

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

**M.Sc Zoology**

Restructured CBCS curriculum Phase IV effective from 2012-'13

<b>SEMESTER - III</b>		<b>CATEGORY</b>	<b>HR</b>	<b>CR</b>	<b>TOTAL Hr (Cr)</b>
ZO 3813	Principles of Ecology and Environmental Management	MC	5	4	
ZO 3814	Research Methodology	MC	4	3	
ZO 3815	Biochemistry and Animal Physiology	MC	6	5	
ZO 3816	Environmental Biology, Biochemistry and Physiology Lab course	MC (P)	5	3	30 Hr (23+2Cr)
ZO 3950	Genomics, Metagenomics and Epigenetics (Or)	ES	4	3	
ZO 3951	Fishery biology	ES	4	3	
ZO 3876	Bio-products and Marketing	ID	6	5	
	<b>Self study (SSP)</b> Outside class hours			2	
<b>SEMESTER - IV</b>					
ZO 4810	Project and Dissertation	P	14	10	
ZO 4811	Microbiology	MC	4	4	30 Hr
ZO 4812	Biotechnology	MC	4	4	(24Cr)
ZO 4813	Molecular Endocrinology and Reproduction	MC	4	3	
ZO 4814	Microbiology, Biotechnology and Endocrinology Lab course	MC (P)	4	3	

# ZO 3813 - PRINCIPLES OF ECOLOGY AND ENVIRONMENTAL MANAGEMENT

SEMESTER : III  
CATEGORY : MC

CREDIT : 04  
NO. OF HOURS / WEEK : 05

*Objectives: This core paper has been designed to impart the existing natural resources of India, their preservation and conservation plans.*

## UNIT I: ECOLOGICAL PRINCIPLES

Introduction to ecology, evolutionary ecology, environmental concepts – laws and limiting factors, ecological models. Characteristics of population, population size and exponential growth, population dynamics, fertility rate and age structure. Competition and coexistence, intra-specific and inter-specific interactions, scramble and contest competition model, mutualism and commensalism, prey-predator interactions. Nature of ecosystem, production, food webs, energy flow through ecosystem, biogeochemical cycles, resilience of ecosystem, ecosystem management. Biosphere, biomes and impact of climate on biomes.

## UNIT II: THE ENVIRONMENT

Physical environment; biotic environment; biotic and abiotic interactions. Habitat and niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche. Population ecology: Characteristics of a population; population growth curves; population regulation; concept of metapopulation, age structured populations. Species interactions, Community ecology, Ecological succession, Ecosystem.

Environmental pollution; global environmental change; biodiversity-status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. Conservation Principles, major approaches and conservation management strategy.

## UNIT III: ENVIRONMENTAL STRESSES AND THEIR MANAGEMENT

Global climatic pattern, global warming, atmospheric ozone, acid and nitrogen deposition, coping with climatic variations. Major classes of contaminants. Uptake, biotransformation, elimination and accumulation of toxicants. Factors influencing bioaccumulation from food and trophic transfer. Pesticides and other chemical in agriculture, industry and hygiene and their disposal. Impact of chemicals on biodiversity. Bioindicator and biomarkers of environmental health. Biodegradation and bioremediation of chemicals. Biodiversity – assessment, conservation and management, biodiversity act and related international conventions.

## UNIT IV: MANAGEMENT OF ECOSYSTEMS

Remote sensing as a tool: physical basis - information extraction – role in ecological research, Environmental auditing, Environmental impact assessment, Biotechnological principles and environmental management.

## UNIT V: AGENCIES OF ENVIRONMENTAL CONSERVATION

Green peace movement - Chipko Movement - nuclear disarmament, Role of government agencies: Central and State Pollution Control Boards - Ministry of Environment and Forests – National Biodiversity Authority - National Environment. Awareness Programme, NGOs, Natural Disaster Management,

Legislations for environmental Protection, Biovillages – sustainable utilization and development, Environmental ethics.

---

### TEXT BOOKS

1. Asthana, D.K. and Meera, A. 2009. A text book of environmental studies, S. Chand , New Delhi.
2. Grant, W.E. and Swannack, T.M., 2008, Ecological Modelling, Blackwell.
3. Odum E.P.1983. Basic Ecology, Saunders, New York
4. Southwood, T.R.E. 2004. Ecological Methods, Chapman and Hall, London, 250pp
5. Wilkinson, D.M., 2007, Fundamental Processes in Ecology: An Earth system Approach, Oxford University Press, UK.

### REFERENCE BOOKS

1. Rajagopalan, R. 2005, Environmental Studies: From Crisis to Cure, Oxford Univ. press, New Delhi
2. Saha, t.K. 2010. Ecology dan Environmental bilogy, Books and Allied, Kolkata.
3. Sanyal, K. Kundu, M. and Rana, s. 2009. Ecology and environment, Books and allied, Kolkata.
4. Satyanarayana, U., 2005, Biotechnology, Books and Allied, Kolkata.
5. Vesilind P.A. and Pierce, J. 1982. Environmental engineering Callingwood, Allarbor Science.

## ZO 3814- RESEARCH METHODOLOGY

<b>SEMESTER</b>	<b>:</b>	<b>III</b>	<b>CREDIT</b>	<b>:</b>	<b>03</b>
<b>CATEGORY</b>	<b>:</b>	<b>MC</b>	<b>NO. OF HOURS / WEEK</b>	<b>:</b>	<b>04</b>

**Objective:** To introduce the basic facets of scientific research and understand the essential requirements of a research problem and latest tools available to achieve desired results.

### UNIT I: INTRODUCTION TO SCIENTIFIC RESEARCH

Definition, basic and applied research, interdisciplinary research, Literature Review - Research reading, discriminative reading, consulting source material, reference cards, primary and secondary literature, Biological abstract, Current Content, Review, Monographs, peer reviewed journals, e-resources, digital library, electronic research tools, bibliography software.

### UNIT II: LABORATORY SAFETY

Biohazards, risk groups, bio-safety levels, laboratory acquired infections, routes of exposure, safety measures, good laboratory practices, biohazardous wastes, types of hazards, bioethics, safety of lab animals.

### UNIT III: EXPERIMENTAL DESIGNS AND ANALYSIS

Observation, hypothesis designing, experimental unit, field survey and questionnaire, sampling unit, experimental error, generalization, controls, randomization, statistical software and analysis: hypothesis testing, Chi square test, LC<sub>50</sub> value, Probit analysis, ANOVA, Regression and Correlation coefficients.

## UNIT IV: RESEARCH REPORT

Literature citation, components of a research report, use of tables and figures, preparation of photographs and microphotographs, formatting and requirements for manuscript preparation.

## UNIT V: INTELLECTUAL PROPERTY RIGHTS

Patent, copy right, trademarks, designs, trade secrets, traditional knowledge, biopiracy, National Biodiversity Authority - acts and regulations, indigenous technology, biodiversity and benefit sharing, Research project proposal preparation - funding agencies and thrust areas.

---

## TEXT BOOKS

1. Gurumani, N 2009. Research Methodology for Biological sciences, MJP Publishers, 753pp.
2. John W. Creswell, 2011. Research Design, Sage, 260pp.
3. Kothari C. R. 2009. Research Methodology: Methods and techniques, New Age International, 401pp.

## REFERENCE BOOKS

1. Dwiredi R. S. 1997. Research Methods in Behavioural Sciences, Mac Millan, 256pp.
2. Southwood, T.R.E. 2004. Ecological Methods, Chapman and Hall, London, 250pp.

## ZO 3815- BIOCHEMISTRY AND ANIMAL PHYSIOLOGY

SEMESTER	: III	CREDIT	: 05
CATEGORY	: MC	NO. OF HOURS / WEEK	: 06

*Objective : To understand the biochemical processes in animal physiology.*

### UNIT I: ENZYMES

Definition of Enzymes, Classification of enzymes, mechanism of enzyme action, Michaelis-Menton reaction, enzyme inhibitors.

### UNIT II: ANABOLISM

Anabolism – biosynthesis: Carbohydrates: central pathway, bypass reactions, gluconeogenesis, glycogenesis. Lipids – Mitochondrial synthesis of fatty acids, non-mitochondrial synthesis of fatty acids, synthesis of triglycerides, synthesis of phospholipids, synthesis of cholesterol, errors in lipid metabolism.

### UNIT III: CATABOLISM AND INTEGRATION OF BIOMOLECULES

Catabolism: Carbohydrates – glycolysis, TCA cycle, HMP pathway, glycogenolysis, energetics of the cycles. Proteins – overview of protein catabolism – Transamination, deamination, fate of ammonia and carbon skeleton, urea cycle. Lipids – mobilization of fats from dietary intake. Break down of fatty acid and cholesterol.

Integration of biomolecules - intermediary metabolites – phosphorylation, types, biological oxidation, energy rich compounds – oxidative phosphorylation.

#### **UNIT IV: BODY MECHANISM**

Systems of circulation, Peripheral circulation, Regulation of heart beat and blood pressure, Transport and exchange of gases, Neural and chemical regulation of respiration, Gas transfer in air and water, Gas exchangers, Circulatory and respiratory responses to extreme conditions, Acid –base balance, Regulation of body pH.

Osmoregulation in aquatic and terrestrial environments, Kidney functions, Extra-renal osmoregulatory organs, Patterns of nitrogen excretion. Thermoregulation - Heat balance in animals, Adaptations to temperature extremes, Aestivation and hibernation, Counter current heat exchangers. Adaptations to Stress- Basic concept of environmental stress.

#### **UNIT V: SENSING THE ENVIRONMENT**

Photoreception, chemoreception, mechanoreception, echolocation, Endogenous and exogenous biological rhythms, Chromatophores and bioluminescence.

Feeding mechanisms and their control, effect of starvation. Muscle physiology – striated and smooth muscle, Adaptations of muscles for various activities, Neuronal control of muscle contraction, Electric organs.

---

#### **TEXT BOOKS**

1. Ambika Shanmugam 1974. Fundamentals of Biochemistry for Medical Studies. Second Edition (Revised), Aries Agencies, Chennai, pp.647.
2. Jain, L.L. Sunjay Jain & Nitin Jain. 2005. Fundamental of biochemistry, S. Chand and Company Ltd., New Delhi, pp.1230.
3. Lehninger, A. L. 2006. Biochemistry, Freeman, New York.
4. Satyanarayana, U and Chakrapani, 2008. Fundamentals of chemistry, Books and allied, Kolkata.
5. Shanmugam, A, 1990. Fundamentals of Biochemistry, Shanmugam, Chennai.

#### **REFERENCE BOOKS**

1. Dantzler, W.H. Comparative Physiology (Handbook of Physiology), Dantzler, W.H. (ed.) Oxford University Press, New York, USA.
2. Devesena, T. 2010. Enzymology, Oxford University press, New Delhi.
3. Nicholas, C.P. and lewis, S. 2010. Fundamentals of Enzymology, Oxford University press, New Delhi.
4. Stryer, L, 1988. Biochemistry. 3<sup>rd</sup> Edition. Freeman.
5. West, Edward Staunton, Todd Wilbert R. Mason Howard, S. and Bruggen John T. Van. 1974. Textbook of biochemistry Amerind Publishing Co. Pvt. Ltd, New Delhi, pp.1595.

## ZO 3816 – ENVIRONMENTAL BIOLOGY, BIOCHEMISTRY AND PHYSIOLOGY LAB COURSE

SEMESTER : III  
CATEGORY : MC (P)

CREDIT : 03  
NO. OF HOURS / WEEK : 05

***Objective:** To provide hands on training in designing and experimenting problems in environmental biology, biochemistry and physiology.*

### UNIT I: ENVIRONMENTAL BIOLOGY

Estimation of Dissolved oxygen, Salinity, Nitrites, Phosphates, Calcium and Alkalinity in water samples.  
Analysis of Industrial effluent - TDS, TSS, BOD, (COD - Demonstration).  
Collection, isolation and identification of marine and fresh water plankton.  
Study of sandy, muddy and rocky shore fauna with special reference to their adaptation.  
Animal Association - parasitism, mutualism and commensalism.

### UNIT II : BIOCHEMISTRY

Buffer preparation and determination of pH.  
Enzyme kinetics: Salivary amylase and Maltose standards: influence of enzyme concentration, time course, pH, temperature, substrate concentration (Lineweaver Burk Plot) on enzyme activity.  
Quantitative estimation of glucose, protein, cholesterol, urea and creatinine in the serum of goat.

### UNIT III: PHYSIOLOGY OF ANIMALS

Oxygen Consumption in an aquatic animal  
Salt loss and salt gain in fish  
Estimation of Proteins, Carbohydrates and Lipids in the tissues of Fish

### UNIT IV: BLOOD ANALYSIS

Effect of Insulin and Adrenalin on Blood Glucose level  
Blood Clotting Time, Bleeding Time  
Estimation of Haemoglobin and ESR.

### UNIT V: SPOTTERS

Principles and application of spectrophotometry or colorimetry, electrophoresis, centrifuge, Chromatography.  
Principle and Application of Sphygmomanometer, Kymograph.  
Haemoglobinometer, ESR

## TEXT BOOKS

1. Asthana, D.K. and Asthana, M.2001. Environmental Problems and Solutions. S. Chand , New Delhi.
2. Alpha Soli, I. Arceivala.1998. Wastewater treatment for pollution control, Tata McGraw Hill, New Delhi

## REFERENCE BOOKS

1. Ambika Shanmugam. 1974. Fundamentals of Biochemistry for Medical Studies. Second Edition, Aries Agencies, Chennai, pp.647.
2. Odum. E.P. 1996 Fundamentals of Ecology. Nataraj Publishers, Dehra Dun.
3. West, Edward Staunton, Todd Wilbert R. Mason Howard, S. and Bruggen John T. Van. 1974. Textbook of biochemistry Amerind Publishing Co. Pvt. Ltd, New Delhi, pp.1595.

## ZO 3950 - GENOMICS, METAGENOMICS AND EPIGENETICS

SEMESTER : III  
CATEGORY : ES

CREDIT : 03  
NO. OF HOURS / WEEK : 04

*Objective: This paper gives a current knowledge about gene, genomics, metagenomics and epigenetics.*

### UNIT I: GENOMICS

Organization and structure of genomes - size, complexity, gene-complexity, architecture of mitochondrial genome, organization and nature of nuclear DNA in eukaryotes; transposable elements, pseudogenes, segmental duplications.

Mapping genomes - physical maps, EST, SNPs as physical markers, radiation hybrids, FISH, optical mapping, gene maps, integration of physical and genetic maps; sequencing genomes: recognition of coding and non-coding regions and annotation of genes, quality of genome-sequence data, base calling and sequence accuracy.

### UNIT II: BIOINFORMATICS

Bioinformatics - datasets, sequence analysis based on alignment, *de novo* identification of genes, *in silico* methods. Comparative genomics - orthologs and paralogs, protein evolution by exon shuffling; human genome project.

Large scale mutagenesis and interference - genome wide gene targeting; systematic approach, random mutagenesis, insertional mutagenesis, libraries of knock-down phenocopies created by RNA interference; transcriptome analysis, DNA micro-array profiling, data processing and presentation, expression profiling, proteomics - expression analysis, protein structure analysis, protein-protein interaction.

### UNIT III: METAGENOMICS

Introduction - from genomics to metagenomics, history of the culture divide, 16S rRNA analysis and culturing, culture independent insight, global impact of metagenomics; next generation of DNA sequencing technologies and potential challenges, the developments and impact of 454 and Solexa sequencing. Pioneering projects in metagenomics - acid mine drainage project, Sargasso sea metagenomics survey and community profiling, the soil-resistome project, human-micro biome project.

### UNIT IV: METAGENOMICS AND ENVIRONMENT

Ecological inference from metagenomics - symbiosis, competition and communication; metagenomics of soil and soil health; microbial community - genomics in ocean; application of metagenomics - technical advancement in the field, application and expected benefits from large scale metagenomics data, application in human health, agriculture, industry and environment remediation.

### UNIT V: EPIGENETICS

Epigenetics - from phenomenon to field, a brief history of epigenetics - overview and concepts; chromatin modifications and their mechanism of action, concept of 'histone-code' hypothesis, epigenetics in *saccharomyces cerevisiae*, position effect variegation, heterochromatin formation, and gene silencing in *Drosophila*, fungal models for epigenetic research: *Schizosaccharomyces pombe* and *Neurospora crassa*; epigenetics of ciliates; RNAi and heterochromatin assembly, role of noncoding RNAs.

Epigenetics: DNA methylation in mammals, germ line and pluripotent stemcells , epigenetic control of lymphopoiesis, nuclear transplantation and the reprogramming of the genome. epigenetics and human disease, epigenetic determinants of cancer.

---

### TEXT BOOKS

1. David C. Allis and Thomas Jenuwein. 2007. Epigenetics. Cold Spring Harbor Laboratory Press, New York, USA.
2. Nature Publishing Group, 2010. Next generation DNA sequencing. Cold Spring Harbor Laboratory Press, New York, USA.
3. Primrose, S. B. and Twyman R. M. 2006. Principle of Genome Analysis and Genomics, Blackwell Publishing Company, Malden, USA.

### REFERENCE BOOKS

1. Brown, T. A., 2005. Genomes 3, Garland Science Publishing, London, UK.
2. Metagenomics: Sequence from the Environment, NCBI.
3. Mount, D. W., Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, New York, USA.
4. The New Science of Metagenomics: Revealing the secrets of our microbial planet, Academic press, Washington DC, USA.
5. Watson, JD. 2004. Molecular Biology of Gene, Pearson Education, Delhi, India.



## ZO 3951- FISHERY BIOLOGY

SEMESTER : III  
CATEGORY : ES

CREDIT : 03  
NO. OF HOURS / WEEK : 04

**Objective:** This subject gives the indepth knowledge about fishes and fish farming

### UNIT I: INTRODUCTION OF FISH

Definition – salient features of the fishes- classification –Berg’s classification-evolution and phylogeny of fishes –locomotion – locomotion due to the movement of appendages –general principles of locomotion-types of locomotion –special modes of locomotion –migration in fishes: advantages of fish migration – Factor influencing fish migration – types of migration

### UNIT II: DIGESTION, GILL RESPIRATION, RESPIRATORY ORGANS

Food and feeding - food quality – alimentary canal – digestive glands – physiology of digestion – adaptive modifications in digestive tract of fishes – types of gills – structure of gill – specialized cells of gills of fishes –mechanism of gill respiration –Air bladder and Weberian apparatus – function of air bladder – Weberian ossicles – function of weberian apparatus.

### UNIT III: SPECIALIZED ORGANS IN FISHES

Light producing organs: nature of light producing organs location – categories of light producing organs - regulation of light emission in fishes - mechanism of light production from luminous organs – Biological significance of luminescence in fishes.

Electric organs in fishes: Nature, source and origin of electric organs in fishes – location and general structures of electric organs – functioning mechanism of electric organs - function of electric organs. Sound producing organs: sonic mechanism in various fishes – significance of sound production in fishes. Poison glands in fishes: poisonous and venomous fishes – division of poisonous fishes – chemical nature of fish toxins.

### UNIT IV: LARVIVOROUS FISHES, PATHOLOGY AND ECONOMIC IMPORTANCE

Essential characters of larvicidal fish – larvicidal fishes in India – sign of sickness in fishes – nutritional diseases, intrinsic diseases, and diseases caused by pathogens and parasites – food value – fish by products.

### UNIT V: PRAWN FISHERY, FISH FARMING AND CAGE CULTURE

Food and feeding of prawn - types of prawn fishery - prawn culture - freshwater and marine prawn culture - export of prawn - pollutional impacts of prawn fishery - advantages of fish culture in cages – limitation of fish culture in cages – principle and scope of integrated fish farming.

---

### TEXT BOOKS

1. Gupta, S.M., 2010. Text book of fishery, Ann Backer, Mumbai.
2. Hanifa, M.A. 2011. Aquatic resources and aquaculture, Dominent, New Delhi.
3. Kamaleshwar Pandey and shukla , J.P. 2010. Rastogi publications, Meerut.
4. Pandey and Shukla. 2010. Fish and Fisheries, Rastogi publications , Meerut.

5. Parihar, R.P. 1996. A text book of fish biology and Indian fisheries, central publishing house, Allahabad, India

### REFERENCE BOOKS

1. Govindan, T.K. 1985. Fish processing, technology, Oxford University, Delhi.
2. Jhingran, V. G. 1982. Fish and fisheries of India, Hindustan publications, India.
3. Shailendra Ghosh, 2009. Fisheries and aquaculture management, Adhyayan, New Delhi.
4. Wikolsky, G.V. 1963. The ecology of fishes, academic press, London.

## ZO 3876 - BIOPRODUCTS AND MARKETING

SEMESTER : III  
CATEGORY : ID

CREDIT : 05  
NO. OF HOURS / WEEK : 06

*Objective: To enable students to appreciate the science behind aquaculture farming and poultry farming and to help students to the production and marketing practices for bio-products.*

### UNIT I: DAIRY PRODUCTS

Dairy products – special milks – cream – butter – ice cream – cheese – condensed milks – dried milks – dried milk products – Indian dairy products

### UNIT II: BIOPRODUCTS OF TERRESTRIAL ANIMALS

Apiculture and honey production – sericulture and silk production – poultry production – eggs and meats.

### UNIT III: BIOPRODUCTS OF AQUATIC ANIMALS

Production of prawn – Fish and Fish products – Food of culturable fishes – fishing methods – fish preservation - Pearl production – Harvesting of pearls

### UNIT IV: MARKETING AND MARKETING PROCESS OF BIOPRODUCTS

Definition of marketing and marketing management –marketing process –evolution – marketing plan – marketing mix- relationship building – branding – customer retention strategies.

### UNIT V: BIO-PRODUCTS MARKETING

Environment – market size – segmentation – using modern techniques – pricing – budgeting – market research – media- market maths – institutional support – promotion boards – events management – social responsibility.

---

### TEXT BOOKS

1. Kotler, P., Armstrong, G., Agnihotri, Y.P., Ehsan, U.H., 2009. Principles of marketing – A south Asian perspective, Pearson.
2. Sukumar, D.E. 2002 Outline of Dairy Technology, Oxford Uni, New Delhi.

## REFERENCE BOOKS

1. Henricksons, R.L. Meat, Poultry & Sea Food Technology
2. Lawrie, R.A. Meat Science by Pergamon Press.
3. Mountney, G.J. Poultry Products Technology
4. Parkhurst & Mountney. Poultry Meat and Egg Production
5. Toman, B. S. and Nerra Singh, 2003. Applied biology.

## ZO 4811 - MICROBIOLOGY

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

*Objectives: To study the microorganism in various types, molecular and applied oriented microorganism.*

### UNIT I: INTRODUCTION

Fundamentals of microbiology-History and scope of microbiology, The origin of Microbial life - Theory of spontaneous generation. Pasteurs's Tyndall experiments fermentation studies. Whittackers five kingdom classification- prokaryotic cellular organization- methods for studying microorganisms.

### UNIT II: MICROBIAL STRUCTURE AND ORGANISATION

Anatomy of prokaryotes - cell wall, cytoplasmic membrane, cilia flagella capsule, cytoplasmic inclusions, sporulation. Organization and structure of microorganism, microbial nutrition and growth-cellular metabolism- generation of cellular energy and biosynthesis of macromolecules – energy release.

### UNIT III: MICROBIAL AND MOLECULAR GENETICS

Gene structure & organization- DNA and RNA as genetic material - replication and expression – mechanism of genetic variation- bacterial conjugation –DNA transmission – transduction – Organization & functioning of prokaryotic genome plasmids -DNA repair and recombination.

### UNIT IV: MICROORGANISM AND HUMAN DISEASES

Pathogenicity of microorganism – epidemiology of infectious disease – human disease caused by virus, prions, bacteria, fungi and protists-prevention. Sterilization - methods of sterilization and Disinfection. Antimicrobial chemotherapy - tests for sensitivity to antimicrobial agents- Non specific (innate) resistance at the immune response.

### UNIT V: MICROBIAL APPLICATIONS

Microbial ecology – microorganism in marine, freshwater, terrestrial environment – microbial interactions – microbiology of food – applied and industrial microbiology

---

## TEXT BOOKS

1. Crueger and Crueger, 2004. A text book of industrial Biotechnology, Panima publishers (Singapore) corporation, New Delhi.

- Dubey R.C. & Maheshwari, D.K. 2009. A text book of Microbiology, S. Chand & company Pvt. Ltd, New Delhi.
- Prescott, Harley and Klein's, 2008. Microbiology, 7<sup>th</sup> edition, Tata McGraw Hill international edition, Page 1-1086.

#### REFERENCE BOOKS

- Jeffrey C. Pommerville, 2006. Alcamo's fundamental of microbiology, Jones and Barlett, Boston.
- Pelzar, M.J. and Chan ECS, King, N.R. 2002. Microbiology-concepts and applications, McGraw Hill, Inc. New York.
- Ronald M Atlas, 1997, Principles of microbiology, 2<sup>nd</sup> edition, Tata McGraw Hill international edition, Page 1-1098.

### ZO 4812 - BIOTECHNOLOGY

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

**Objective:** This paper gives the update knowledge and applied values of biotechnology

#### UNIT I: MOLECULAR BIOLOGY AND GENETICS

Molecular structure of genes and chromosomes; DNA replication and control; Transcription and its control; Translational processes; Regulatory controls in prokaryotes and eukaryotes; Mendelian inheritance; Gene interaction; Complementation; Linkage, recombination and chromosome mapping; Extrachromosomal inheritance; Chromosomal variation; Population genetics; Transposable elements, Molecular basis of genetic diseases and applications.

#### UNIT II: BIOPROCESS BIOTECHNOLOGY

Bioprocess technology for the production of cell biomass and primary/secondary metabolites, such as baker's yeast, ethanol, citric acid, amino acids, exopolysaccharides, antibiotics and pigments etc.; Microbial production, purification and bioprocess application(s) of industrial enzymes; Production and purification of recombinant proteins on a large scale; Chromatographic and membrane based bioseparation methods; Immobilization of enzymes and cells and their application for bioconversion processes. Aerobic and anaerobic biological processes for stabilization of solid / liquid wastes; Bioremediation.

#### UNIT III: BIOPROCESS ENGINEERING

Kinetics of microbial growth, substrate utilization and product formation; Simple structured models; Sterilization of air and media; Batch, fed-batch and continuous processes; Aeration and agitation; Mass transfer in bioreactors; Rheology of fermentation fluids; Scale-up concepts; Design of fermentation media; Various types of microbial and enzyme reactors; Instrumentation in bioreactors.

#### UNIT IV: ANIMAL BIOTECHNOLOGY

Special features and organization of plant cells; Totipotency; Regeneration of plants; Plant products of industrial importance; Biochemistry of major metabolic pathways and products; Autotrophic and heterotrophic growth; Plant growth regulators and elicitors; Cell suspension culture development: methodology, kinetics of growth and production formation, nutrient optimization; Production of

secondary metabolites by plant suspension cultures; Hairy root cultures and their cultivation. Techniques in raising transgenics.

#### **UNIT IV: CHARACTERISTICS OF ANIMAL CELLS**

Metabolism, regulation and nutritional requirements for mass cultivation of animal cell cultures; Kinetics of cell growth and product formation and effect of shear force; Product and substrate transport; Micro & macro-carrier culture; Hybridoma technology; Live stock improvement; Cloning in animals; Genetic engineering in animal cell culture; Animal cell preservation.

#### **UNIT V: RECOMBINANT DNA TECHNOLOGY & BIOINFORMATICS**

Restriction and modification enzymes; Vectors: plasmid, bacteriophage and other viral vectors, cosmids, Ti plasmid, yeast artificial chromosome; cDNA and genomic DNA library; Gene isolation; Gene cloning; Expression of cloned gene; Transposons and gene targeting; DNA labeling; DNA sequencing; Polymerase chain reactions; DNA fingerprinting; Southern and northern blotting; In-situ hybridization; RAPD; RFLP; Site directed mutagenesis; Gene transfer technologies; Gene therapy.

**Bioinformatics:** Major bioinformatics resources (NCBI, EBI, ExpASY); Sequence and structure

databases; Sequence analysis (biomolecular sequence file formats, scoring matrices, sequence alignment, phylogeny); Genomics and Proteomics (Large scale genome sequencing strategies; Comparative genomics; Understanding DNA microarrays and protein arrays); Molecular modeling and simulations (basic concepts including concept of force fields).

---

#### **TEXT BOOKS**

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

#### **REFERENCE BOOKS**

1. Davis, J.M. 2007. Basic cell culture, 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. Ranga, M.M. 2003. Animal biotechnology, Agrobios, New Dehi.

### **ZO 4813 - MOLECULAR ENDOCRINOLOGY AND REPRODUCTION**

<b>SEMESTER</b>	<b>:</b>	<b>IV</b>	<b>CREDIT</b>	<b>:</b>	<b>03</b>
<b>CATEGORY</b>	<b>:</b>	<b>MC</b>	<b>NO. OF HOURS / WEEK</b>	<b>:</b>	<b>04</b>

*Objective: This paper highlights the knowledge of reproductive biology and molecular endocrinology*

#### **UNIT I: INTRODUCTION OF AND HORMONES**

Hormones as chemical signals for control and regulation of physiological processes. Nature of hormonal actions - biology of hormones.

Structure of peptide and protein hormones - Purification and characterization of hormones – Structure, Function relationships in different hormones - Biosynthesis of protein hormones - Storage and secretion of hormones: molecular mechanisms of regulation - Transcriptional and post-transcriptional mechanisms of hormone biosynthesis and secretion - Regulation of biosynthesis and secretion - Inhibitors of hormone biosynthesis and their use.

## **UNIT II: HORMONE SIGNALING**

Nature of hormonal effects and actions - Mechanisms of hormone action and signal attenuation- Signal discrimination - signal transduction and signal amplification in hormone regulated physiological processes - Structural requirements for successful hormone-receptor interactions - Receptor antagonists and their applications - Metabolism of hormones by target and non-target tissues - Pharmacokinetics of hormones - Hormones and behaviour- cellular and molecular actions of semiochemicals.

## **UNIT III: THERAPEUTIC AGENTS OF HORMONE**

Hormones as therapeutic agents - Current developments in design and production of hormonal contraceptives - Recombinant protein hormones-production and application in regulation of fertility in farm animals and humans - Evolution of chemical communication in animal systems - Unsolved problems in hormonal biology.

## **UNIT IV: MALE REPRODUCTIVE MECHANISM**

Sex determination and differentiation: Mechanism of sex determination, differentiation of gonad and the genital tract.

Spermatogenesis: structural and molecular events - experimental approaches to study spermatogenesis - Seminiferous epithelial cycle - Sertoli cell: structure and function - Leydig cell - Leydig and Sertoli cell proliferation during foetal and postnatal development- Regulation of testicular functions - Epididymal maturation of spermatozoa - Signal transduction pathway in acrosome reaction - Male sterility: azoospermia, oligozoospermia, asthenozoospermia, varicocele - Genetic basis for male infertility, Mutational analysis in genes for hormones, receptor and gamete development.

## **Unit V: FEMALE REPRODUCTIVE MECHANISM**

Follicular development and selection - Role of extra and intra gonadal factors in folliculogenesis - Oocyte maturation and its regulation - Ovulation: factors involved in follicular rupture - Luteinization and luteolysis - Follicular atresia - Regulation of reproductive cycle in female: menstrual cycle in human, estrous cycle in rat, estrous behaviour in cycling animals - Female reproductive disorder: amenorrhea, polycystic ovary.

Fertilization: Activation of egg - Contraception leading to prevention of polyspermy: surgical, hormonal and immunocontraception.

## **REFERENCES**

---

### **TEXT BOOKS**

1. Ernst Knobil and Jimmy D. Neil, 2002. The Physiology of Reproduction, Raven Press.
2. Peter C.K. Leung and Eli Y. Adashi, 2004. The ovary, Elsevier (Academic Press), New York.
3. Samuel S. C. Yen, Robert B. Jaffe, Robert L. Barbieri, 2009. Reproductive Endocrinology: Physiology, Pathophysiology, and Clinical Management, Saunders publisher. USA.

## REFERENCE BOOKS

1. Christina Wang, 1999. Male Reproductive Function, Kluwer Academic Publishers, New York.
2. Freedman L. P., 1998. Molecular Biology of Steroid and Nuclear Hormone receptors, Birkhauser, Boston, USA.
3. Jayanta, K.P. and Saroj, S.G. 2009. Oxford University press, New Delhi.
4. Litwack, G. 1985. Biochemical actions of hormones, ed. Academic press, New York, USA.
5. Solly Zuckerman Zuckerman, Barbara J. Weir, T. G. Baker. 1977. The ovary, Academic Press.
6. Veer Bala Rastogi, 2007. Molecular biology, Kedar Nath Ram Nath, Delhi.

## ZO 4814 – MICROBIOLOGY, BIOTECHNOLOGY AND ENDOCRINOLOGY LAB COURSE

SEMESTER : IV CREDIT : 03  
CATEGORY : MC (P) NO. OF HOURS / WEEK : 04

**Objective:** This lab study helps to understand about microbes, microbial techniques, biotechnology and hormone function in human being.

### UNIT I: MICROBIOLOGY

Staining Techniques: Simple staining technique. Gram staining technique, Negative staining

Pure culture techniques – preparation of slants, sub culturing, types of streaking.

Study of cultural characteristics of bacteria/Fungi on selective –differential media

### UNIT II: DETERMINATION OF MICROBES

Determination of Thermal Death Point (TDP) and Thermal Death Time (TDT) of Microorganisms.

Determination of growth curve of a given microorganism

Isolation of antibiotic resistant mutants by chemical mutagenesis.

Isolation and enumeration of microorganism for air, soil and water.

### UNIT III: BIOTECHNOLOGY

Isolation of genomic DNA from bacteria and purification by column spin.

Isolation of plasmid DNA by Poly ethylene glycol method.

Restriction digestion of isolated DNA (single and double digestion).

Quantification of DNA and RNA spectrophotometric method.

DNA amplification by PCR.

DNA elution from Agarose gel.

#### **UNIT IV: ENDOCRINOLOGY**

Identification of hypothalamic nuclei following histological, histochemical and immunocytochemical methods.

Isolation and characterization of pituitary cells.

In vitro effect of glucocorticoid and catecholamines on phagocyte functions.

In vivo bio- assay for estrogen and testosterone

#### **UNIT V: ESTIMATION OF ENZYME ACTION**

Estimation of cAMP in a rat tissue (e.g. adipose) with and without hormone stimulation.

Streptozotocin administered rat model for diabetes.

Demonstration of phospholipase C action.

---

#### **TEXT BOOKS**

1. Ader R, Felten D.L. 2007. Psychoneuroimmunology, Nicholas C., Academic Press, UK.
2. DeGroot L. J. and Jameson J.L., 2006. Endocrinology, Saunders Elsevier Press, USA.
3. Kalaichelvan, D.T. 2005. Microbiology and biotechnology a laboratory manual, MJP, Chennai.
4. Murugesan, A.G. and Rajakumari, C. 2005. Environmental science and biotechnology (theory and techniques) , MJP, chennai.
5. Rajan, S. and Balakumar, S. 2003. Medical Microbiology (theory and practicals), rock city publications, Trichy.

#### **REFERENCE BOOKS**

1. Brown R., 1994. An Introduction to Neuroendocrinology, Cambridge University Press, Cambridge, UK.
2. Ignacimuthu, S. 2002. Methods in biotechnology, Phoenix, New Delhi.
3. Schmauder, H.P. and Scjweozer, M. 2002. Methods in biotechnology, Taylor and Francis, UK.



## – FARM MANAGEMENT AND ENTREPRENEURSHIP

**SEMESTER : III**  
**HOURS : 6**

**CATEGORY : ID**  
**CREDITS : 5**

*Objective: This paper enhance the knowledge of management of animal farms and entrepreneurship*

### **UNIT I: ENTREPRENEURSHIP**

Entrepreneur: Meaning of entrepreneur – evolution of the concept, function of an entrepreneur, traits of entrepreneur. Types of entrepreneur, interpreneur – and emerging class – factors promoting entrepreneurship, barriers to entrepreneurship.

### **UNIT II: OPPORTUNITY ANALYSIS**

Opportunity analysis – project identification – selection – analysis – sources of finance and supporting institution.

### **UNIT III: BUSINESS PLAN PROCESS**

Meaning of business plan, business plan process, guidelines for writing a business plan – structure and content of business plan – style and format of the business plan – outline of a business plan and exploration of each section of the plan – model business plan for business venture and social venture through case studies.

### **UNIT IV: FISH, PRAWN, PEARL AND HONEY BEE CULTURE**

Aquaculture – fish culture – maintenance of nursery ponds – construction of fish farm – culturing ponds – composite fish farming – prawn culture – breeding methods and spawning of prawn – pearl culture – apiculture – Hive maintenance and management - Sericulture – silk production in India.

### **UNIT V: POULTRY AND DAIRY FARMING**

Poultry breeding and management – breeds of Fowls – breeding for meat production – care of new borns – poultry production in India – poultry diseases – Dairy farming – breeds of cattle – artificial insemination - milk production in India.

---

### **TEXT BOOKS**

1. Gupta, S.M., 2010. Text book of fishery, An Backer, Mumbai.
2. Khankha, S.S. 2011. Entrepreneurial development, S. Chand, Delhi.
3. Sukumar, D.E. 2002. Outline of Dairy Technology, Oxford University, New Delhi.

### **REFERENCE BOOKS**

1. Govindan, T.K. 1985. Fish processing, technology, Oxford University, Delhi.
2. Kamaleshwar Pandey and Shukla, J.P. 2010. Rastogi publications, Meerut.
3. Shailendra Ghosh, 2009. Fisheries and aquaculture management, Adhyayan, New Delhi.
4. Tomas, B.S and Neera Singh. 2003. Applied Zoology, Emkay, Delhi.