honey Bee, House fly and Mosquito mouth parts

UNIT V: SPOTTERS

Representatives from each phylum based on structural organisation and phylogeny – record

TEXT BOOKS

1. Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut.
2. Ekambaranatha Ayyar and T.N.Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1,2) S.Viswanathan, Chennai.
3. Barnes, 1995 Invertebrate Zoology, W.B.Saunders, Philadelphia.



AZ 1508 / AZ1505 - ECONOMIC ENTOMOLOGY

SEMESTER : I CREDITS : 03

CATEGORY : MC NO. OF HOURS / WEEK : 03

Objectives: To study the economic importance of insects and insect pest management.

UNIT I

Outline Classification of the Class Insecta; Causes for insects assuming pest status and Methods of collection, preservation and mounting of insects.

UNIT II

Most common insect pests of rice and their control: Rice thrips, brown planthopper and rice earhead bug. Insect pests of stored grains their preventive and curative methods: internal feeder, external feeder and scavenger. Locust and its control.

UNIT III

Insects in relation to public health and their control: Mosquito, House fly, Eye fly, Sand fly, Bed bug, Flea and head louse. Most common insect pests of domestic animals and their control: Stable fly, Shaft louse and Head maggot.

Unit IV

Apiculture: Introduction, types of honey bees, hive, apiary, selection of bees for apiary, Newton's bee hive, enemies of honey bees, diseases of honey bees and conclusion. Sericulture: introduction, types of silk worms, silk worm races, life history of mulberry silk worm, features of sericulture industry, pests of silk worm, diseases of silk worm and conclusion.

Unit V

Pest Management; Elementary knowledge of insecticide, Biological control of Insect pests and Integrated Pest Management.

TEXT BOOKS

1. Vasantharaj David, B. 2001. Elements of Economic Entomology, Popular Book Depot, Chennai.
2. Ministry of Agriculture, Government of India, 1995. Manual on Integrated Pest Management in Rice & Cotton.
3. John William S. 1995. Management of Natural Wealth, Loyola College Publications, Chennai.
4. John William, S. 2007. Defeating The Public Enemy The Mosquitoes: A real Challenge, Loyola College Publications Chennai.
5. Abishek Shukla, D. 2009. A Hand Book of Economic Entomology, Vedams e Books, New Delhi.



AZ 2104- ANIMAL DIVERSTIY

SEMESTER : II CREDITS : 03

CATEGORY : AR NO. OF HOURS / WEEK : 04

Objectives: To observe the organization, functional morphology and diversity of representative invertebrates and chordates.

UNIT I

Structure, organization and life history of *Entamoeba histolytica* and *Plasmodium vivax*, *Obelia geniculata*.

UNIT II

Structure, organization and life history of *Taenia solium*, Nematode parasites of man - *Ascaris*, *Hirudinaria*.

UNIT III

Structure, organization and life history of *Penaeus indicus*, *Pila globosa*, Star fish.

UNIT IV

Organization of Frog, Calotes, Pigeon and Rat.

UNIT V

Types of chordata eggs; extra embryonic membranes and their functions in chick, placentation in mammals.

TEXT BOOKS

1. Ekambaranatha Ayyar and T.N.Ananthakrishnan, 2008. A manual of Zoology Vol.I & II (Part 1,2) S.Viswanathan, Chennai.
2. Barnes,R.D 2001. Invertebrate Zoology, W.B.Saunders.
3. Verma, P.S., Agarwal, V.K and Tyagi B.S. 1995. Chordate embryology, S.Chand, New Delhi.
4. Berril, N.J. 1971. Developmental Biology, Mc Graw Hill, New York.



AZ 2105- ANIMAL DIVERSITY LAB COURSE

SEMESTER : II CREDITS : 01
CATEGORY : AR (P) NO. OF HOURS / WEEK : 02

Objectives: To observe the organization, functional morphology and diversity of representative invertebrates and chordates

Unit I: MAJOR DISSECTION

Cockroach: Digestive system, Nervous system. Freshwater mussel:
Digestive system
Prawn: Nervous system. Frog: Arterial system, venous system

UNIT II: MINOR DISSECTION

Earthworm: Lateral hearts. Cockroach: Reproductive system

UNIT III: MOUNTING

Cockroach: Mouth parts, salivary apparatus. Earthworm: Body setae.
Prawn: Appendages. Frog: Hyoid apparatus: Brain.

UNIT IV: SPOTTERS

Representatives from each phylum based on structural organization and phylogeny.

UNIT V: RECORD

Submission of certified laboratory record is mandatory.

TEXT BOOKS

1. Lai, S.S. 2005. A Text Book of Practical Zoology: Invertebrate, Rastogi, Meerut.
2. Ekambaranatha Ayyar and T.N.Ananthakrishnan, 2008 A manual of Zoology Vol.I & II (Part 1,2) S.Viswanathan, Chennai.
3. Barnes, R.D 2001 Invertebrate Zoology, W.B.Saunders, London.



AZ 2504 - CHORDATA

SEMESTER	: II	CREDITS	:	04
CATEGORY	: MC	NO. OF HOURS / WEEK	:	04

Objectives: *To elaborate the organization, functional morphology diversity and taxonomical position of chordates.*

UNIT I

Chordate characteristics- Systematic position of Cephalochordata and Urochordata.

UNIT II

Characteristics of subphylum vertebrata, Classification of vertebrata upto class level. Agnatha - Organization of shark - Importance of fishes and their biological significance- Organization of frog- Parental care in fishes and amphibia.

UNIT III

Organization of *Calotes versicolor*- Impact of terrestrialisation- Arcades and fossae of reptilian skulls in classification of reptiles- Identification of poisonous snakes - Poison apparatus, biting mechanism and snake venom.

UNIT IV

Organization of pigeon- Flightless birds – Flight adaptations - Migration in birds- Organization of rat - Classification of living mammals upto order level– structure and affinities of Prototheria- Metatheria.

UNIT V

Fate of aortic arches in chordates - Jaw suspension in vertebrates - Placentation in mammals- Systematic position of man.

TEXT BOOKS

1. Ekambaranatha Ayyar and T.N. Ananthkrishnan, 2008. A manual of Zoology Vol II, Part I and II, S. Viswanathan, Chennai.
2. Young, J, Z 1972. The life of vertebrates. Oxford Univ., London.
3. Newman, H.H. 1956 The Phylum Chordata, MacMillan, London.



AZ 2505 - CHORDATA LAB COURSE

SEMESTER : II CREDITS : 02

CATEGORY : MC (P) NO. OF HOURS / WEEK : 02

Objectives: To study the organization, functional morphology, adaptive modification and evolutionary significance of chordates.

UNIT I: MAJOR DISSECTIONS

Shark: Arterial system and cranial nerves (Demonstration only)

Frog: Arterial system - Venous system, Cranial nerves- V and X.

Rat: Arterial system - Venous system

UNIT II: MINOR DISSECTIONS

Shark: Placoid scales. Frog: Hyoid apparatus and Brain.

UNIT III: SPOTTERS

Adaptive modification and evolutionary significance: Prochordates – Fishes – Amphibian – Reptiles - Birds and Mammals- Skeletal structures of frog, calotes and rat.

UNIT IV: EMBRYOLOGY

Stages in the development of Amphioxus, Frog and Chick- Placenta in shark and mammals.

UNIT V: RECORD

Submission of certified laboratory record is mandatory.

TEXT BOOKS

1. Lal, S.S., 2005. A text Book of Practical Zoology: Vertebrate, Rastogi, Meerut.
2. Ekambaranatha Ayyar and T.N. Ananthkrishnan, 1998 A manual of Zoology Vol II, Part I and II, S.Viswanathan, Chennai.
3. Young, J,Z., 1972. The life of vertebrates. Oxford Uni. London.
4. Newman,H., 1956.The Phylum Chordata, MacMillan, London.



AZ 2506 - BASIC BIOTECHNOLOGY

SEMESTER : II CREDITS : 03

CATEGORY : MC NO. OF HOURS / WEEK : 03

***Objectives:** To outline the basics of Biotechnology - scope and importance and to understand the interdisciplinary activity.*

UNIT I: INTRODUCTION TO BIOTECHNOLOGY

Definition - interdisciplinary activity- scope and importance.

Biotechnology global scenario - International safety guidelines - Patent law and intellectual property rights.

UNIT II: PRINCIPLES OF TISSUE CULTURE

Culture media - Primary culture and cell lines - Organ culture. Industrial application of animal tissue culture

UNIT III: FUNDAMENTALS OF r-DNA TECHNOLOGY

Restriction enzymes: classification - Nomenclature and activity - Restriction mapping of DNA; Plasmids, Cosmids and transposons. Molecular cloning - construction of genomic libraries - Indirect cloning - cDNA preparation and uses of DNA probes.

UNIT IV: BIOCHEMICAL ENGINEERING

Basic concepts of fermentation- bioreactor design- biosensors

UNIT V: AGRICULTURE AND AQUACULTURE BIOTECHNOLOGY

Applications in agriculture: micropropagation of biomass – nitrogen fixation – GMO's.

Applications in aquaculture: improved diagnostics- hormones and feeds- genetic manipulation. Cryopreservation – Transgenic fish - Nutritional quality.

TEXT BOOKS

1. Ignacimuthu S, 2008. Basic Biotechnology. Tata McGraw-Hill, New Delhi.
2. Ranga, M.M., 2003. Animal Biotechnology, Agrobios, New Delhi.
3. Lohar, P.S., 2005. Biotechnology, MJP, Chennai.
4. Satyanarayana, U., 2005. Biotechnology, Books and Allied, Kolkata.
5. Ramawat *et al.*, 2009 Comprehensive Biotechnology, S.Chand & Compy, New Delhi.



AZ 3200 - AGRICULTURAL ENTOMOLOGY

SEMESTER : III
CATEGORY : AO₁

CREDIT : 03
NO. OF HOURS / WEEK : 04

Objective: To impart knowledge on insect pests and plant protection to sustain green revolution.

UNIT I: INTRODUCTION

An outline classification of insects; Life cycle of a Hemipteran, Coleopteran and Lepidopteran pest (explain one example in each). Mouth parts of insects- useful and harmful insects.

UNIT II: INSECT PESTS

Types of insect pests: Medical pests, Veterinary pests, Insect pests of household, insect vectors of plant diseases, Causes for insect assuming pest status. Termites and their control.

UNIT III: AGRICULTURAL PESTS AND DAMAGE

Common insect pests of the following plants and their control measures: Paddy, Sugarcane, Groundnut, Coconut and Cotton. Insect pests of stored grains- Locusts and their control.

UNIT IV: IPM AND BIOLOGICAL PESTICIDE

Integrated Pest Management. Signaling chemicals: Pheromones, antifeedents or feeding deterrents and insect repellents. biopesticide, isolation of biopesticide, application of biopesticide, Biological control of insect pests.

UNIT V: CHEMICAL PESTICIDE

An elementary knowledge of insecticides and repellents - chemical insecticides.

Safety of residue, chemical and physical properties, Toxicity studies, evolution of modern pesticides, insecticide formulation, Mixtures of active substances, classification based on mode of entry, chemical nature. Growth regulators in metabolism, toxicology of insecticides. Effect of chemical pesticide in environment.

TEXT BOOKS

1. Bettelheim, F.A., Brown, W.H., Campbell, M.K., Farrel, S.O. and Torres, O.J. 2012. Introduction to organic and Biochemistry, International edition.
2. Vasanthraj David, B and T. N. Ananthakrishnan, 2004. General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd., New Delhi, Page 1-1184.
3. Vasanthraj David, B. and T. Kumaraswami, 1996, Elements of Economic Entomology, Popular book Depot, Chennai.

REFERENCE BOOKS

1. Ignacimuthu, S. and A. Sen, 1999, Biopesticides in Insect Pest Management, Phoenix publishing, New Delhi.
2. Pandey, B.N. 2012. Evolution, Comparative anatomy, biometry, Economic zoology and Animal Developmetn , Tata McGraw Hill, New Delhi.



AZ 3201 - AGRICULTURAL ENTOMOLOGY LAB COURSE

SEMESTER : III
CATEGORY : AO₁ (P)

CREDIT : 01
NO. OF HOURS / WEEK : 02

Objective: To impart knowledge on plant protection from insect pests.

UNIT I: Methods of collection, preservation and mounting of insects.

UNIT II: Assessment of pest infestation and damage caused in groundnut and cotton – measurement of leaf damage- mounting of insect mouth parts.

UNIT III: Evaluation of biopesticide against insect pests, *Heliothus armigera* and *Spodoptera litura*

UNIT IV: Identification and description of life cycle in common pests.

UNIT V: Identification of economically important pests of Paddy, Sugarcane, Cotton, Groundnut and Coconut. Handling of plant protection appliances.

TEXT BOOKS

1. Pruthi, H.S. 1969. Text book on Agricultural Entomology, I.C.A.R. Publication, New Delhi.
2. Vasanthraj David, B and T. N. Ananthkrishnan, 2004. General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd., New Delhi, Page 1-1184.

REFERENCE BOOKS

1. Ignacimuthu, S. and A. Sen, 1999. Biopesticides in Insect Pest Management, Phoenix, New Delhi.
2. MoA, 1995. Manual of Integrated pest management in rice and cotton, Ministry of Agriculture, Government of India, Faridabad.
3. Rajesh Karyakarte and Ajit Damle, 2008. Medical parasitology, Books and allied Pvt. Ltd, Kolkata
4. Vasanthraj David, B. and T. Kumaraswami, 1996, Elements of Economic Entomology, Popular book Depot, Chennai.

AZ 3301 - CLINICAL TECHNIQUES

SEMESTER : III
CATEGORY : EG₁

CREDIT : 01
NO. OF HOURS / WEEK : 03

Objectives: To learn the common pathogens and clinical diagnostic techniques for various diseases in man.

UNIT I: HUMAN ANATOMY AND SAFETY MEASURE

Human body overview - Structural organization system, functions- common causes of accidents in lab – laboratory safety – toxic chemicals and biohazards waste. Personal safety measure, decontamination of infectious material- disposal of lab wastes and hazardous chemical reagents and glasswares- fire safety.



UNIT II: HAEMATOLOGY

Composition and functions of blood - collection of blood & preservation-types of anaemia- blood coagulation-Blood pressure- pulse rate- bleeding time- clotting time- determination of haemoglobin- erythrocyte sedimentations rate- packed cell volume- Total count of RBC- Differential count of WBC- bleeding disorders of man – blood grouping.

UNIT III: MEDICAL MICROBIOLOGY

Definition and scope of microbiology- structure and function of cells-sterilization - parasites - Entamoeba-Plasmodium-Leishmania and Trypanosome- hospital epidemiology-medical ethics.

UNIT IV: MEDICAL INSTRUMENTATION TECHNIQUES

Computer tomography (CT scan) – Magnetic Resonance imaging – Electrocardiogram – flowcytometry – Haemocytometer –positron emission tomography – treadmill test.

UNIT V: DIAGNOSTIC PATHOLOGY

Handling and labeling of histology specimens - Tissue processing, fixation, dehydration, clearing, paraffin embedding and block preparation - Microtome, types of microtome- sectioning– staining and mounting – Problems encountered during section cutting and remedies.

TEXT BOOKS

1. Godker, P.B. and Godker, P.D. 2011. Text book of medical Laboratory Technology, Bhalani Publishing house, Mumbai.
2. Guyton and Hall, 2010. Text book of medical physiology, Elsevier, New Delhi.
3. Mohan, H, 2005. A text Book of Pathology, Jaypee, New Delhi.

REFERENCE BOOKS

1. Cella, J.H. and Watson, J. 2004. Manual of laboratory test, Aitbs, New Delhi.
2. Gayatri Prakash, 2012. Lab manual on blood analysis and medical analysis, S. Chand, New Delhi.
3. Manoharan, A. and Sethuraman, 2003. Essential of Clinical Heamatology, Jeypee, New Delhi.
4. Mukherjee, K.L. 2003. Medical Laboratory Technology - A procedure manual for Diagnostic tests Vol. I, II & III Tata McGraw Hill, New Delhi.
5. Pratibha Nallari and Venugopal Rao, 2010. Medical biotechnology, Oxford University press, New Delhi.
6. Richard, A., Mc Pherson, Mathew, Pincus, R. 2007. Clinical and management by laboratory methods, Elsevier, Philadelphia.



AZ 3508 – ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

SEMESTER : III CREDIT : 04
CATEGORY : MC NO. OF HOURS / WEEK : 04

Objectives: To enlighten the functions of organ systems in animals and man towards homeostasis.

UNIT I: SCOPE, NUTRITION AND RESPIRATION

Scope of animal physiology, cellular, general and comparative animal physiology. Nutritive types - Carbon and nitrogen requirements: carbohydrates, lipids and proteins – Vitamins - Feeding mechanisms - Enzymes and digestion – Absorption -Metabolism - Energy production from carbohydrates, proteins and lipids - Basal metabolism - Respiratory organs - Respiratory pigments - Transport of gases - Control of respiration

UNIT II: CIRCULATION AND EXCRETION

Types of transport system - Neurogenic & myogenic hearts - Composition and functions of blood - Haemodynamics - Electrical activity of heart - Excretory organs - Synthesis and occurrence of major excretory products - Urine formation and its elimination in mammals.

UNIT III: OSMOTIC AND IONIC REGULATION

Osmoregulation- Mechanisms of ionic regulation - adaptations related to habitats - Thermoregulation - Circadian rhythm & Biological clocks

UNIT IV: METABOLIC PATHWAYS AND CARBOHYDRATE METABOLISM

Glycogenesis - Glycogenolysis – gluconeogenesis – metabolic pathway of glucose – glycolysis – production of ATP in aerobic pathway – Krebs's cycle – electron transport chain- oxidative phosphorylation – hormonal control of carbohydrate metabolism and regulation of blood glucose level.

UNIT V: ENZYMES AND ENZYME ACTIVITY

Definition – enzymes as biological catalysts – chemical nature of enzyme – sources and site of enzymes - physical properties of enzymes – functional properties of enzymes – effect of temperature on enzyme action – effect of pH, enzyme action - Kinetics of enzyme action , Michaelis-Menton equation – theories of enzyme specificity – factors influencing enzyme activity.

TEXT BOOKS

1. Devasena, T. 2010. Enzymology, Oxford University press, New Delhi.
2. Singh, H.R and Kumar, N. 2007. Animal physiology and biochemistry, Vishal publishing company, Jalandhar.
3. Sreekumar, S. 2010. Basic physiology, PHI learning private ltd., New Delhi.
4. Wood, D.W. 1968. Principles of Animal physiology. Edward Arnold, London.

REFERENCE BOOKS

1. Hoar, S.W. 1976. General and comparative physiology, Prentice Hall.
2. Parameswaran, Ananthakrishnan, T. N. and Ananthasubramaniam, K.S. 1975. Outlines of Animal Physiology, S. Viswanathan, Chennai.



3. Prosser, O.L. and F.A. Brown 1961: Comparative animal physiology, W.B. Saunders, London.
4. William, H.E. and Daphne, C.E. 2009. Biochemistry and molecular biology 4th edition, Oxford University press, New Delhi.
5. Willmer, P., Stone, G. and Johnston, I. 2005. Environmental physiology of animals, Blackwell, UK.

AZ 3509 – ANIMAL PHYSIOLOGY AND BIOCHEMISTRY LAB COURSE

SEMESTER : III CREDIT : 02
CATEGORY : MC NO. OF HOURS / WEEK : 02

Objectives: To illustrate the function of organs and organ systems in different animals.

UNIT I : Survey of digestive enzymes in cockroach.

Ptyalin activity in relation to temperature and pH in human saliva.

UNIT II: Estimation of oxygen consumption in an aquatic and a terrestrial animal.

Estimation of total protein, fat and carbohydrate

UNIT III: Qualitative detection of excretory products.

Influence of temperature on the ciliary activity of freshwater mussel gill and calculation of Q 10.

UNIT IV: Blood - total and differential counts.

UNIT V: Recording of heart beat, muscle twitch and reflexes in frog.

TEXT BOOKS

1. Bishop, M.L., Fody, E.P., Schoeff, L.E. 2009. Clinical chemistry: principles, procedure, correlations. Wolters Kluwer, India.
2. Burtis, C.A. and Ashwood, E.R. 2008. Tietz Fundamentals of clinical chemistry, Elsevier, Philadelphia.
3. Tortora, G.J and Derrickson, B.H. 2008. Principles of anatomy and physiology, 12th edition, John Wiley and sons, New Jersey.

REFERENCE BOOKS

1. Hoar, S.W. 1976: General and comparative physiology, Prentice Hall.
2. Prosser, O.L. and F.A. Brown 1961: Comparative animal physiology, W.B. Saunders, London.
3. Woods, D.W. 1968: Principles of Animal physiology. Edward Arnold, London.



AZ 3510- DEVELOPMENTAL BIOLOGY

SEMESTER	:	III	CREDIT	:	03
CATEGORY	:	MC	NO. OF HOURS / WEEK	:	03

Objective: To understand the ontogeny of animals.

UNIT I: INTRODUCTION

Introduction-History of developmental biology-Theories of preformation-epigenesis-pangenesis-Biogenetic law-germplasm theory-Mosaic theory-Regulative theory-Gradient theory-theory of organizers

UNIT II: GAMETOGENESIS AND FERTILIZATION

Oogenesis & Spermatogenesis-Morphology & types of eggs & sperms- Fertilization- Activation of ovum and Amphimixis. Theories of fertilization- Cleavage-Cleavage-patterns and planes-theories of cleavage-Effect of yolk on cleavage.

UNIT III: GASTRULATION AND ORGANOGENESIS

Morphogenetic movements-Fate maps - Organogenesis in Amphioxus – Frog – Chick and mammals-Development of Eye, Ear, Brain and Heart. Origin and development of foetal membranes in Chick and mammals- somatopleuric and splancholeptic development. Placentation of mammals.

UNIT IV: METAMORPHOSIS

Development in sponges and starfish: Metamorphosis of frog and insect - Cleavage- blastulation-gastrulation. Regeneration: types – blastema formation - Parthenogenesis: complete and incomplete – meiotic and ameiotic thelytoky.

UNIT V: EXPERIMENTAL EMBRYOLOGY

Cell lineage-Primary and Secondary organizers-Nuclear transplantation and gradients- Embryo transplantation techniques - Test tube babies - Artificial insemination Infertility - Rh factor – Microinjection - Transgenic animals. Organizers & Inductors.

TEXT BOOKS

1. Gilbert, S.F. 2010. Development Biology, Sinauer Associates, Massachusetts, USA.
2. Lewis Wolpert, 2007. Principles of development, 3rd edition, Oxford University press, New Delhi.
3. Muneesh Kainth, 2013. A Textbook of Chordate Embryology, Wisdom Press.
4. Verma, P.S., Agarwal, V. K. 2010.Chordate Embryology: Developmental Biology S. Chand & Company. New Delhi.

REFERENCE BOOKS

1. Balinsky, B.I. 1970. Introduction Embryology Philadelphia & London.
2. Berril, N.J.1971. Developmental Biology, McGraw Hill, New York.
3. Carlson, Bruce, M. 2009. Human embryology and developmental biology, Elsevier, Philadelphia.
4. Schoenwolf, Gary, C., Larsen, William, J. 2009. Larsen's human embryology, Elsevier, Philadelphia.



AZ 4200 - BIOINFORMATICS

SEMESTER : IV CREDIT : 03
CATEGORY : AO₂ NO. OF HOURS / WEEK : 04

Objective: To provide biologically important predictions from annotated data and transformation of these data for genome / gene / DNA analyses.

UNIT I: INTRODUCTION TO BIOINFORMATICS

History of Bioinformatics and Pharmaceutical Industry - Bioinformatics in Business – scope of Bioinformatics, Tools and techniques of bioinformatics.

UNIT II: COMPUTATIONAL MOLECULAR BIOLOGY

Datamining and Sequence Analysis - Database Similarity Searches - Practical Aspects of Multiple Sequence Alignment - Phylogenetic Analysis – Recent trend in bioinformatics.

UNIT III: INTERNET AND BIOINFORMATICS

Data mining in Bioinformatics- Knowledge discovery - Problems faced in Bioinformatics -Human Genome Project - Influence areas - Bioinformatics in India

UNIT IV: BIOLOGICAL DATABASE AND THEIR MANAGEMENT

Database concepts - Introduction of SQL - Biological Database - Sequence Database- DNA sequence data bases, specialized database, secondary protein sequence data bases –and composite protein sequence data bases.

UNIT V: DATABASE AND TOOLS

Predictive Methods Using Nucleic acid and Protein Sequences Submitting DNA Sequences to the Database - Internet & Data mining - Programming in C.

TEXT BOOKS

1. Rastogi, S. C. 2003, Bioinformatics (Concepts, Skills and Applications) CBS, New Delhi.
2. Setubal, J. and J. Meidanis, 1997, Introduction to Computational Molecular Biology, PWS, Boston.
3. Stephen A. K. and Womble, D.D., 2003, Introduction to Bioinformatics: A Theoretical and Practical Approach, Humana Press, New Jersey.
4. Zhumur, G and Bibekanand, M. 2008. Bioinformatics (principles and applications) Oxford University press, New Delhi.

REFERENCE BOOKS

1. David, M. 2001, Bioinformatics: Sequence and Genome Analysis Cold spring harbor laboratory Press.
2. Gibas C and P. Jambeck, 2000, Developing Bioinformatics Skills, O' Reilly and Associates, California.
3. Rashidi, H. and Lukas K. Buehler, 1999, Bioinformatics Basics Applications in Biological Science and Medicine, CRC press.



AZ 4201 - BIOINFORMATICS LAB COURSE

SEMESTER : IV CREDIT : 01
CATEGORY : AO₂ NO. OF HOURS / WEEK : 02

Objectives: To impart hands on training in bioinformatics tools and techniques.

UNIT I : DNA SEQUENCE ANALYSIS

Sequence analysis - blast, Phi-Psiblast - Multiple sequence - alignment - Clustal

UNIT II : PROTEOMICS

Proteomics - Physio-chemical analysis of protein-expsy tools

UNIT III : PHYLOGENETIC ANALYSIS

Phylogenetic analysis- phylip, Predicting structure - Secondary structure analysis and tertiary structure analysis.

UNIT IV : MODELING

Homology modeling of structure - study on structural visualization tools - Retrieving and displaying 3-D structure.

UNIT V : DATABASE

Database concepts, data mining and data retrieval - Biological database-DNA databases, Protein database, structural databases (SCOP, CATH, HOMSREAD, PDB) - Study on secondary Database.

TEXT BOOKS

1. Krawetz, S.A. and Womble, D.D. 2003. Introduction to Bioinformatics: A Theoretical and Practical Approach, Humana, New Jersey.
2. Rastogi, S. C. 2003. Bioinformatics (Concepts, Skills and Applications) CBS, New Delhi.

REFERENCE BOOKS

1. Lesk, A. M. 2005. Introduction to bioinformatics, Oxford University, USA.
2. Setubal, J. and J. Meidanis, 1997. Introduction to Computational Molecular Biology PWS, Boston.



AZ 4301 - HUMAN HEALTH AND HYGIENE

SEMESTER : IV CREDIT : 01
CATEGORY : EG₂ NO. OF HOURS / WEEK : 03

Objective: To provide health education, health-goal and attitudes.

UNIT I : INTRODUCTION

Health and individual responsibilities, factors influencing health, making healthful decisions. Modern life style and health maintenance.

UNIT II: HEALTH PARAMETERS

Physical health, psychological health, sociological health, health issues, human health needs and health education, ecological consideration, Genetic influence on health, overcoming environmental influences.

UNIT III: HYGIENE

Hygiene and health factors at home, personal hygiene, oral hygiene and sex hygiene – physical activity and exercises.

UNIT IV: LIFE STYLE ACTIVITY

Physiological effects of alcohol, alcoholism, abuse of alcohol, treatment of chronic abuse of alcohol, composition and effects of tobacco smoke - the smoking habits (active and passive smoking), legislation.

UNIT V: DISORDER AND DISEASES

Health products – junk food and its risks – antioxidants - Familiarization of various disorders of human body. Disorders of blood vascular system, respiratory system, excretory system. Parasites and diseases caused by them. Vector borne diseases and their control – Diabetes and obesity linked to health – deficiency of vitamins. Proper use of drugs -ill effects of self medication. First aid.

TEXT BOOKS

1. Baran, A. and Mahapatra, S. 2000. Essentials of Medical physiology. Current Book International, Kolkata.
2. Guyton and Hall, 2010. Textbook of Medical Physiology, Elsevier.
3. Sancheti, K. H. 1995. Best of Health, Oriental watchman , Pune.

REFERENCE BOOKS

1. Elia, M., Ljungqvist, O., Stratton, R., Lanham, S.A. 2012. Clinical Nutrition Paperback, Wiley-Blackwell.
2. Gibney, M.J., Margetts, B.M., Kearney, J.M. and Arab, L. 2004. Public Health Nutrition, Wiley-Blackwell.
3. John, P and Gregory, B. 2008. Infection and immunity, Oxford University press, New Delhi.
4. Kiran, A. K. 2008. Fundamental of applied nutrition, Alfa publications, New Delhi.
5. Rajesh Karyakarte and Ajit Damle, 2008. Medical parasitology, Books and allied Pvt. Ltd, Kolkata.



AZ 4505 – ORGANIC EVOLUTION

SEMESTER : IV CREDIT : 03
CATEGORY : MC NO. OF HOURS / WEEK : 03

Objective: To Explore the process and products of evolution.

UNIT I: INTRODUCTION

Inorganic and organic evolution-History of evolutionary thought, Primordial earth and primeval atmosphere, Chemical origin of life: Synthesis of organic molecules, Urey-Miller experiment, Origin of prokaryotes and eukaryotes.

UNIT II: CAUSAL FACTORS

Lamarckism - Neo Lamarckism - Darwinism - Neo Darwinism and modern synthetic theory - DeVrie's Mutation theory – modern concepts of mutation - Mutation and their role in evolution - Animal colouration and Mimicry

UNIT III: ADAPTIVE RADIATION AND SPECIATION

Isolating mechanisms - Modes of speciation-Hybridization is an evolutionary catalyst- Law of Adaptive Radiation- Adaptive radiation in reptiles and mammals - Convergence and parallelism - Evolutionary constancy.

UNIT IV: EVIDENCES AND PALAENTOLOGY

Morphological, physiological and biochemical, embryological, Taxonomical and geographical evidences - Palaeontological evidences – evolutionary genomics. Types of rocks - Geological time scale – Nature of fossils- Dating of fossils - Fossil records of man and fossil records of horse.

UNIT V: MAN AND NATURAL SELECTION

Natural selection in action in man- level of selection- Eugenics, Euphenics and Euthenics- Adaptation- Human Genome Project – Evolution and ethics.

TEXT BOOKS

1. Colbert, E.H. Morales, M. and Minkoff, E.C. 2011. Colbert's Evolution of The Vertebrates: A History of the Backboned Animals Through Time, Wiley, India.
2. Lull, R.S. 2010. Organic evolution, The Macmillan, New York.
3. Michael J. Benton, M.J. 2004. Vertebrate Palaeontology, Wiley-Blackwell.

REFERENCE BOOKS

1. Dobzhansky T. Ayala F.I.T. Stebeinns G.L. Valentini J.W. 1973 Evolution - Surjeet publication New Delhi.
2. Moody, P.A. 1962. Introduction of evolution, Harper and Brothers, New Delhi.



AZ 4506 - ENVIRONMENTAL BIOLOGY

SEMESTER	:	IV	CREDIT	:	04
CATEGORY	:	MC	NO. OF HOURS / WEEK	:	04

Objective: To elaborate the importance of environment, its protection and conservation.

Unit I: BIOTIC FACTORS AND ABIOTIC FACTORS

Introduction to ecology- branches and sub-division of ecology- scope of ecology -Autecology and synecology-Abiotic factors: temperature- light-pressure; soil as a substratum: composition of soil, soil texture, soil profile, pedogenesis soil organism, adaptation of soil, causes and types of soil erosion, soil conservation -biogeochemical cycle: Nitrogen, carbon-phosphorous, oxygen and sulphur.

UNIT II: POPULATION ECOLOGY

Man and the environment-threats from the environment, environment deterioration, conservation of environment -Animal population: Density-Natality- Mortality- Population growth curve- Age distribution, Population equilibrium-Population fluctuation-Dispersal. Intraspecific animal relationships- social integration and division of labour. Interspecific animal relationships: Neutralism - symbiosis- mutualism, commensalism –antagonism- antibiosis – parasitism- predation and competition.

UNIT III: COMMUNITY ECOLOGY

Characteristics of a community- community diversity- Stratification, -ecotone- edge effect- ecological niche- Ecological succession-types pattern and significance of succession –Dynamics of Ecosystem- components of ecosystem- Trophic level-Energy flow-ecological pyramids- Food chain- Food web.

UNIT IV: HABITAT ECOLOGY

Adaptation of animal inhabiting different habitat- pelagic adaptation - intertidal rocky shore-intertidal sandy shore adaptation, Deep sea adaptation and desert adaptation.

UNIT V: APPLIED ECOLOGY

Natural resource management- Renewable and non renewable resources- wild life management- Necessity of conservation, causes for wild life depletion, Methods of conservation, organisation, Sanctuaries and National Parks-Green house gases- Global warming and ozone layer- Pollution-Water, air, soil(Land pollution) -Disaster management: Flood-Earthquake-Cyclone-Landslide.

TEXT BOOKS

1. Asthana, D.K. and Meera, A. 2009. A text book of Environmental studies, S. Chand, New Delhi.
2. Dahiya, P. and Ahlawat, M. 2011. Environmental Science: A new approach, Narosa, New Delhi.



3. Reddy, G.R., Flora, S. J. S. and Basha, R. 2012. Environmental Pollution: Ecology and Human Health, Narosa, New Delhi.
4. Singh, H.R. 2009. Environmental biology, S. Chand, New Delhi.

REFERENCE BOOKS

1. Odum, E.P. 1983. Basic Ecology, Saunders, Philadelphia.
2. Rana, S.V.S. 2011. Environmental Pollution: Health and Toxicology, Narosa, New Delhi
3. Sanyal, K., Kundu, S. and Rana, S. 2009. Ecology and environment, Books and allied ltd Kolkata.
4. Verma, P.S. and V. K. Agarwal 1987. Animal Ecology, S. Chand, New Delhi.

AZ 4507 - ENVIRONMENTAL BIOLOGY LAB COURSE

SEMESTER	:	IV	CREDIT	:	02
CATEGORY	:	MC (P)	NO. OF HOURS / WEEK	:	02

***Objective:** To provide a method for assessing biotic factors, abiotic factors and the organisms in the environment.*

UNIT I: ESTIMATION OF ABIOTIC FACTORS

Estimation of dissolved Oxygen, Dissolved carbon-di-oxide, Determination of alkalinity in water samples, Determination of salinity of water samples, Determination of bicarbonate and carbonates.

UNIT II. MOUNTING TECHNIQUES

Collection, isolation, identification and mounting of marine and freshwater plankton.

UNIT III: ADAPTATION AND ANIMAL ASSOCIATIONS

Study of sandy shore fauna .

Study of rocky shore fauna.

Study of animal Association.

UNIT IV: INSTITUTIONAL VISIT AND FIELD WORK

Study of pond as an ecosystem- Field trip to lakes, pond and different shores. Collection fauna from sea shore. Visit to environmental biology labs, Research Institutes and Effluent treatment plants.

UNIT V: COLLECTION OF MICROARTHROPODS

Study of different soil microarthoropods - Extraction and identification of soil micro arthropods through Tullgren's funnel method and Ladell's Floating Method



TEXT BOOKS

1. Abhijit Dutta, 2009. Experimental biology: A Laboratory Science, Narosa, New Delhi.
2. Micheal, P, 1984. Ecological Methods for field visit and laboratory investigation. Tata McGraw Hill, New Delhi.
3. APHA, 1992. Standard Methods for the examination of water and waste water, American Public Health association, Washington D.C.

REFERENCE BOOKS

1. Eugenia, 2008. Environmental Biotechnology and cleavers Bioprocesses, London.
2. Ramesh, R & M, Anbu 1996. Chemical methods for environmental Analysis of water and sediment. Macmillan India Limited, Chennai.

AZ 5402 – INSTRUMENTAION AND CHEMICAL TECHNIQUES

SEMESTER	:	V	CREDIT	:	04
CATEGORY	:	ES	NO. OF HOURS / WEEK	:	06

Objective: To learn various instrumentation and analytical techniques employed for understanding of life.

UNIT I: INTRODUCTION

Guide lines for good laboratory practices - Sterilization and disinfection – physical – chemical – biological agents – basic laboratory instruments - principles and types of Autoclave, Hot air oven, centrifuge, monometer, Digester, Soxhlet apparatus – Air sampling device and Incubator.

UNIT II: MEDICAL INSTRUMENTS

Generalized medical instrumentation system – measurement - medical and physical parameters – sensors- units of measurement – classification f biomedical instruments – regulation of medical devices – instrument characterization – static and dynamic characterization.

UNIT III: BIOPOTENTIAL

Electrodes – biomedical sensors: chemical and bio-analytical, ESR measurement, haemoglobin – cardiovascular measurements – blood pressure – blood flow – cardiac cycle – ECG- cardiac pacemakers – defibrillations - Flowcytometer - Autoradiography.

Medical uses of Radioactive isotopes – Radiation- Geiger-Muller counter- biological impacts –Medical and biological uses of X-rays – NMR- Ultrasound - Laser and their applications.

UNIT IV: CHEMICAL APPARATUS

Introduction of apparatus – chemical balance : different types , principles and practices, concepts of molecular weight, atomic weight, molarity , acids, bases, salts and indicators- concepts of acid base reactions, pH-Sorenson’s pH scale, pH meter, colorimetry – principle and working.



UNIT V: CHEMICAL ANALYSIS

Experimental procedures and application of chromatography - Types of chromatography, HPLC and GC/Mass Spectrometer, uses of chromatography- principles and application of electrophoresis. Spectrophotometry, PCR, ELISA, Radio immune assay - Biochemical analyzer.

TEXT BOOKS

1. Khandpur, R.S, 2004. Biomedical instrumentation, Tata McGraw Hill, New Delhi.
2. Subramanian, M.A., 2005. Biophysics – Principles and Techniques, MJP, Chennai.
3. Veerakumari, L. 2006. Protein sequencing in Bioinformatics Bioinstrumentation, MJP publication, Chennai.
4. Wilson, K.M. and Walker, J.M. 2010. Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press.

REFERENCE BOOKS

1. Cottenill , R.M.J., 2002. Biophysics: An introduction, John Wiley and sons, England.
2. Das, D., 1996. Biophysics and Biophysical Chemistry for Medical and Biology students, Academic Calcutta.
3. Merck, Sharp and Dohme, 2000. The Merck Manual of diagnosis and therapy, rahway, New York.
4. Nicholas, C.P and Jacqueline, N. 2009. Exploring proteins, Oxford University press, New Delhi.

AZ 5403 – MEDICAL LABORATORY TECHNIQUES

SEMESTER	:	V	CREDIT	:	04
CATEGORY	:	ES	NO. OF HOURS / WEEK	:	06

Objective: To study the basis of medical laboratory techniques.

UNIT I: HAEMATOLOGY

Composition of blood and their function- collection of blood & lab procedure-haemopoiesis- types of anaemia- mechanism of blood coagulation- Blood pressure - bleeding time- clotting time- determination of hemoglobin-erythrocyte sedimentations rate- packed cell volume- Total count of RBC & WBC- Differential count WBC- blood grouping and typing- haemostasis- bleeding disorder of man - Haemolytic disease of newborn, Platelet count, reticulocytes count, Absolute Eosinophil count.

UNIT II: LABORATORY SAFETY AND HUMAN HEALTH AND HYGIENE

Laboratory safety – toxic chemicals an biohazards waste biosafety level- good laboratory practice – hygiene and health issue – physiology effect of alcohol- alcoholism – abuse of alcohol – treatment of chronic abuse alcohol – effect of tobacco – smoking habits – junk food – overcoming environment influences.

UNIT III: MEDICAL MICROBIOLOGY AND INSTRUMENTATION TECHNIQUES

Definition and scope of microbiology- structure and function of cells-sterilization - parasites - Entamoeba-Plasmodium-Leishmania and Trypanosome- hospital epidemiology-medical ethics.



Computer tomography (CT scan) – Magnetic Resonance imaging – Electrocardiogram – flowcytometry – Haemocytometer – positron emission tomography – treadmill test.

UNIT IV: PHYSIOLOGY

Cardiovascular system –Cardiac cycle-Blood Pressure and Pulse –blood pressure- regulation of heart rate, cardiac shock. Heart sounds, Electrocardiogram –significance – ultra sonography – ultrasonic diagnostic methods – computed tomography – PET – SPECT.

UNIT V: DIAGNOSTIC PATHOLOGY

Handling and labeling of histology specimens - Tissue processing - processing of histological tissues for paraffin embedding, block preparation. Microtomes – types of microtome - sectioning, staining –staining methods- vital staining - mounting- problems encountered during section cutting and remedies - Frozen section techniques- freezing microtome.

TEXT BOOKS

1. Godker, P. B. and Darshan, P, Godker, 2011. Text book of medical Laboratory Technology, Mumbai.
2. Guyton and Hall, 2000. Text Book of medical Physiology, 10th edition, Elsevier, New Delhi.
3. Mukerjee, K.L, 1999. Medical Laboratory Technology- Vol,I,II,III. Tata MC GrawHill, New Delhi.
4. Sood, R, 2009. Medical Laboratory technology, Methods and interpretation

REFERENCE BOOKS

1. Manoharan, A, and Sethuraman, 2003. Essential of Clinical Hematology, Jaypee brothers, New Delhi.
2. Richard, A, Mc Pherson, Mathew, R, Pincus, 2007. Clinical and management by laboratory methods, Elsevier, Philadelphia

AZ 5516 - CELL AND MOLECULAR BIOLOGY

SEMESTER	:	V	CREDIT	:	04
CATEGORY	:	MC	NO. OF HOURS / WEEK	:	04

Objective: To emphasize cell as the structural and functional unit and to elaborate heredity and variations.

UNIT I: INTRODUCTION

General account of cell- Cellular building blocks- basic structure and organization- origin of single cell to multicellular organism- cell theory.

UNIT II: TOOLS AND TECHNIQUES

Microscopy- Light, Phase contrast, Dark field, Fluorescence, Polarizing and electron microscopes (TEM and SEM) – Camera lucida. Cytological study of living and dead cells.



Microtechniques (fixations-stains-staining methods - vital staining) – cytochemical techniques- cell fractionation- homogenization and centrifugation- isolation of cellular components. Tissue culture.

UNIT III: CELL STRUCTURE AND CELLULAR COMPONENTS

Comparison of cell structure of prokaryotes and eukaryotes (*E.coli* and Virus).

Biomembrane- various membrane models- transport mechanism- endoplasmic reticulum – golgi – ribosomes - cilia & flagella.

Lysosomes-Mitochondria- oxidative phosphorylation-Biogenesis.

Peroxisomes- glyoxisomes, centrioles and microtubules. Interphase nucleus, chromosomes –kinds of chromosomes.

Cell Cycle –cell division- meiosis and mitosis –cell cycle regulation – cell birth, lineage and cell death.

UNIT IV: MOLECULAR BIOLOGY

Nucleic acids- DNA-structure and RNA Structure - DNA replication, repair and recombination, DNA damage and repair mechanisms.

DNA transcription and bio synthesis of protein.

Cell signaling, Hormones and their receptors, cell surface receptor, signal transduction pathways, second messengers, regulation of signaling pathways.

UNIT V: ADVANCED STUDIES IN MOLECULAR BIOLOGY

Cancer biology - Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis. stem cell therapy- Cells and molecules involved in innate and adaptive immunity- B and T cells.

Maternal effects and cytoplasmic inheritance - Nuclear transplantation.

TEXT BOOKS

1. Ajoy Paul, 2011. Text book of cell and Molecular biology, Books and Allied, Kolkata.
2. Lodish, H., Berk, A., Matsudaira, P., Kaiser, C.A. 2007. Molecular cell biology, what freeman, New York.
3. Schulz, W.A. 2005. Molecular biology of human cancer, Springer.
4. Watson, J.D., Baker. T. A., Bell,P.S., Gann, A., Levine, M., Losick, R. 2004. Molecular biology of the gene. Benjamin cummings, New York.
5. Powar, C. B. 1997. Cell biology, Himalaya publishing house, Bombay.

REFERENCE BOOKS

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter, 2002. Molecular biology, Garland science. New York.
2. Becker, W. M., Kleinsmith, L.J., Hardin, J. 2000. The world of the cell. Benjamin, New York.
3. De Robertis, E.D.F. & De Robertis, E.M.F., 1981. Cell and Molecular Biology, Saunders International, Philadelphia.



AZ 5517 – IMMUNOLOGY

SEMESTER : V
CATEGORY : MC

CREDIT : 04
NO. OF HOURS / WEEK : 04

***Objective:** To emphasize the importance of immune system in protecting the body.*

UNIT I: INTRODUCTION

General concepts of the immune system. Innate and adaptive immunity; Inflammation - general properties - Structure, properties and functions of the immune cells & organs: Hematopoiesis, T and B-lymphocytes, NK cells; Monocytes and macrophages; Neutrophils, eosinophils, and basophils -Mast cells and dendritic cells. Thymus and bone marrow; Lymph nodes, thymus and bursa of Fabricius, lymph node, spleen, Peyer's patches and Kupffer cells, spleen, MALT, GALT and CALT.

UNIT II: ANTIGEN AND ANTIBODIES

Antigens and haptens: Properties (foreignness, molecular size, heterogeneity). B and T cell epitopes. T-dependent and T-independent antigens. Major histocompatibility gene complex: Organization of MHC. Structure and cellular distribution of HLA antigens.

Antibodies: Structure, function and properties of the antibodies; Different classes and biological activities of antibodies; Antibody as B cell receptor, antigenic determinants on antibodies (isotype, allotype and idiotype). Genesis of antibody variability. Hybridoma technology, monoclonal antibodies and abzymes -Introduction to antibody engineering.

UNIT III: CELL MEDIATED IMMUNITY

Cell types (CTLs, NK cells, macrophages and TDTH cells), effectors mechanisms and effectors molecules of cell mediated reactions. Assessment of cell-mediated cytotoxicity. Cytokines - properties and functions of IL-1 to IL-5, IL-10, IL-12, IFN- γ . Regulation and modulation of immune response: A general account. Adjuvants, tolerance, immunopotential and immunosuppression. Hypersensitivity: Types and mechanism of hypersensitive reactions.

UNIT IV: AUTOIMMUNITY

Mechanisms of induction of organ specific (Hashimoto's thyroiditis, autoimmune anemias, Goodpasture's syndrome, IDDM), and systemic autoimmune diseases. Therapeutic approach. Transplantation immunology: Types of grafts, immunologic basis of graft rejection, immunosuppressive therapy and transplants to immunologically privileged sites. Immunity and tumors: tumor antigens (TSTA and TAA), immune response to tumors. Tumor evasion of the immune system. Immunotherapy for tumors.

UNIT V: CLINICAL IMMUNOLOGY

Immunity against viral, bacterial and parasitic infections - Immunological basis of hypersensitivity - Graft rejections. Vaccines: Types and uses - Immunization schedule for children - Prevention of post natal diseases: tetanus, diphtheria, whooping cough, cholera, yellow fever, measles and AIDS.



TEXT BOOKS

1. Roitt, M and Peter J. Delves, 2005. Essential immunology, 10th Edition, Blackwell, USA.
2. Richard A. Goldsby, Thomas j. Kindt, Barbara A. Osborne, Janis Kuby, 2003. Immunology, W.H. Freeman, NY.
3. Raj Khanna, 2011. Immunology, Oxford University press, New Delhi.
4. Madhavee Latha, P. 2012. A text book of immunology, S. Chand, New Delhi.

REFERENCE BOOKS

1. Abul K Abbas, Andrew K. Litchman and Jorden S. Pober, 2003. Cellular and Molecular Immunology, 3rd Edition, W.B. Saunders, Philadelphia
2. Clark. John wiley and Sons, W. The Experimental Foundations of Modern Immunology, New York.
3. Lichtman, A. and Pober, W.B. Cellular and Molecular Immunology by Saunders Company, Philadelphia.
4. Elger, K.D. 2009. Immunology understanding the immune system, 2nd edition, John Wiley and sons., New Jersey.

AZ 5518- PRINCIPLES OF GENETICS

SEMESTER	:	V	CREDIT	:	04
CATEGORY	:	MC	NO. OF HOURS / WEEK	:	04

Objective: To impart broad knowledge of hereditary mechanisms and variations.

UNIT I: CLASSICAL GENETICS

Mendelian principle - Laws of Mendel – Law of Dominance, Segregation, Independent Assortment , Polygenic inherited - Interaction of genes and modified ratios.

UNIT II : GENETIC MATERIAL

Multiple alleles - genetics of ABO, Rh and MNO blood groups in man – Erythroblastosis - Foetalisis, Inheritance disorder in man: genetic, chromosomal and metabolic disorders.

UNIT III : MICROBIAL GENETICS

Transformation – Transduction – phage – Multiplication – Multiplication of phage in bacteria – Conjugation – RNA structure and function - Linkage - crossing over - Stern's experiment to prove crossing over.

UNIT IV : GENES IN POPULATION

Hardy Weinberg law- Gene frequencies and changes – sex linked genes in humans – Inbreeding and outbreeding – pedigree analysis – human karyotyping & variations - Probability – Introduction and application in genetics.

UNIT V : EUGENICS

Application of genetics principle to plant and animal breeding - cloning – gene therapy - genetic counseling & Planned Genotypes - germ cell storage – artificial insemination and Amniocentesis - Gene manipulation and consequence – Bioethics.



TEXT BOOKS

1. Veer Bala Rastogi, 2010. Genetics, Kedar Nath ram Nath, Delhi.
2. William S. Klug, Michael R. Cummings, Charlotte A. Spencer and Michael A. Palladino. 2012. Concepts of Genetics Plus Mastering Genetics, 10th Edition.
3. Alain Bemhesim Philippe dessen, Jean Lousie. 2011. Atlas of Genetics and Cytogenetic in Oncology and Hematology, Hwet edition.
4. Leland Hartwell, Leroy Hood, Michael Goldberg and Ann Reynolds. 2010. Genetics: From Genes to Genomes (Hartwell, Genetics).
5. Gupta, P.K., 2009. Genetics 3rd Edition Rastogi, Meerut.

REFERENCE BOOKS

1. Mahabal ram, 2010. Cytogenetics and genetics, PHI learning Pvt. Ltd, New Delhi.
2. Robert J. Brooker. 2008. Genetics: Analysis and Principles.
3. Tamari, R.H. 2001. Principles of genetics, McGraw Hill.
4. Sinnott, E.V., Dunn, L. C & Dobzhansky, 1985. Principles of genetics, 5th Edition New Delhi, Tata McGraw hill.
5. Burns, G. W 1980, Science of Genetics: An Introduction to heredity. 4rd Edition New York, Macmillian
6. Winchester, A.M 1966, Genetics: A survey of the principles of heredity. 3rd Edition Oxford & India Book House, New Delhi.
7. Smitha, R and Neelam, P. 2010. Genetic engineering, oxford University press, New Delhi.

AZ 5519 - ANIMAL BIOTECHNOLOGY

SEMESTER :	V	CREDITS	:	04
CATEGORY:	MC	NO. OF HOURS / WEEK	:	04

Objective: To study the influence of biotechnology in the field of animal sciences and to create awareness about the applied aspects of animal biotechnology.

UNIT I: ANIMAL CELL, TISSUE AND ORGAN CULTURE

History of animal cell and organ culture- requirements of animal cell, tissue and organ culture – characteristics of animal cell growth in culture- culture media- natural media-synthetic media-cultivation of animal cell in bioreactors-organ culture techniques-stem cells and applications, technological uses of animal cell culture.

UNIT II: ANIMAL CELLS AND GENE TRANSFER SYSTEM

Methods of transfection - liposomes –viral mediated –electroporation –biolistic –direct DNA injection – micro injection – DNA micro arrays – gene expression synthesis for animal cells.

UNIT III: TRANSGENIC ANIMAL TECHNOLOGY

Concept of transgene and transgenesis – transgenic mammals-knock out mice, sheep, transgenic fishes, - animals as bio reactor , molecular farming . application of molecular markers – important of live stocks.



UNIT IV: ANIMAL BIOTECH AND HEALTH CARE

Production of Hybridoma and microclonal antibodies, human live insulin, RFLP, RAPD, DAN finger printing – Human genome project, DNA diagnostic systems-Gene therapy

UNIT V: ANIMAL BIOTECH AND SOCIETY

Socio ethical problem due to animal genetic engineering – recent trends in animal biotechnology – ethical implications.

TEXT BOOKS

1. Ignacimuthu, S. 2008. Basic biotechnology, Tata McGraw hill, New Delhi.
2. Ranga, M.M. 2003. Animal biotechnology, Agrobios, New Dehi.
3. Ruby, R.C. 2012. A text book of biotechnology , S. Chand company, New Delhi.
4. Sasidhara, R. 2011. Animal biotechnology, MJP publishers.

REFERENCE BOOKS

1. Jayanta, K.P. and Saroj, S.G. 2009. Oxford University press, New Delhi.
2. Peters, p. 2009. Biotechnology – A guide to genetic engineering, WMC brown publisher, UK.
3. Ramawat, K.G et al. 2009. Comprehensive biotechnology, S. Chand company, New Delhi.
4. Veer Bala Rastogi, 2007. Molecular biology, Kedar Nath Ram Nath, Delhi.

AZ 5520 - GENETIC ENGINEERING

SEMESTER :	V	CREDITS	:	04
CATEGORY:	MC	NO. OF HOURS / WEEK	:	04

Objectives: To enhance the knowledge on manipulation of genetic material towards desired, directed and pre determined way.

UNIT I: INTRODUCTION

Basic knowledge of DNA structure and functions, protein structures and functions. Fundamentals of Genetic Engineering - Gene Organization: Gene structure in prokaryotes and Eukaryotes.

UNIT II: BIOLOGY OF GENETIC ENGINEERING

Plasmids and Plasmid biology- Plasmid vectors-Amplification- Hybrid plasmids- Bacteriophage vectors - M13 Bacteriophage – Cosmids-Host cell types: prokaryotic hosts and eukaryotic hosts.

UNIT III: TOOLS AND GENE CLONING STRATEGIES

Nucleases - Endonucleases - Exonucleases - Restriction enzymes - Polymerases – Ligases. Terminal Transferases, Alkaline phosphatases, Polynucleotide kinases – Adaptors and linkers.



Direct Cloning methods – Indirect cloning methods through partial digestion- cDNA cloning- Transformation of hosts – Alternative DNA delivery systems.

UNIT IV: SELECTION, SCREENING AND ANALYSIS OF RECOMBINANTS

Chromogenic substances - insertional-inactivation -Complementaion of defined mutations - Screening using nucleic acid probes -Screening clone Banks -Immunological Screening for expressed genes - Characterizations based on m-RNA -invitro translation -Restriction mapping -Blotting techniques -DNA Screening

UNIT V: APPLICATIONS

Genetic Engineering in Biotechnology Industries - Health care- Agriculture- Environment - Socioethical problems of Genetic Engineering.

TEXT BOOKS

1. Fitch, J.P., 2004. An engineering introduction to Biotechnology, Prentice Hall, New Delhi.
2. Hawkins, J.D., 2005. Gene structure and expression, Cambridge Univ. Press, London.
3. Lohar, P.S., 2005. Biotechnology, MJP, Chennai.
4. Nicholl, S.T., 2005. An introduction to Genetic Engineering, Cambridge Univ. Press, London.

REFERENCE BOOKS

1. Smitha, R and Neelam, P. 2010. Genetic engineering, oxford University press, New Delhi.
2. Thiel, 2002. Biotechnology: DNA to Protein-A Laboratory project, Tata Mc Graw Hill. New Delhi.

AZ 5521 – MOLECUALR BIOLOGY, GENETICS AND BIOTECHNOLOGY LAB COURSE

SEMESTER :	V	CREDITS	:	04
CATEGORY:	MC	NO. OF HOURS / WEEK	:	04

Objectives: To provide hands on training in cellular and molecular techniques and correlate functional significance and inter dependence of Cytogenetics.

UNIT I: TECHNIQUES IN CELL BIOLOGY

Micrometry- Stage and Ocular micrometer - Camera Lucida.

Mounting of buccal epithelium and observing living cells using vital staining.

Blood Smear preparation - Differential Count of WBC.

Simple Mendelian traits in man, law of independent assortment

Counting of RBC and WBC using Haemocytometer (Demonstration only)

Culturing of chicken fibroblast / culturing of mouse fibroblast cells, production of hybridoma.

UNIT II: MOUNTING TECHNIQUE

Mitosis in Onion root tip squash preparations

Meiosis in grasshopper testis squash

Human ABO blood grouping & Rh typing.

UNIT III: MOLECULAR TECHNIQUES

Isolation of immunoglobulin by ammonium sulphate precipitation method obtaining immunoglobulin concentrates by dialysis method.

Isolation of genomic DNA of Eukaryotes/ Bacteria(Plasmid)

Quantification of human DNA

Estimation of DNA –Polyrylamine method (Demonstration)

UNIT IV: CHROMOSOME AND KARYOTYPING

Karyotyping - identification of chromosome abnormalities

Mounting of the giant chromosomes of chironomous larva (salivary gland)

UNIT V: MICROTECHNIQUES

Study of prepared slides of histology

- | | | |
|------------------------------|------------------------|--|
| a) Columnar Epithelium | b) Ciliated Epithelium | c) Glandular Epithelium |
| d) Areolar Connective tissue | e) Cartilage T.S. | f) Bone T.S. g) Cardiac muscle |
| h) Striated muscle | i) Non striated muscle | j) Nervous tissue k) Ovary T.S. l) Testis T.S. |

Agrose Gel Electrophoresis system, Southern blotting technique, PCR technique, MABs production, Dolly the mammalian clone, Vaccine production, DNA sequencing system, DNA finger printing.

TEXT BOOKS

1. Durairaj, G. 1998. Laboratory manual in genetics, Emerald publishers.
2. Gowenlock, R. 2001. Varkey's Practical clinical biochemistry, CBS press, New Delhi.
3. Mukhopadhyay, S.N. 2007. Experimental process biotechnology protocols, Viva book, New Delhi.
4. Yadav, P.R., and Tyagi, R. 2005. Experimental biotechnology discovery, New Delhi.



REFERENCE BOOKS

1. Old and Primerose, 2001. Principles of Gene Manipulation techniques, Blackwell Science
2. Marimuthu, p. 1995. Practical geneties, IBMS. Edward Gasque, 1992. A manual of laboratory experiments in cell biology University of Wisconsin, Brown, Wisconsin.

AZ 6603- ENVIRONMENTAL BIOTECHNOLOGY

SEMESTER :	VI	CREDITS	:	08
CATEGORY:	MS	NO. OF HOURS / WEEK	:	06

Objectives: To describe and discuss the application and role of biotechnology in conceiving and protecting the environment. To understand the commercial aspects of Environmental Biotechnology.

UNIT I: INTRODUCTION

Important areas of Environmental Biotechnology – Waste treatment – Biomass as source of energy - waste as renewable source of energy, Biocomposition of wastes, sources of wastes (Industrial, agricultural, forestry, municipal source) Biomass Concretion; Production of SCP, Non biological Process, Direct Combustion – hog fuel ; Dialysis, classification, Biological Process, Energy manifestation, Aerobic & Anaerobic Digestion. Biotechnology of the marine environment.

UNIT II: BIO-ENERGY

Energy plantations – petro plants, algal hydrocarbons, bioethanol production, Biogas –Biogas technology in India, Advantages of Biogas plants, Biogas production, Anaerobic Digestion, Solubilization, Acidogenesis, Methanogenesis, Methanogases . Biohydrogen fuel and its advantages.

UNIT III: BIO-REMEDIATION

In situ Bioremediation, Ex situ Bioremediation, Solid phase system, scenery based system, Bioremediation of Industrialists of hydrocarbons, Bioremediation of Industrialists in paper and pulp industry, Bioremediation of heavy metals – metal biosorption technology , Bioremediation of coal wastes through VAM fungi, Bio remediation of Xenobiotics

UNIT IV : DEGRADATION OF WASTES AND MICROBES

Definition of xenobiotics, Gene manipulation of pesticides degrading microorganisms, Bio Augmentation, Biofiltration, Microorganisms used in biofilters, Mechanism of biofiltration microbial denitrification, Bioleaching, microorganisms used in bioleaching – Direct and indirect leaching method, copper leaching, uranium leaching, gold leaching, silica leaching, Ecological Impacts of GMMS (Genetically modified Microorganisms)

UNIT V: BIOREACTORS AND ENVIRONMENTAL ENGINEERING

Design of Bioreactors: Reactors types, Batch reactors, Continues reactions - Uses of Bio Reactors.



TEXT BOOKS

1. Allan S Cragg, 2010. Environmental Biotechnology, Oxford University Press.
2. Bhatia, S.C. 2011. Hand Book of Environmental Biotechnology, Atlantic Publishers Ltd. New Delhi.
3. Eugemia et al, 2008. Environmental Biotechnology and cleaner Bio Process, Tylor & Francis London, UK.
4. Rittmann. B.E and Parl Mecarty. 2001. Environmental Biotechnology, Principles and applications. McGraw Hill, New york.
5. Bimal, C. B adm Rintu , B. 2010. Environmental biotechnology, Oxford University press, New Delhi.
6. Alan Scragg, 2010. Environmental biotechnology, Oxford University press, New Delhi.

REFERENCE BOOKS

1. Ahmed, N. F.M. Qureshi and Q.Y. Khan. 2001. Industrial Environmental Biotechnology, Horizon Press.
2. Ramesh, K.V. 2005. Environmental Microbiology, MJP Publishers, Chennai.
3. Rema, L. P. 2006, Applied Biotechnology, MJP Publishers, Chennai.

AZ 6604 - BIOINFORMATICS

SEMESTER :	VI	CREDITS	:	08
CATEGORY:	MS	NO. OF HOURS / WEEK	:	06

Objectives: To provide biologically important predictions from annotated data and transformation of these data for genome / gene / DNA analyses.

UNIT I: Overview of bioinformatics- Biological databases and sequence analysis - searching the databases - History of Internet - Database Management System.

UNIT II: Introduction to database – Database search – Algorithms issues in databases search – sequence database search - FASTA – BLAST – Amino acid substitution matrices PAM and Blossum

UNIT III: DNA mapping and sequencing – Map alignment – Large scale sequencing and alignment – shotgun – DNA sequencing – Sequence assembly – Gene predictions – Molecular predictions with DNA strings.

UNIT IV: Parsimony – ultra metric problem – perfect phylogeny – phylogenetic alignment – connection between multiple alignment and tree construction.

UNIT V: Common multiple alignment methods – strings – edit distance between two strings – string similarity – local alignment gaps – parametric sequence alignment – multiple alignment.

TEXT BOOKS

1. Baldi, P. and S. Brunak, 1988. Bioinformatics: A Machine Learning Approach, MIT Press.
2. Harshawardhan, P.B. 2007. Bioinformatics - Principles and Applications - Tata Mc Graw Hill, New Delhi.
3. Mount, D. W., 2001. Bioinformatics - Sequence and genome analysis. Cold Spring Harbor.

REFERENCE BOOKS

1. Cynthia, G. and Jambeck, P. 2001. Developing Bioinformatics Computer Skills, Shroff, Mumbai.
2. Dan Gusfield, 1997. Algorithms on Strings Trees and Sequences, Cambridge Univ. London.
3. James D. Tisdall, J.D. 2001. Beginning Perl for Bioinformatics, Shroff, Mumbai.

AZ 6605 - FACETS OF BIOETHICS

SEMESTER :	VI	CREDITS	:	04
CATEGORY:	MS	NO. OF HOURS / WEEK	:	03

***Objectives:** To evaluate the most controversial scientific discoveries of the recent times and to analyse issues on biosafety and human rights*

UNIT I: INTRODUCTION TO BIOETHICS AND HUMAN RIGHTS

Ethics –Bioethics – positive effects – negative effects- ethics in Biotechnology- Historical development of human rights - UN Commission for human rights - Civil and political rights - Article 21 of Indian constitution - Ethics: concept and general implication.

UNIT II: ENVIRONMENTAL ETHICS

Ethical issues on industrial & urban environment: Xenobiotics and biomagnifications - Environmental protection: laws and legislations - Bhopal gas tragedy- Sardar sarovar narmadha project- NGOs - Global warming- Kyoto protocol-Climate change.

UNIT III: MICROBIAL TECHNOLOGY AND ETHICS

Genetics engineering and genetically modified microbes - Patenting genes, gene sequences and whole organisms - Microbes as biological weapons - Accidental release of GMO's

UNIT IV: ETHICAL IMPLICATIONS OF ANIMAL BIOTECHNOLOGY

DNA Technology: gene cloning and bioethics - Containment facilities for genetic engineering experiments - Regulations on laboratory and field experiments - Labelling of GM Foods - Human:



artificial insemination- in vitro fertilization and embryo transplants- surrogate motherhood and womb leasing- freezing germ cells and human embryos – pre natal diagnosis- gene therapy – human genome project – human cloning - Pharmacogenetics and health care products - Legislations and biosafety.

UNIT V: ETHICS IN CLINICAL TRIALS AND GOOD CLINICAL PRACTICE

Clinical trial, good clinical practice (GCP) – history of clinical trials –phases of clinical trials – institutional set-ups for conducting clinical trials – regulation and approval – ethics in clinical trials. National good laboratory practice (GLP) programme – GLP authority functions- quality standards for clinical trials.

TEXT BOOKS

1. ACRE, 2003. A report of advisory committee on release of genetically modified organisms to the environment, UK.
2. Lohar, P.S. 2005. Biotechnology, MJ, Chennai
3. Shaleesha A. Stanley, 2008. Bioethics, Wisdom Educational Service, Chennai.

REFERENCE BOOKS

1. Anon, 1993. Report to the committee on ethics of genetics modifications and food use, HMSO Publishing, London.
2. Ignacimuthu S, 1995. Basic Biotechnology. Tata McGraw-Hill, New Delhi.
3. Saha, T.K. 2010. Ecology and Environmental biology, Books and allied, Kolkata.

AZ 6651 - POULTRY AND DAIRY SCIENCE

SEMESTER :	VI	CREDITS	:	15
CATEGORY:	SK	NO. OF HOURS / WEEK	:	15

Objectives: To study the importance and application of poultry and dairy for the betterment of human livelihood, and to provide practical knowledge on poultry and dairy farming.

UNIT I: POULTRY INDUSTRY

Poultry industry in India - Poultry for sustainable food production and livelihood - Commercial poultry farming - Nutritive value of egg and meat- Broiler management (Definition; Housing and equipment; Brooding, feeding and health cover of broilers; Record keeping; Broiler integration) - Layer management (Brooder; Grower and layer management; Culling of layers; Marketing of eggs and meat).



UNIT II: QUAIL AND TURKEY

Quail and Turkey management (Management; Feeding; Health cover; Marketing Strategy) – Backyard Poultry Farming in India: Management- Women in backyard poultry farming.

UNIT III: DAIRY FARMING

Dairy farming - Breeds of dairy cattle's – Draft breeds – Dairy breeds – Dual purpose breeds – exotic breeds – breeding – Cross breeds – artificial insemination programme – Dairy cattle management – housing – water supply – cattle nutrition feeding standards – breeding and cattle improvement programmes in India – bacterial , viral and fungal diseases of cattle.

UNIT IV: DAIRY TECHNOLOGY

Dairy Technology - Composition of milk – milk and milk spoilage – pasteurization – Milk production in India – Processing of milk products (cream – butter – ghee – ice cream – khoa – butter milk) – Public health importance of milk.

UNIT V: LAB AND FIELD WORK

Poultry : Identification of the common breeds of fowl - Poultry housing and equipment - Incubation : Collection and storage of hatching eggs – Incubation period – Operational requirement – Fumigation – Hatchery sanitation – Causes of low hatchability and sexing – Debeaking and Deworming - Vaccination and medication programme for broilers and layers - Culling of layers - Biosecurity and disease management - Internship programme at Institute of Poultry Production and Management (IPPM), TANVASU, Madavaram - Project – Record.

Dairy: Modern dairy farm - Judging of dairy cattle and buffaloes – determination of specific gravity of milk- Determination of fat in milk - Preparation of cream – visiting Loyola Cattle farm – project – internship programme at central cattle breeding farm, Alamathi – Record.

TEXT BOOKS

1. Eckles C.H. and E.L. Anthony, 2001 Dairy Cattle and milk production, Biotech.
2. John William S. 2003. Poultry for Sustainable Food production and Livelihood. Loyola Publication, Chennai,
3. Sukumar, D.E. 2002 Outline of Dairy Technology, Oxford Uni, New Delhi.
4. Tomar, B.S and Neera Singh. 2003. Applied Zoology, Emkay publications, Delhi.

REFERENCE BOOKS

1. Banerjee G.C., 1992. Poultry, Oxford and IBH, New Delhi.
2. ICAR, 1997. Handbook of Animal Husbandary– The Indian Council of Agricultural Research, New Delhi
3. Prabakaran, R. 1998.Commercial Chicken production. published by P. Saranya, Chennai.
4. Revives P.M. and Henderson, 1969 Dairy Cattle Feeding and Management Wiley Eastern, New Delhi.
5. Rangappa, K.S and Achaya, K.T. 1974. Indian Dairy products, Asia publisher, Bombay.