



**(For the candidates admitted from the academic year 2016-2017 onwards)**

Sem.	Course	Course Title	Ins. Hrs / Week	Credit	Exam Hrs	Marks		Total
						Int.	Ext.	
I	Core Course – I (CC)	Animal Taxonomy, Phylogeny and Biodiversity	6	4	3	25	75	100
	Core Course – II (CC)	Cell and Molecular Biology	6	4	3	25	75	100
	Core Course – III (CC)	Molecular Genetics and Evolution	5	4	3	25	75	100
	Core Course – IV (CC)	Developmental Biology	5	4	3	25	75	100
	Core Practical – I (CP)	Animal Taxonomy, Phylogeny and Biodiversity, Cell and Molecular Biology, Molecular Genetics and Evolution & Developmental Biology (P)	4+4	4	3	40	60	100
	<b>TOTAL</b>			<b>30</b>	<b>20</b>			
II	Core Course – V (CC)	Animal Physiology	6	5	3	25	75	100
	Core Course – VI (CC)	Biochemistry & Biophysics	6	5	3	25	75	100
	Core Practical – II (CP)	Animal Physiology & Biochemistry & Biophysics	4+4	4	3	40	60	100
	Elective Course – I (EC)	Applied Biotechnology / Endocrinology	5	5	3	25	75	100
	Elective Course – II (EC)	Coastal geomorphology / Poultry Farming	5	5	3	25	75	100
	<b>TOTAL</b>			<b>30</b>	<b>24</b>			
III	Core Course – VII (CC)	Microbiology	6	5	3	25	75	100
	Core Course – VIII (CC)	Biostatistics and Computer Applications	6	5	3	25	75	100
	Core Practical – III (CP)	Microbiology & Biostatistics and Computer Applications (P)	4+4	4	3	40	60	100
	Elective Course – III (EC)	Research Methodology and Biotechniques / Applied Entomology	5	5	3	25	75	100
	Elective Course – IV (EC)	Fishery biology / Bioinformatics	5	5	3	25	75	100
	<b>TOTAL</b>			<b>30</b>	<b>24</b>			
IV	Core Course – IX (CC)	Environmental Biology	5	5	3	25	75	100
	Core Course – X (CC)	Immunology	5	5	3	25	75	100
	Core Practical - IV (CP)	Environmental Biology & Immunology (P)	4+4	4	3	40	60	100
	Elective Course – V (EC)	Sericulture / Aquaculture	5	4	3	25	75	100
	Project	Project	7	4	-	-	-	100
	<b>TOTAL</b>			<b>30</b>	<b>22</b>			
<b>GRAND TOTAL</b>			<b>120</b>	<b>90</b>				<b>2000</b>

Note:

Project :100 Marks

Dissertation : 80 Marks

Viva Voice : 20 Marks

Core Papers - 10

Core Practical - 4

Elective Papers - 5

Project - 1

**Note:**

**1. Theory                      Internal      25 marks                      External      75 marks**

**2. Practical                      ”                      40 marks                      ”                      60 marks**

**3. Separate passing minimum is prescribed for Internal and External**

- a) The passing minimum for CIA shall be 40% out of 25 marks (i.e. 10 marks)
- b) The passing minimum for University Examinations shall be 40% out of 75 marks (i.e. 30 marks)
- c) The passing minimum not less than 50% in the aggregate.

**Reference/Text Books contain the following details:**

Name of the Author

Title of the Book

Name of the Publisher

Year

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## CORE COURSE I

### ANIMAL TAXONOMY, PHYLOGENY AND BIODIVERSITY

#### Objectives:

Animal diversity which is an essential topic for biologists to know the distribution, taxonomy and phylogeny of animal. To enlighten the primitive forms of invertebrates and vertebrates distribution. To help our students to understand the status and mode of living of different forms of animals.

#### UNIT I

Introduction to Taxonomy – Stages in taxonomy – importance of taxonomy – Aims and tasks of a Taxonomist – identification using taxonomic keys. Zoological classification: kinds of classification – Phyletic lineages – Linnean Hierarchy – Concepts of species – Typological, Nominalistic, Biological, Evolutionary, Recognition species concepts – other kinds of species – polytypic species – subspecies – super species.

#### UNIT II

Zoological Nomenclature: History of Nomenclature – Nature of scientific names – Synonyms and Homonyms – Meanings of Authors in Brackets – Types: Holotypes, Paratype, Lectotype, Syntype, Neotype and Allotype – Publications on Taxonomy Research – ICZN and its rules – Ethics in Taxonomy Research.

#### UNIT III

**Phylogeny of Invertebrates:** Protozoa – Phylogenetic origin and evolution of the class Metazoa. Theories and origin of metazoan. Bilateria – theories and origin. Coelomata - Coelom and its origin. Trilobites – structure and significance. Mollusca – origin and evolution. Molluscan fossils and their significance. Echinoderm fossils.

#### UNIT IV

**Phylogeny of Vertebrates:** Jawless vertebrates - characteristic features of lampreys. earliest vertebrates: Ostracoderms – characteristic features and classification. Evolutionary position of Ostracoderms. Primitive jawed vertebrates – origin of jaws. Origin of Reptiles, Dinosaurs. Amphibian and reptilian features of seymouria, mammal like reptiles, aquatic reptiles, flying reptiles, rise and fall of dinosaurs. Fossil Birds- Archeopteryx. Origin of primates – adaptive radiation of lemuroids, Tarsius – new world monkeys, old world monkeys and apes, Australopithecus.

#### UNIT V

**Biodiversity:** definition – types – genetic, species and ecosystem diversity. Values and uses of biodiversity. Biodiversity measurements, Mega diversity centres. Loss of biodiversity. Conservation of biodiversity : *in situ* (afforestation, social forestry, agro forestry, Biosphere reserves, national parks and sanctuaries), *ex situ* (Cryopreservation, gene banks, sperm banks, DNA banks, tissue culture and biotechnological strategies). Biodiversity laws of India. Wild life protection Acts.

**Text Books:**

1. Simpson, G.G. 1987, Principles of Animal Taxonomy, Oxford IBH Publishing Co., Pvt., New Delhi.
2. Devasahayan J.K., and N. Inbamani, 1987, Animal Phylogeny, R.V. Publications, Virudhunagar.
3. Agrawal K.C. 1996 Biodiversity, Agro Botanical Publishers, New Delhi

**Reference Books:**

1. Barnes R. D. 1982. Invertebrates Zoology 6th endn. Toppan International Co.,
2. Barrington, E. J. W. 1969. Invertebrate Structure and functions. English Language. Book Society.
3. Borradi, L.A. 1955. The Invertebrata. 2nd endn. Cambridge University Press.
4. Carter, G. S. A. (1946) General Zoology of Invertebrates 2nd endn. (Wick and Jackson Ltd., London).
5. Clark, R.B and A.L. Panchen. 1971. Synopsis of animal classification. Chapman and Hall Publications, London.
6. Gardinar, M. S. 1972. Biology of the invertebrates, Mc Graw Hill Book Co., New York.
7. Hyman L.H. 1940 - 1959. The Invertebrata, Vol. I to VI.
8. Jolie, M. 1968. Chordate Morphology. East West Press.
9. Kapoor, V.C. 2010 Theory and Practice of Animal Taxonomy, Oxford and IBH Publishing Co., Pvt., New Delhi.
10. Kapoor, V.C. 1991. Theory and Practice of Animal Taxonomy. Oxford and IBH Publishing Co., Pvt. Ltd. New Delhi.
11. Kotpal, R.L. 1982. Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Minor Phyla. Rastogi Publications Mayer, E. Elements of Taxonomy.
12. Narendran, T.C. 2009. An Introduction to Taxonomy, Zoological Survey of India, Kolkatta.
13. Newman, H.H. 1987. The Phylum Chordata. Sathis book Enterprise Publishers.
14. Simpson, G.G. 1987. Principles of animal taxonomy. Oxford IBH Publishing Co.
15. Solbrig, O.T., Van Emden, H.M. and Van Oordt, P.G.W.J. 1995, Biodiversity and Global change, CAB International, Wallingford. U.K.
16. Waterman, A.J. 1971. Chordate Structure and Function. Macmillan Co. London.
17. Young, J.Z. 1950. Life of Vertebrates. Clarendon Press Oxford.

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## **CORE COURSE II**

### **CELL AND MOLECULAR BIOLOGY**

#### **Objectives:**

This course facilitates to understand the structure at molecular level and function of prokaryote and eukaryote cell. To enlighten our students about the cellular organelles and its functions. The knowledge in Cell communications and signaling pathways.

#### **UNIT I**

Cell Membrane : Molecular organization – molecular models – cell permeability – cell surface differentiations and cell – cell communication – membrane receptors and signal transduction pathways. Cytoskeleton and Cell Motility: Microtubules, microfilaments and intermediate filaments – role in cell organization, division and motility. Methods of Cell Study: Micrometry – cell culture methods – cell fractionation technique – cytochemical staining methods – cytophotometry – immunocytochemistry and autoradiography.

#### **UNIT II**

Mitochondria and Energy Transduction: Molecular organization of mitochondria and their role in oxidative phosphorylation. Golgi bodies, Lysosomes, Endoplasmic reticulum- structure and functions. Nucleus and Chromosomes: Nuclear envelope – Nuclear pore – Nuclear proteins – Nucleosome – Structure and function of chromatin, euchromatin and heterochromatin. Giant chromosomes - Polytene and Lamp brush chromosome.

#### **UNIT III**

Nucleic Acids and Their Functions: DNA and RNA – chemical composition, types and functions. Exons – introns – extra chromosomal DNA- overlapping genes - Transposable elements. Gene amplifications. Replication of DNA, DNA repair mechanism. Mechanism of RNA splicing in eukaryotes. Cell division - Mitosis and meiosis. Cell Cycle: Phases of cell cycle - Molecular organization and functional significance of mitotic apparatus.

#### **UNIT IV**

Ribosomes: Morphology, ultra structure, biochemistry and functions. Protein Synthesis: Mechanism of transcription – role of transcription factors – transcription regulators – Processing of mRNA – translation – post translational modifications and control mechanism. Protein sorting and targeting. Protein Transport: Intracellular compartments and protein sorting. Vesicular traffic in secretory and endocytic pathways, transport from ER through Golgi to lysosome, endosome.

## **UNIT V**

Cell communications: General principles of cell communication- signaling pathways. - signaling through G-protein linked cell surface receptors - signaling through enzyme-linked cell surface receptors - Biology of Cancer Cells: Characteristics of Cancer Cells, types of tumours. Apoptosis and its relevance in cancer biology. Oncogenes – Environmental factors inducing cancer.

### **Text Books:**

1. Powar, C.B. (1983), Cell Biology, Himalaya Publishing House, Bombay
2. David Freifelder (1998), Molecular Biology, Ii Ed., Narosa Publishing House, New Delhi.
3. De Robertis, E.D.P., and De Robertis, Jr. E.M.F. 2001. Cell and molecular biology. Williams & Wilkins, USA.

### **Reference Books:**

1. Alberts, B., Johnson, A., Lewis, J, Raff, M., Roberts, K and Walter, P. 2002. Molecular biology of the Cell. Garland science, New York.
2. Bolsover, S.R, Hyams, J.S, Shephard, E.A, White, H.A and Wiedemann, C.G. 2004. Cell Biology. John Wiley & sons, Inc. Publication, New Jersey.
3. De Robertis, E.D.P. And De Robertis, E.M.F. (1987), Cell and Molecular Biology, Viii Ed., Lea And Febiger, Philadelphia.
4. Hartl, D.L. and Jones, E.W. 2005. Genetics analysis of genes and genomes. Jones and Barlett. UK.
5. Klug, W.S and Cummings, M.R. 2005. Concepts of Genetics. Pearson Education P (Ltd), Singapore.
6. Lewin, B. 2000. Genes VII. Oxford University Press Inc. New York.
7. Lewis, Keleinsmith And Valeris M. Kish (1988), Principles Of Cell Biology, Harper And Row Publications, New York.
8. Lewis, R. 2005. Human genetics – concepts and applications. McGraw-Hill. New Delhi.
9. Lodish, H., Berk A., Matsudaira, P., Kaiser, C.A., Krieger, M., Scott, M.P., Zipursky, S.L.And Darnell, J. 2004. Molecular Cell Biology. W.H. Freeman & Co., New York.
10. Watson Et Al., (1987), Molecular Biology Of The Gene, The Benjamin Cummings Publishing Co., Inc., California.
11. Watson, J.D, Baker, T.A, Bell, S.P., Gann, A., Levine, M and Losick, R. 2004. Molecular biology of the gene. Pearson Education P(ltd), Singapore

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## CORE COURSE III

### MOLECULAR GENETICS AND EVOLUTION

#### **Objectives:**

*To enlighten our students about the DNA and its functions. The knowledge in the molecular biology and genetics will provide diagnosis of genetic disorders and treatment at molecular level. It provides basic information of molecular phylogenies and evolution*

#### **UNIT I**

Structure and functions of genetic materials: Nuclear and mitochondrial genome organization, Structures of DNA and RNA, Stereochemistry of bases and secondary structures. Genetic structure analyses of eukaryotic genomes. Chromatin structure and nucleosome concept, Organization and function of genetic material, Gene paradox, Repetitive DNA, Satellite DNA, Overlapping genes, Split genes, Pseudogenes.

#### **UNIT II**

Identification of genetic material - Fine structure of gene - Cistron, muton, recon, exon, intron. Multigene families - types - simple and complex multigenes. Regulation of gene expression in prokaryotes - *Lac* and tryptophan operon of bacteria. Regulation of gene expression in eukaryotes - Gene clustering, Mechanism of positive and negative control of gene expression. Genetic code - Decoding of gene control - alphabets of the code, coding dictionary. Translational and transcriptional control of gene expression, Environmental effects on gene regulation. Epigenetics.

#### **UNIT III**

Mutation -point mutations, spontaneous and inducible mutations, reversible and suppressor mutations, lethal mutations, biochemical mutations, phenotypic effects of mutation, molecular basis of mutation, mutagens - physical, chemical and biological. Human Genetics: Inborn errors of metabolism: disorders of amino acid metabolism - PKU, alkaptonuria and albinism, Haemoglobin disorders - Sickle cell anaemia and thalassemia. Carcinogens - Genetic basis of cancer -Role of oncogenes and tumour suppressor genes - RB genes and P<sub>53</sub>.

#### **UNIT IV**

Origin of life on Earth - Theory of Chemical Evolution. Primitive Earth Conditions - anoxic reductive atmosphere, relatively high temperature, volcanic eruption, radioactivity, high frequency UV radiation. Molecular evolution : Abiotic formation of sugars, amino acids, organic acids, purines, pyrimidines, glycerol and nucleotides and their polymerization to RNA on reactive surfaces, polymerization of amino acids to Polypeptides and Proteins. Ribozymes and RNA World. Formation of DNA, Formation of nucleoproteins, Prions, Natural selection of self-replicating polymers.

#### **UNIT V**

Molecular phylogenies and evolution: History of molecular phylogenetics - amino acid sequences, DNA sequences - DNA and its repetitive sequences. Nucleic acid phylogeny based on - DNA- DNA hybridization, restriction enzymes and nucleotide sequences.

Combined nucleic acid – amino acid phylogenies. Rate of molecular change, molecular clock, regulatory genes and evolution. Gene evolution - evolution of gene families, molecular drive, assessment of molecular variation.

### **Text Books:**

1. Ursula Goodenough (1984), Genetics, Saunders College Publishing Co., London.
2. Kavita B. Ahluwalia 1991 'Genetics' Wiley Eastern Ltd., New Delhi. 2.
3. Monroe.W.Strickberger, Evolution Third Edition. Jones and Bartlett publishers International, London, UK.

### **Reference Books:**

#### **Genetics**

1. Benjamin Levin (2005) Genes VIII, Oxford University Press, New York.
2. Daniel L. Hartl (1996) Genetics, III Ed., Jones Bartlett Publishers. Boston.
3. David Friefelder (1998) Microbial Genetics, Narosa Publishing House, New Delhi.
4. Gardner, E. J. et.al. (1991). Principles of Genetics. John Wiley & Sons. New York.
5. Gurbachan S.Miglani-2003 "Advanced Genetics". Narosa Publishing House, New Delhi.
6. Jenkins, J. B. (1983) Human Genetics, The Benjamin Cummings Publishing Co.,
7. John D. Hawkins (1996) Gene Structure and Expression, III Ed. Cambridge University Press.
8. Munroe.W. Also, Curt Stern, 1983 'The Principle of Human Genetics'. W.H. Freeman & Co., San. Francisco.
9. Robert H. Tamarin (1996) Principles of Genetics, WCB Publishers.
10. Robert. H Tamarin 2004 'Principles of Genetics' Tata Mc. Graw-Hill Publishing Company Ltd. New Delhi.
11. Strickberger Monnroe, W. (1996) Genetics, Prentice Hall of India Pvt. Ltd., New

#### **Evolution**

1. Moody, P.A. 1978. Introduction to Evolution. Harper International.
2. Dodson. 1990. Evolution, Reinhold, New York.
3. Barton, N. H., Briggs, D. E.G., Eisen, J. A., Goldstein, A. E., Patel, N. H., Cold. Evolution, Spring Harbor Laboratory Press, New York, USA
4. Evolution, Hall, B. K. and Hallgrimsson, B., Jones and Bartlett Publisher, Sudbury, USA.
5. Futuyma, D. J., Evolution, Sinauer Associates, Inc., Sunderland, USA

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## **CORE COURSE IV**

### **DEVELOPMENTAL BIOLOGY**

#### **Objectives:**

This course provides the process of early embryonic development and review the current development in the field of embryology. The formation of embryo and embryological disorders and treatment methodology. Precaution and health care during pregnancy and gestation.

#### **UNIT I**

Introduction to developmental biology. Gametogenesis – Spermatogenesis – Cells in seminiferous tubules, spermiogenesis, structure and types of sperm. Oogenesis – origin and growth of oocyte, maturation of egg, egg envelopes, vitellogenesis, and organization of egg cytoplasm. Types of eggs. Egg cortex - polarity and symmetry of egg. Fertilization : Events of fertilization- acrosome reaction in sperm – cortical reaction in egg - recognition of egg and sperm, gamete fusion, activation of egg metabolism, physiological changes in the organization of egg cytoplasm, theories of fertilization.

#### **UNIT II**

Cellular differentiation- cytodifferentiation and chemodifferentiation. Stem cells- totipotency and pluripotency. Embryonic Stem cells and their applications. Cleavage – Patterns of cleavage – radial, spiral and bilateral; Types – meroblastic, holoblastic and superficial, factors affecting cleavage. Blastulation – Types of blastula. Fate maps. Presumptive organ forming areas in frog and chick. Morphogenetic movements and gastrulation in frog and chick.

#### **UNIT III**

Organogenesis – Ectodermal derivatives: formation of central nervous system- development of brain eye in frog. Mesodermal derivatives: heart and kidney in frog. Endodermal derivative: intestine in frog. Organogenesis in Chick – development of heart. Extra embryonic membranes in Chicks – Placentation – its types and physiology in mammals.

#### **UNIT IV**

Polarity and gradient: dorsal and ventral polarity – homeo box concept. Organizer concept - embryonic induction - mechanism of induction. Regeneration: Types of regeneration- amphibian limb regeneration- stimulus and suppression of regeneration. Metamorphosis- types- amphibian metamorphosis- events and hormonal control. Insect metamorphosis: moulting, growth and hormonal control.

## **UNIT V**

Precaution and health care during pregnancy and gestation. Impotency: Causes of Impotency and sterility male and infertility in female – Concept of test-tube baby - Artificial Insemination in humans - In Vitro Fertilization (IVF) and Gamete-Intra-Fallopian Transfer (GIFT) – Advantages and disadvantages. Teratogenesis- Developmental mechanism of teratogenesis. Contributions of teratology to developmental biology. Teratogens and induced birth defects.

### **Text Books:**

1. Veer balarastogi, Developmental biology, Kedarnath Ram nath publishers, meerut.
2. Arumugam.N. 1998. Developmental Biology, Saras Publications,
3. Balinsky, B.I. 1981. An Introduction to Embryology. W.B. Saunders Company. Philadelphia.

### **Reference Books:**

1. Berry.A.K.2007. An Introduction To Embryology, Emkay Publications, New Delhi-51.
2. Beril., N.J..1986. Developmental Biology. Tata Mcgraw-Hill Publishing Ltd. New Delhi.
3. Banerjee. S , Development Biology, Dominant Publishers, New Delhi
4. Browder, L.N. (1980) Developmental Biology, Saunders College, Philadelphia.
5. Deuchar, E.M. (1976) Cellular Interaction In Animal Development, Chapman And Hall, London.
6. Verma, P.S. And Agarwal V.K. 2005. Chordate Embryology (Developmental Biology) S. Chand& Company Ltd., New Delhi.

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## **CORE PRACTICAL I**

### **ANIMAL TAXONOMY, PHYLOGENY AND BIODIVERSITY, CELL AND MOLECULAR BIOLOGY, MOLECULAR GENETICS AND EVOLUTION & DEVELOPMENTAL BIOLOGY (P)**

#### **Objectives:**

To obtain knowledge about the identification and classification of animals. To get the information of animal population - the phylogeny and fossil forms in the title of animal diversity. To impart the knowledge and concepts of Cell and Molecular Biology, Molecular Genetics and Evolution, Developmental Biology

**ANIMAL TAXONOMY:** A list of at least 50 representative animals belonging to major classes of nine invertebrate phyla and major orders of 5 classes of vertebrates can be shown as spotters to the students. A student has to identify and describe the salient features and assign them to the order, class and phylum to which they belong.

**PHYLOGENY:** Invertebrate larval forms - Trochophore, Nauplius, Bipinnaria, Tornaria

Fossils – Ammonoids, Belemnoids, Nautiloids, Echinoderm fossils, Dinosaurs and Archaeopteryx.

#### **BIODIVERSITY**

1. Marking of important Biodiversity regions, countries and centres in World and Indian map.
2. Collection of endemic animals photos with information from websites, journals, newspapers.

#### **Dissections**

Video clipping dissection of earthworm, cockroach, shark, frog, calotes and rat can be shown to the students. A student can make use of material available in any search web site for online dissection using Apple quick time software.

#### **CELL AND MOLECULAR BIOLOGY**

Micrometry

Human Buccal Smear

Blood Smear – Cockroach/ Man.

#### **MOLECULAR GENETICS AND EVOLUTION**

Drosophila culture – Identifications of Normal, mutants & sexes.

Blood groups ABO & Rh their genetic significance.

Pedigree analysis.

Human karyotyping & Chromosomal abnormalities.

### **DEVELOPMENTAL BIOLOGY**

Preparation of sperm suspension in frog/bull and observation of the spermatozoa.  
Observation of live spermatozoa and study of rate of motility of sperm in frog /bull semen.

Developmental stages in chick embryo.

Vaginal smear preparation in rat / mouse to study the stages of oestrous cycle.

**Record of Laboratory work shall be submitted at the time of practical examination.**

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## **CORE COURSE V**

### **ANIMAL PHYSIOLOGY**

#### **Objectives:**

Animal Physiology helps the students in understanding how the body functions adapts with respect to its external and internal environment, related to nervous integration, sensation, metabolism and reproduction.

#### **UNIT I**

Definition of digestion and types of digestion – extra and intracellular. Nutrition-Food requirements, Physiology of ingestion. Digestion in mouth, cardiac stomach, pyloric stomach, small intestine. Digestive enzymes and their role in the digestion of carbohydrates, proteins and lipids. Absorption and assimilation of digested food materials. Balanced diet, BMR and BMI. Homeostatic mechanisms: Osmo-ionic regulation in crustaceans and fishes – temperature and pH regulations in animals. Light – photobiological processes – pressure – acclimatization to high altitudes – Hydrostatic pressure – Buoyancy.

#### **UNIT II**

Respiration- Structure of mammalian lungs and gaseous exchange- Transport of oxygen-formation of oxyhaemoglobin and affinity of haemoglobin for Oxygen, Oxygen dissociation curves-Transport of CO<sub>2</sub> Chloride shift, Bohr Effect. Circulation: Open and closed circulation. Structure of mammalian heart and its working mechanism – Heartbeat and cardiac cycle. Myogenic and neurogenic hearts. Properties and Functions of blood – factors contributing to heart problems.

#### **UNIT III**

Excretion – Forms of nitrogenous waste material and their formation. Organization of mammalian excretory system-structure and function of kidney and nephron – Counter current mechanism of urine formation. Muscles – General structure and types of muscles. Sliding filament mechanism of muscle contraction. Chemical changes during muscle contraction – role of calcium, ATP utilization and its replenishment.

#### **UNIT IV**

Structure of nerve cell. Nature of nerve impulse – resting potential and action potential. Properties of nerve impulse – threshold value, refractory period, all or none response. Conduction of nerve impulse, Structure of synapse, mechanism of synaptic transmission – electrical and chemical transmissions, Neurotransmitters. Receptors: types, Photoreceptor – structure of human eye and physiology of vision, Phonoreceptors – structure of human ear- organ of corti-

physiology of hearing. Bioluminescence – Chronobiology: Biological rhythms – rhythms in man – biological clock.

## **UNIT V**

Endocrine glands – Relationship between hypothalamus and pituitary gland. Hormones of hypothalamus. Hormones of Adenohypophysis and Neurohypophysis. Hormones of pineal gland, thyroid gland, parathyroid, thymus, adrenal and pancreas. Endocrine control of mammalian reproduction – Male and female hormones – Hormonal control of menstrual cycle in humans. Hormones of insects.

### **Text Books :**

1. Sambasivaiah, Kamalakara Rao and Augustine Chellappa 1990. A Text book of Animal Physiology and Ecology, S. Chand & Co., Ltd., New Delhi – 110 055.
2. Parameswaran, Anantakrishnan and Ananta Subramaniam, 1975. Outlines of Animal Physiology, S. Viswanathan [Printers & Publishers] Pvt. Ltd.,
3. William S. Hoar, 1976. General and Comparative Physiology, Prentice Hall of India Pvt. Ltd., New Delhi – 110 001.

### **Reference Books :**

1. Baldwin, E. (1964) An Introduction To Comparative Biochemistry, Cup, London.
2. Beck, W.S. (1971). Human Design, Harcourt Brace Joranson Inc.,
3. Dawson, H. (1964) General Physiology, Little Brown Co., Boston.
4. Echert, R. And Randall, D. (1987) Animal Physiology, Cbs Publishers And Distributors
5. F.N. (1971) Animal Function, Principles And Adaptation, Macmillan Co., London.
6. Giese, A.C. (1979) Cell Physiology And Biochemistry, Prentice Hall
7. Gordon, M.S., Bartholomew, G.A., Grinnell, A.D., Jorgensen, C.B., And White.
8. Prosser, C.L. Brown 1985. Comparative Animal Physiology, Satish Book Enterprise, Agra – 282 003.
9. Turner, C.D. And Bagnara, J.T. (1976) General Endocrinology, 6<sup>th</sup> edn., Wb Saunders Co., Philadelphia.
10. Wilson, J.A. (1979) Principles Of Animal Physiology
11. Wood, D.W., 1983. Principles Of Animal Physiology 3<sup>rd</sup> Ed., 5.

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## CORE COURSE VI

### BIOCHEMISTRY AND BIOPHYSICS

#### Objectives:

*This paper gives information about the biochemical and biophysical aspects related to living organisms. The life supporting molecules, their metabolism, biological oxidation and its relevance. Biophysical aspects and their properties.*

### BIOCHEMISTRY

#### UNIT I

Introduction to Biochemistry: – Physical and chemical processes of living systems – Water and its functions – Dissolved gases and their properties – pH and buffer. *Proteins*: Classification - Structure and functions. *Carbohydrates*: Classification – Structure, properties and functions. *Lipids*: Classification, structure, properties and functions. *Amino Acids*: Structure and classification – Ketogenic and glucogenic amino acids – Prostaglandins – their classes, functions and Pharmacological uses. *Vitamins*: Structure of water soluble and fat soluble vitamins and Deficiency symptoms.

#### UNIT II

Metabolism of *Carbohydrate*: Glycolysis, TCA cycle, HMP shunt pathway, Glycogenesis and glycogenolysis. *Protein*: General pathway of amino acid metabolism – deamination, transamination and decarboxylation. Urea cycle. Catabolism of Tyrosine, Tryptophan, Glycine and phenylalanine. *Lipid*: Beta-oxidation, biosynthesis of saturated fatty acids- Palmitic acid, Nucleic acids:- metabolism of purine and pyrimidine nucleotides. High energy phosphates and their role in redox reaction. Phosphagens-ATP as an energy molecule. Synthesis of ATP.

#### UNIT III

Respiratory pigments: Structure of Haemoglobin and Cytochrome. *Biological Oxidation*: Nucleotides, Flavoproteins, Cytochromes – Redox potential – Oxidative phosphorylation. *Enzymes*: Classification – Properties – 3D structure of an enzyme – Enzyme kinetics – Mechanism of action of enzymes - active site, Lock and Key model, induced fit hypothesis. Mechanism of enzyme catalysis, enzyme-substrate complex formation, Allosteric enzymes. Co-enzymes and its properties. *Hormones*: Mechanism of hormone action – Peptide hormone – Adenylatecyclase – Cyclic AMP mechanism –  $Ca^{++}$  - Phosphoinositol, steroid hormone and transcriptional control. Receptors of hormones- G-protein.

## BIOPHYSICS

### UNIT IV

Scope of Biophysics in Biology- structure and properties of atoms and molecules- chemical bonds – types – molecular interactions- atomic and molecular orbitals – X-ray diffraction – Polymerization of organic molecules– Colloids- description, and properties. Thermodynamic principles – Membrane biophysics – diffusion, active transport. Tyndall effect, Surface tension, Brownian movement, filtration, osmosis, dialysis.

### UNIT V

Properties of natural light. Photoelectric effect – Photodynamic sensitization – Effect of UV light and ionizing radiations – Detection – Disintegration – Measurement of radio activity – Gieger Muller counter – Isotopes as tracers - Free energy from electromagnetic waves - Natural radiations. Principles and application of chromatography – Paper – Thin layer – Column – Ion – exchange – filtration – Gas liquid – HPLC and Affinity. Principles and applications of electrophoresis – Agarose gel electrophoresis – PAGE – SDS-PAGE.

#### Text Books:

1. Lehninger L. Albert, David. L. Nelson, Michael M. Cox. (1993), Principles Of Biochemistry, Cbs Publishers And Distributors, Delhi.
2. Ramamurthy, V and S. Raveendran. 2010. Fundamentals of Biochemistry. Aruma Publications, Koradacherry.

#### Reference Books:

1. Frunton J.S. & S. Simmonds, G. General and R.H. Dol. 1987. Outlines of Biochemistry, John Wiley & Sons.
2. Baldwin, E. 1964. An introduction to comparative Biochemistry, CUP, London.
3. Jain, J.L. 2003. Fundamentals of Biochemistry, S. Chand & Compnay Ltd. New Delhi.
4. Freifelder, D. 1993. Physical Biochemistry. W.H. freeman and company. New york.
5. Mallikarjuna Rao. 2006. Medical biochemistry. New Age International publishers, New Delhi.
6. Voet. G. 1989. Biochemistry. John Wiely and Sons, Inc.
7. Dubay, G. 1989. Biochemistry. Mac Millan publishing company, New York.
8. STRYER, L. (1988), Biochemistry, W.H. Freeman and Company, New York.
9. COOPER, T.G. (1977), The Tools of Biochemistry, Wiley Interscience Publication, John Wiley and Sons, New York.



**Text Book:****BIO PHYSICS**

1. Casey, E.J.(1962), Biophysics Concepts and Mechanisms, East West Press Pvt. Ltd., Delhi.
2. Arora, M.P. 2004. Biophysics. Himalaya Publishing House, Mumbai. P 378.
3. P.Narayanan (1999) 'Introductory Biophysics' New Age Publishing Co., Mumbai, India.

**Reference Books:**

1. Ackerman, E., Ellis, L.B. and Williams, L.E. 1979. Biophysical Science. Prentice hall of India, New Jersey, USA.
2. Daniel, M. 1989. Basis biophysics for biologists. Agro – Botanical publishers, India.
3. Pattabhi, V. and Gautham, N. 2003. Biophysics. Narosa publishing House, New Delhi.
4. Skoog, A., Douglas, J and Leary, J.J. 1992. Principles of Instrumental analysis. Sauders Golden Sunberst Series. Philadelphia.
5. Zubey. 1994. Biochemistry. The International books.
6. Bose, S. (1982) Elementary Biophysics. Jyoth Books.
7. Casey, E. J. (1962) Biophysics concepts and Mechanism. Affiliated East – West Press Pvt. Ltd., New Delhi.
8. Epstein, H. T. (1963) Elementary Biophysics selected topics. Addisson – Wesley Publishing Company Inc London.
9. Vasantha Pattabhi and N.Gautham (2001) 'Biophysics' Narosa Publishing Company, New Delhi.

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## CORE PRACTICAL II

### ANIMAL PHYSIOLOGY & BIOCHEMISTRY AND BIOPHYSICS (P)

#### Objectives:

To obtain knowledge about the physiological mechanism from animal models on respiration, excretion and some blood parameters. To identify the endocrine glands and their secretions.

#### Animal physiology:

1. Estimation of  $R_Q$  in fish with reference to light and temperature.
2.  $O_2$  consumption in aquatic animal (fish).
3. Blood analysis: Total WBC count, PCV, MCV.
4. Differential Counts
5. Total RBC count
6. Blood grouping and coagulation.
7. Hemoglobin estimation.
8. Estimation of blood glucose level in human (GOD kit).
9. Estimation of ammonia, uric acid and urea from samples

#### Spotters:

*Slides* : T.S of pineal gland, thyroid gland, parathyroid, thymus, adrenal and pancreas, T.S of Ovary, T.S of Testes, Muscles (striated, non-striated and cardiac), Nerve call.  
*Models*: Structure of mammalian eye, organ of Carti,

#### Biochemistry and Biophysics

1. Preparation of solution- molar, millimolar, micromolar and nanomolar; solutions of normality and percentage.
2. Determination of different pH using pH meter.
3. Preparation of standard graph using Spectrophotometer.
4. Chromatographic techniques:
  - a. Paper Chromatographic technique to separate amino acids.
  - b. Thin layer chromatographic technique to separate lipids.
5. Quantitative estimation of amino acid, protein, carbohydrate and lipid in animal tissues.
6. Quantitative estimation of DNA/ RNA
7. To isolate the Casein from milk.
8. To verify Beer Lambert's law
9. Fractionation of proteins using PAGE electrophoresis
10. **Spotters:** Thin layer, column, paper chromatography, Centrifuge, Kymograph, Spectrophotometer / Colorimeter, Sphygmomanometer, ECG, EEG.

**Record of Laboratory work shall be submitted at the time of practical examination.**

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**ELECTIVE COURSE I (A)**  
**APPLIED BIOTECHNOLOGY**

**Objectives:**

This paper deals with the applied aspects of biotechnology in medical, agricultural, industrial, microbial and environmental fields. The uses of the recombinant techniques and its application for the betterment of mankind.

**UNIT I**

Medical Biotechnology – Applications of r-DNA technology in human health - Recombinant DNA proteins and their uses: i) Interferon, ii) Interleukin, iii) Factor VIII, iv) Urokinase and v) Tissue plasminogen activator – Recombinant vaccines: Hepatitis-B, Rabies and FMD Vaccine - Commercial production of penicillin – DNA finger printing and its use in Forensic science

**UNIT II**

Hybridoma technology: Production and Application of monoclonal and polyclonal antibodies – Gene Therapy — Cell bank – Animal bioreactor and molecular pharming. Transgenic animals – transgenic animal model development – Transgenic mouse – embryonic stem cell method and pronucleus method – Transgenic fish and sheep. Bioethics in animal genetic engineering.

**UNIT III**

Agricultural Biotechnology: Genetically Modified Microorganisms – Phytoremediation. Bacterial Biofertilizers –Rhizobium, Acetobacter, Azospirillum inoculants – Nitrogen, Phosphate and sulphate fixing mechanisms, Green manuring – Cyanobacterial inoculants – VAM fungi. Benefits of biofertilizers - Biopesticides in pest management.

**UNIT IV**

Industrial and Microbial Biotechnology – Fermentation technology: Fermentors, Selection of microbes, Fermentation medium – Production of Penicillin, Vitamin B<sup>12</sup>, Amino acids and Proteases – Production of organic compounds by microbial fermentation – Ethanol and acetone production - Antibiotics – microbes used – commercial production of antibiotics – Single Cell Protein (SCP) production and their advantages.

**UNIT V**

Environmental Biotechnology – Bioremediation – *In-situ*, and *Ex-situ* Bioremediation – Use of genetically engineered bacterial strains – Bioremediation of dyes – Bioremediation in paper and pulp industry.

Immobilized culture – Bioremediation of heavy metals: Mechanism of metal removal – Bioremediation of coal waste through VAM fungi – Bioremediation of xenobiotics – Recycling of waste water through Microbes.

**Text book :**

1. Dubey, R.C. A Textbook of Biotechnology (Edition, 2006) S. Chand & Co. Ltd. Ram Nagar, New Delhi, India.
2. Gupta, P.K. Biotechnology and genomics (Edition, 2009) Rastogi Publication, Meerut, India

**Reference Books:**

1. Chopra, V.L and Nanin, A. 1992. Genetic Engineering and Biotechnology. Oxford and IBH Publishing Company, New Delhi.
2. Copping, G and Rodgers, P. 1986. Biotechnology. Oxford and IBH Publishing Company, New Delhi.
3. Das, H.K. Textbook of Biotechnology (Edition, 2006) Wiley Dream Tech, India Pvt. Ltd. New Delhi, India
4. Gustafon, J.P. 1984. Gene Manipulation in Plant Improvement. Plenum Press, New York.
5. Ignacimuthu, S. 1996. Basic Biotechnology, Tata McGraw- Hill Publishing Company Limited, New Delhi.
6. Lewin, B. 1990. Gene IV. Oxford University Press. Oxford. Marx, J.L., 1989. Revaluation in Biotechnology. Cambridge University Press, Cambridge.
7. Old R.W. and Primrose, S.B. 1985. Principles of gene manipulation. An Introduction to Genetic Engineering. Oxford Blackwell Publishers, London.
8. Ramawat, K.G and Shaily Goyal. Comprehensive Biotechnology (Edition, 2009), S. Chand & Co. Ltd. Ram Nagar, New Delhi, India.

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**ELECTIVE COURSE I (B)**  
**ENDOCRINOLOGY**

**Objectives:**

This paper provides knowledge about whole body control mechanism by hormones and also provides diseases caused due to hypo and hyper secretion of hormones and treatment options for imbalanced hormonal functions.

**UNIT I**

Scope of Endocrinology: Introduction, Objectives, aims and scope of endocrinology - Nature, function and classification of hormones - Hormones as messengers - Feedback control of hormone secretion- General principles of hormonal action - Experimental methods of hormone research.

**UNIT II**

**Invertebrate and Crustacean Endocrinology:** Concepts of neurosecretion and neuroendocrine system in invertebrate and crustacean groups - Neuroendocrine system in insects - hormonal control of reproduction, metamorphosis and moulting in insects.

**UNIT III**

**Vertebrate Reproductive Endocrinology:** Structure of mammalian testis and ovary - hormones of testis and ovary - Reproductive cycles (oestrus cycle and menstrual cycle) - Foeto-placental unit as an endocrine entry - hormonal regulation of pregnancy - parturition and lactation. Disorders of male and female reproductive systems, Assisted reproductive technology (ART) - MART - FART.

**UNIT IV**

**Pituitary and Thyroid gland:** Pituitary gland- structural organization - secretions, biosynthesis and their functions - hypothalamic control. Thyroid gland - structural organization - function and biosynthesis of thyroid hormone - metabolic effects of thyroid hormone - Effects of thyroid hormone on growth and reproduction - Parathyroid gland - structural organization - secretions, biosynthesis and Parathyroid hormone functions.

**UNIT V**

**Pancreatic Islets and Adrenal Glands:** Structure of pancreatic Islets - functions of insulin and glucagon - Diabetes. Adrenal gland - structural organization, functions of adrenal hormones. Biosynthesis and regulations.

**Text Book**

1. Turner, C.D. 1966. General Endocrinology. W.B. Saunders Co., London

**References:**

1. Barrinton, E.J.W. 1968. An introduction to general and comparative endocrinology. Academic press, New Delhi.
2. Bantley, P.J. 1985. Comparative vertebrate endocrinology. S.Chand and Co., New Delhi.
3. Mac Hadley, 1994. Endocrinology. Prentice Hall of India. New Delhi.
4. Michael, P. 1968. Endocrinology and human behavior. Oxford University press, New Delhi.

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**ELECTIVE COURSE II (A)**  
**COASTAL GEOMORPHOLOGY**

**Objectives:**

The main aim is to prepare the students for self-employment in the opened areas like coastal geomorphology in fishery biology. The relevant knowledge in coastal morphology, diversity and ecosystems and their impacts.

**UNIT I**

Definition and scope of coastal geomorphology- Coastal ecosystems- geomorphic classification of coastal systems –Diversity of Coastal Ecosystems- unconsolidated and consolidated coastal materials-Factors influencing coastal morphology and processes.

**UNIT II**

Physical basis of coastal environment – tides- tidal range-tidal currents- effects of tides on tidal flats- physical basis of wave movement-effects of waves- Tsunamis.

**UNIT III**

Processes in coastal ecosystem- bars- beach drift - beach forms- Beach and near shore sediments and morphology- Beach rock- Abrasion Platforms and cliffs- estuaries meandering.

**UNIT IV**

Salt marsh and mangrove ecosystems- Conservation and management of salt marshes and Mangroves- Corals and reef formation-Impacts of disturbance on coral reefs- sea grasses- swamps-coastal islands, forms, types and processes.

**UNIT V**

Coastal ecosystem impacts: Greenhouse effect and sea level rise- Effects of a changing climate -Effects on cliffs and shore platforms - Effects on beaches, spits and barriers - Effects on coastal dunes -Effects on intertidal wetlands -Effects on estuaries and lagoons - Effects on deltaic coasts - Effects on coral and algal reefs- protection of Marine Biosphere resources-impacts of coastal mining.

**Text Books:**

1. Ahnert, F.1998 Introduction to Geomorphology Arnold Publisher, London,
2. Eric Bird, 2007.Coastal geomorphology : an introduction, Wiley Publishers, England.

**Reference books :**

1. Oldale, R.1980 A geologic history of carp cod, U.S. Geological Survey, Washington.
2. Reed Wicander& James S.Monroe, 1999 Essentials of Geology Wadsworth Publishing Company, Tokyo 447 pp.
3. Sent, P.K. and Prasad, N.2002 Introduction to Geomorphology of India. Allied publishers private limited Mumbai 378 pp.
4. Robin Davidson-Arnott, 2010. An Introduction to Coastal Processes and Geomorphology, United States of America by Cambridge University Press, New York.
5. Amsath. A. and Maharajan. A. 2016. Coastal Geomorphology, Hari-Krish Publication, Nagercoil

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## **ELECTIVE COURSE II (B)**

### **POULTRY FARMING**

#### **Objectives:**

The main aim is to give information about the poultry and its importance.. It gives an idea for the self- employment opportunities to the students. The role of different research organizations and funding agencies to promote aquaculture.

#### **UNIT I**

Introduction to poultry science –Origin and history of poultry species: Chicken, turkey, duck and quail – Important qualitative traits in poultry. Economic traits of egg-type chicken and their standardization – Economic traits of meat – type chicken and their standardization. Nomenclature of breeds of fowl, classification of fowls, selection of breeds. Housing and equipment – General principles of building poultry sheds, deep litter system, laying cages.

#### **UNIT II**

Brooding and rearing – Natural and artificial brooding - Methods of brooding brood temperature, space and duration; fed, water and space allowance, debeaking – vaccination. Management of growers, layers, broilers – lighting of chicks, growers and layers. Summer and winter management, debeaking and culling. Poultry manure – volume, composition, value and disposal.

#### **UNIT III**

Feed additives – Names, allowance and usage of Food additive – the impact on human health. Food stuffs for poultry in relation to protein, amino acids, minerals (Ca and P), vitamins and fibre content. Feed formulations for chicks, growers, phase I to phase III layers and broilers. Nutritive value of egg, factors affecting egg size, storage and preservation of egg, marketing, incubation and hatching of eggs. Annual egg production in India.

#### **UNIT IV**

Symptoms, prevention, control and treatment of viral, bacterial, fungal, protozoan and worm infection, ticks, mites and lice affecting fowl.

#### **UNIT V**

Processing, Preservation, grading, storage and marketing of eggs and meat Economics of Poultry production – problems in poultry production. Economics of poultry production units to examine first hand rearing and business operation status.

**Text Book:**

1. Sunil Kumar Das (1994) – Poultry production, CBC Publishers and Distributors, Delhi.
2. Babu, M. and Lurthu Reetha, T. 2011. A Handbook on Poultry farming. Tamilnadu Veterinary and Animal Sciences University and Nehru Memorial College, Tiruchy.

**Reference Books:**

1. Ahsan, J. and Sinha, S.P. 2003. A Hand book on Economic Zoology. S. Chand & Company Ltd., New Delhi.
2. Arumugam, N., Murugan, T., Johnson Rajeshwar, J. and Ram Prabhu, R. 2009. Applied Zoology. Saras Publication, Nagercoil.
3. Banerjee G.C. (1992) A textbook of animal husbandary, Oxford and IBM Publishing Co., New Delhi.
4. Crawford RD.1990. Poultry Breeding and Genetics.
5. Elsevier. Hutt FB. 2003. Genetics of Fowl. Norton Greek Press.
6. Gupta,S.B.,Indian Poultry Industry year book 1975 –C-34, New Bactak Road, New Delhi
7. Intensive Poultry Management for egg production. Bulletin NO. 152, London.
8. Shukula, G.S. and Upadhyay V.B. (1997) Economic Zoology, Rakesh Rastogi Meerut.
9. Singh RP & KumarJ. 1994. Biometrical Methods in Poultry Breeding. Kalyani.
10. Tomar, B.S. and Singh, N. 2007. A Text Book of Applied Zoology. Emkay Publications, Delhi.

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## **CORE COURSE VII**

### **MICROBIOLOGY**

#### **Objectives:**

This paper instruct the students the History and Scope of microbiology, Microbial Technology, Microorganisms and Environment, food microbiology, microbial diseases and treatment.

#### **UNIT I**

History and Scope of microbiology- Classification of microbes. Structure of *a bacterium*. Bacterial respiration and reproduction – economic importance of bacteria. Classification of viruses- physical and chemical structures of viruses - DNA and RNA viruses. Concept of Sterilization - Physical and Chemical methods of sterilization. Stains and staining techniques. Bacterial nutrition and Growth- Nutritional types. Growth factors, Types of culture - culture media- Isolation of pure culture –Colony morphology and growth- Growth curve and Growth kinetics.

#### **UNIT II**

Microbial Technology: Genetic engineering of food and additives – Single Cell Protein (SCP) production – Production of organic acids (acetic acid), ethanol – Antibiotics – Microbial toxins – Fermentation products. Microbial Genetics: Recombination in Bacteria – Transformation – conjugation – Sex duction; Recombination in Bacteriophage – Transduction – Lytic and Lysogenic cycle. Genetic applications of bacteria and viruses.

#### **UNIT III**

Microorganisms and Environment: Microorganism of different soils - interactions with the atmosphere. Microorganisms in Aquatic Habitats – Microbiological analysis - in fresh water and marine water. Microorganisms and pollution – Microorganisms in sewage. Microorganism in extreme environments- thermophilic, methanogenic and halophilic. Photosynthetic bacteria, Cyanobacteria. Archaea of cold regions and space.

#### **UNIT IV**

Food Microbiology: Microbes of milk and food, methods of detection, pasteurisation and food poisoning. Spoilage of food, fruits, vegetables, cereals, meat, poultry egg, seafood, caned products – Factors influencing spoilage – Food preservation. Food borne infections and intoxications - Clostridium, Salmonella, and Staphylococcus –microtoxins in food with reference to Aspergillus species- Quality assurance- microbiological quality standards of food, government regulatory practices and policies- FDA, EPA.

## UNIT V

Microorganisms and Microbial Diseases: General Account of Pathogenic Bacteria – prognosis, diagnosis and treatment for diseases caused by viruses (Yellow fever, Dengue, Polio, HIV, Influenza), Bacteria (Pneumonia, Diphtheria, Tuberculosis, Typhoid, Gonorrhoea ) Fungi (Madura foot, Athlete's foot, Candidiasis) and Protozoa (Malaria, Amoebic dysentery, Trypanosomiasis, Leptospirosis).

### Text Books:

1. Lansing M, Prescott, John. P. Harvey, Donald A, Klein. Microbiology second edition – W.M.C. Brown Publications
2. R.C. Dubey, D.U. Maheshwari 2005. A Text book of Microbiology., S.Chand and company Ltd, New Delhi

### Reference books:

1. Burden, K.L. and R.P. Williams (6th Ed.) 1968. Microbiology. The Macmillan Co., London P. 818.
2. Dawes, E.A. (Ed.) 1986. Energy conservation in bacterial photosynthesis. In: Microbial energetics. Blackie & Son Ltd., Glasgow, 133-144pp.
3. Doelle, H.W. (Ed.) 1969. Fermentation acetic acid bacteria and lactic acid bacteria. In: Bacterial metabolism. Academic Press. New York, London. 256 – 351 pp.
4. Gevaral .J, Tortora, Berdell R. Funne Christine L. Cara, 1994. Microbiology an Introduction- fifth edition,
5. Hay, J.M. (Ed.) 1986. Modern Food Microbiology. CBS publishers, Delhi. 622 pp.
6. Kumarasamy, P, A. Maharajan and V. Ganapiriya. 2012. Microbiology. HariKrish Publication, Nagercoil.
7. Reed, G. (4th Ed.) 1983. Prescott & Dunn's Industrial Microbiology. AVI Publishing Co., Inc. Connecticut, 883. pp.
8. Roberts, T.A. and F.A. Skinner (Eds.) 1983. Food Microbiology: Advances and Prospects, Academic Press, Inc. London, 393 pp.
9. Selle, A.J. (Ed.) 1967. Fundamental Principles of Bacteriology. Tata McGraw – Hill Publishing Company Ltd., New Delhi, 822 pp.

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## **CORE COURSE VIII**

### **BIOSTATISTICS AND COMPUTER APPLICATIONS**

#### **Objectives:**

The aim of this paper is to know the statistical problems in biological science which is useful for the students for their research works. A basic knowledge in computer and its applications for further research.

#### **UNIT I**

Data in biostatistics – Collection of data and its methods, Classification of data, Presentation of data – Diagrammatic presentation of data, graphical presentation of data and tabulation of the data. Sample – methods of sampling. Variables and its types. Frequency distribution.

#### **UNIT II**

Descriptive statistics: measures of central tendency – mean and other means, median and mode. Measures of Dispersion – Range, Standard deviation uses and calculation. Co-efficient of variations and standard error. Measures of Skewness and Kurtosis. Correlation analysis Pearson and Rank correlation. Regression analysis based on biological data.

#### **UNIT III**

Probability – Definition – Additional theorems and multiplication theorem of probability with simple problems related to this. Probability distribution binomial, Poisson and normal distribution and its properties. Testing the hypothesis t- test, chi square test and goodness of fit, F test and ANOVA one way and two way analysis.

#### **UNIT IV**

Statistical packages: SPSS-data editor-Creating, coding variables. Output viewer, Exploring data with SPSS-Graphics and diagrammatic representations with SPSS, Application of SPSS in biological Sciences. Simple statistics with statistical packages –SPSS.

#### **UNIT V**

History and generations of computer. Components of a computer. Input and output devices of a computer. Hardware and software of a computer. Languages and its uses in biology, operating systems –Windows, MS-office-Word Processor (MS Word) ; Data processor (MS Excel) ; Presentaion (MS power point). Internet and e-mail. World Wide Web (www), web designing. Modem-Wi-fi and its uses.

**Text Books:**

1. Daniel, W.W. 2000. Biostatistics - A foundation for analysis in the Health science. John Wiley and sons, New york.
2. Sokal, R.R. and Rohlf, F.J. 2000. Biometry. Freeman, San Francisco.
3. Zar, J.H. 2003. Biosatistical Analysis. Person Edition Asia, New Delhi.

**Reference books:**

1. Bailey, N.T.J (1997) Statistical methods in Biology, III Ed., Cam. University Press, N.Y.
2. Gupta S.P. Statistical Methods, Sultan Chand & Sons Publishers, New Delhi
3. Khan &Khanum 1994 Fundamental of Bostatistics, Ukaaz Publications, Hyderabad
4. Palanichamy S, and Manoharan M, Statistical Methods for Biologists, Palani Paramount Publications, Palani
5. Ramakrishnan 2007 Saras Publications, Periavilai, Nagaercoil
6. Snadecor, G.W. and W.G.Cochran (1967) – Statistical methods, Oxford & IBH Publishing, New Delhi.
7. Sokal, R and James, F (1973), Introduction to Biostatistics, W.H. Freeman and Company Ltd., Tokyo, Japan.
8. Zar, J.H. (1974) – Biostatistical analysis – Prentice Hall Inc., New Jersey, USA.

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## CORE PRACTICAL III

### Microbiology & Biostatistics and Computer applications (P)

#### Objectives:

To obtain practical knowledge about the microbial mechanism from experiments with growth and metabolism. To identify the problems related to biological sciences and biostatistics. The use of computers in biological field.

#### Microbiology

1. General rules to be adopted in Microbiology laboratory.
2. Preparation of Non-selective and selective culture media.
3. Estimation of bacteria from soil and water using plate count method.
4. Observation of morphological characters of bacteria (temporary wet mount technique).
5. Preparation of smears for staining
6. Staining methods: - simple staining, gram negative staining, gram positive staining.
7. Bacterial growth curve

#### Biostatistics and Computer Applications

##### BIostatISTICS

Any **TWO** Problems related to Chi-square test, Student's t – test, Correlation and Regression

Graphical presentation of data histogram, pie diagram, bar diagram

SPSS package - univariate and multivariate analysis.

##### COMPUTER APPLICATIONS

1. Using windows OS – manipulating files – editing files
2. Demonstration of the Internet and its uses.

**Spotters:** Basic components of computers – Input – Mouse, keyboard, light pen, scanner Output (Printer, Monitor) devices. Modem.

**A record of laboratory work shall be submitted at the time of practical examination.**

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## **ELECTIVE COURSE III (A)**

### **RESEARCH METHODOLOGY AND BIOTECHNIQUES**

#### **Objectives:**

The main aim of this paper is (Unit I) to give information about how to write/publish a thesis and its basic steps. Other units are dealing with microtechniques, immunotechniques and tissue culture techniques. The Unit V gives information about cryotechniques.

#### **UNIT I**

Concept of Scientific research – selection of a research problem – Research design – sampling methods – Hypothesis and null Hypothesis – Data collection – Making observation and records. Preparation of index cards – Reference collection – Refereed journals, Impact factor, Citation index – H-factor and copyright.

#### **UNIT II**

Preparation of scientific paper' for publication in a journal. Preparation and presentation of research paper for Symposia, Seminar and Conferences. Technical papers and Monographs. Internet and e-journals. Preparation of thesis – components of thesis. Selection of animal models – Maintenance – CPCSEA regulations. Using computers in research – Computer aided techniques for data analysis, data interpretation and presentation.

#### **UNIT III**

Microtechniques : Permanent mounting: Narcotization and killing – fixing – washing – processing – staining – mounting – labelling. Histological preparation of tissues for SEM and TEM. Microphotography principles and applications. Detection of molecules in living cells, *in situ* localization by techniques such as FISH and GISH. Cryotechniques for microscopy. Freeze drying for physiologically active substances.

#### **UNIT IV**

Immunological techniques: Antigen and Antibody Preparation and purification, Production of monoclonal antibodies. Immunological techniques in medical diagnosis – HIV – Hepatitis A & B – cancer and pregnancy. Electrophoresis techniques – Gel electrophoresis –SDS-PAGE – Two dimensional gel electrophoresis. ELISA, Blotting Techniques, PCR, MALDI and N- terminal sequencing.

## **UNIT V**

Animal Cell Culture Techniques: Design and functioning of tissue culture laboratory – Cell proliferation measurements – Cell viability testing – Culture media preparation. Types of culture: – Flask, Test tube, Organ and Embryo culture. Protoplast culture. Stem cell culture. Cryopreservation for cells, tissues and organisms. Germplasm storage: Cryobank – Pollen bank, sperm bank. Biosensors and biochips – Applications.

### **Text books:**

1. Guramani. N. (2009). Research methodology for biological sciences. MJP publishers, Chennai.
2. Kothari CR, 2009. Second edition. Research Methodology – Methods and Techniques. Wiley Eastern,Ltd., New Delhi.

### **Reference Books:**

1. Case C.L and Johnson TR, 1984. Laboratory Experiments in Microbiology. The Benjamin Cummings Pub. Co., London.
2. Fritschen LJ and Gay LW, 1979. Environmental Instrumentation. Springer Verlag, New York.
3. Humason GL, 1979, Freeman WH and Co.,Animal Tissue Techniques. IV Edition, San Francisco.
4. Oser BL, 1965Hawk's Physiological Chemistry, 14<sup>th</sup> Edition, , Tata McGraw Hill Co.,
5. Osterman A, 1984Methods of Protein and Nucleic acid Research. Springer Verlag, New York.
6. Plumber D.T. 1971, An Introduction to Practical Biochemistry. Tata McGraw Hill Co.,
7. Sharma BAV, Ravindra Prasad D and Sathyanarayana P, 1989,Research Methods in Social Sciences, Sterling Pub. Pvt. Ltd.
8. Panneerselvam, R., Research methodology, prentice hall of India, New Delhi.

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## **ELECTIVE COURSE III (B)**

### **APPLIED ENTOMOLOGY**

#### **Objectives:**

To enlighten the students on harmful insects and their biology, nature of damage and management measures. To teach our students about various invertebrate pests which attack our crops and belongings and their management measures. To know information about useful insects.

#### **UNIT I**

Insect Pests: Definition - Classification of insect pests based on magnitude of damage, occurrence on crops – Types of damage caused by Insects on crop plants -The biological Success of Insects – Reasons for the Success of Insects – Pest Outbreak – Pest Resurgence – Insects as Phyto-pathogenic vectors.

#### **UNIT II**

Bionomics and Management of selected Insect Pests of Crops – Pests of Paddy, Cotton, Pulses, Vegetables (Brinjal and Tomato) , (Any Three to Four Major Pests for each crop) Economic Threshold Levels - Pests of stored products – External and Internal feeders (Any Three to Four Major Pests for each category) – Basic requirements for storage of food grains in Godowns -Polyphagous Insects.

#### **UNIT III**

Methods of Insect Pest Management: Types – Natural and Artificial methods – Cultural, Mechanical, Physical, Biological and Chemical methods. Pesticides – Classification, Types of formulations, mode of action, Toxicity, insecticide resistance, environmental safety.

#### **UNIT IV**

Management with Natural Enemies and other Biological Agents: Parasites and Parasitoids, Predators, Microbial agents. Conservation of Natural Enemies – Botanical Pesticides. Non-Conventional methods – Uses of IGRs, Repellents, Anti-feedants, Pheromones, Chemo-sterilants, Irradiation and Quarantine for managing insect pests.

#### **UNIT V**

Managing Insects with Resistant Plants: Insect and Host-Plant relationship – Mechanisms of Resistance – Genetic Nature of Resistance – Factors Mediating the Expression of Resistance. Integrated Pest Management: Basis for Integration - Potential components - Need for IPM and its application - Pest – Predator complex and Ecological balance. Pest resistant crops.



**Text books :**

1. Tembhare, D.B. 1984. Modern Entomology. Himalaya Publishing House, Mumbai.
2. Vasantharaj David, B. 2001. Elements of Economic Entomology. Popular Book Depot, Chennai, India.

**Reference Books:**

1. Ambrose, D.P. 2004. General Entomology. Kalyan Publishers, West Bengal.
2. Metcalf, C. V and Flint, W.P. 1979. Destructive and Useful Insects: Their Habitats and Control. Tata McGraw Hill Publications, New Delhi, India.
3. Pedigo, L.P. 2003. Entomology and Pest Management (Fourth Edition). Pearson Education (Singapore) Pte. Ltd., Delhi.
4. Vasantharaj David, B. and T. Kumaraswamy. 2002. Elements of Economic Entomology. Popular Book Depot, Chennai, India.
5. Verma, D.K. 1999. Applied Entomology. Mittal Publications, New Delhi.
6. Fenemore, P.G and A. Prakash. 2006 (Second Edition). Applied Entomology. New Age International Publishers, New Delhi.

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## **ELECTIVE COURSE IV (A)**

### **FISHERY BIOLOGY**

#### **Objectives:**

The main aim is to give information about the culture of fishes and crabs. It gives an idea for the self-employment opportunities to the students. The role of different research organizations and funding agencies to promote aquaculture.

#### **UNIT I**

History of Ichthyology – World and Indian fisheries. Fishes and their evolutionary history. Fish migration – Types of migratory fishes: Diadromous fishes - Anadromous, Catadromous and Amphidromous - Potamodromous and Oceanodromous fishes. Methods of migration - Factors influencing migration. Ponds and its management. Crustacean fisheries, molluscan fisheries and its economic importance.

#### **UNIT II**

Marine fisheries – Sardines, Mackerals, Sciaenids, Silver bellies, Pomfrets, Carangids and Sharks. Inland fisheries – Freshwater, riverine, reservoir, pond and cold water fisheries. Estuarine and brackish water fisheries and their economics. Deep sea fishes- Fish fauna of deep sea and their adaptive modifications.

#### **UNIT III**

Fish population studies – Assessment of fish stocks: marking and recapture method, area sampling method. Age and growth studies- length-frequency methods, scale method, otolith methods and other skeletal parts as age indicators. Length –weight relationship- condition factor.

#### **UNIT IV**

Culture fisheries – Integrated fish farming technology – rice cum common carp culture, fish cum duck culture- sewage fed fisheries- monosex culture, polyculture, ornamental fishes.

#### **UNIT V**

Fish processing and preservation- fish products and by products. Induced breeding techniques with examples. Fishing gears and crafts used in Indian fisheries. Brief account on transport and marketing. Effect of pollution of fishes. Fish pathology: Parasites – Protozoan, Fungal, Bacterial, Worms and Arthropods.

**Text Books :**

1. Biswas, S.P., (1993) Manual Of Methods In Fish Biology, International Book Co. Absecon Highlands, New Jersey.
2. Jhingran, V.G., (1991) Fish And Fisheries Of India. Hindustan Publishing Copr., New Delhi.

**Reference Books :**

1. Bose, A.N., Yang, C.T., And Misra, A. (1991) Coastal Aquaculture Engineering. Oxford And Ibh Publishing Co., Pvt. Ltd., New Delhi.
2. Chakrabarti, N.M., (1994) Diseases Of Cultivable Freshwater Fishes And Their Control. International Books And Periodicals Supply Service, New Delhi.
3. Day, F., (1986) The Fishes Of India, Vols., I & II. Today And Tomorrow's Book Agency, New Delhi.
4. Govindan, T.K. (1992) Fish Processing Technology, Oxford And Ibh Publishing Co., Pvt. Ltd., New Delhi.
5. Mpeda Hand Book of Aquafarming (1992) Freshwater Fishes, Marine Products Export Development Agency, Kochi.
6. New, M.B., Tacon, A.G.J., And Csavas., I. (1993) Farm – Made – Aqua Feeds. Food And Agriculture Organization Of United Nations, Rome.
7. Santhanam, R., (1990) Fisheries Science, Daya Publishing House, New Delhi.
8. Seghal, K.K. (1992) Recent Researches In Cold Water Fisheries, Today And Tomorrow's Publishers And Printers, New Delhi.
9. Sinha, V.R.P. (1993) A Compendium Of Aquaculture Technologies For Developing Countries. Center For Science And Technology And Oxford And Ibh Publishing Co., Pvt., Ltd., New Delhi.
10. Pillai, T.V.R. (1993) Aquaculture : Principles And Practices. Fishing News Agency, London.
11. S. Raveendran, K. Muthukumaravel, O. Sathick And V. Ramamurthy. 2011. Estuarine Biology. Aruma Publications, Koradacherr

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## **ELECTIVE COURSE IV (B)**

### **BIOINFORMATICS**

#### **Objectives:**

The aim of this paper is to know the bioinformatics and its applications in biological science which is useful for the students for their research works. Through bioinformatics the various bio techniques may be obtained for further research.

#### **UNIT I**

Bioinformatics and its relation with Molecular Biology – Historical overview and Definition of Bioinformatics – Data generation through Genome sequencing, Protein sequencing, Gel electrophoresis, NMR Spectroscopy, X-Ray Diffraction, and microarray - Applications of Bioinformatics.

#### **UNIT II**

Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL) - Protein databases (Primary, Composite, and Secondary) - Specialized Genome databases: (SGD, TIGR, and ACeDB) - Structural databases (PDB, MMDB, CATH, SCOP) - Structural features of RNA: Primary, Secondary, Tertiary. Introduction to RNA Secondary structure prediction - Methods for RNA Secondary structure prediction, Limitations of RNA Secondary structure prediction.

#### **UNIT III**

Protein Structures: Primary, Secondary, Super Secondary, Domains, Tertiary, Quaternary, Ramachandran plot - Protein secondary structure prediction methods: GOR, Chou-Fasman - Protein Tertiary structure prediction methods: Homology Modeling, Protein folding, Molecular Dynamics of Protein, Molecular Docking of Protein - Motif databases and analysis tools. Domain databases (CDD, SMART, ProDom) and Analysis tools - Hidden Markov Model (HMM).

#### **UNIT IV**

Pairwise Sequence alignment (BLAST and FASTA Algorithm) and multiple sequence alignment (Clustal W algorithm) - Methods for presenting large quantities of biological data: sequence viewers (Artemis, SeqVISTA) - 3D structure viewers (Rasmol, SPDBv, Chime, Cn3D, PyMol), Anatomical visualization. Quantitative Structure Activity Relationship (2D & 3D). Combinatorial libraries & their design. High throughput screening, virtual screening, Lipinski's rule of five.

## UNIT V

Genomics: Genome Annotation, Genome Assembly, Structural and Functional Genomics. System biology - Interactomics (PPI), Fluxomics, Biomics. Metagenomics - Metabolic pathway database (KEGG pathway database) - Concept of metabolome and metabolomics – Computer Aided Drug Design (CADD) – Drug Design Approaches – Target based, Structure based and *De novo* Approaches –ADME –Tox Property Prediction and Models.

### Text Books:

1. Lesk, A.M. 2007. Introduction to Bioinformatics (Second edition). Oxford University press, New Delhi.
2. Murthy.C.S.V. 2004. Bioinformatics. Himalaya Publishing House. Delhi.

### Reference Books:

1. Attwood, T.K., Parry-Smith, D.J. Phukan, S. 2014 (Ninth Impression). Introduction to Bioinformatics. Pearson Education, Delhi.
2. Bal, H.P. 2007. Bioinformatics Principle and applications. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
3. Campbell, A.M and Heyer, L.J. 2004. Discovering Genomics, Proteomics and Bioinformatics. Pearson Education, Delhi.
4. Gladis HelenHepsyba, S. and Hemalatha, C.R. 2009. Basic Bioinformatics, MJP Publishers, Chennai.
5. Krane, D.E and Raymer, M.L. 2006. Fundamental Concepts of Bioinformatics. Pearson Education, USA.
6. Kumerasan, V. 2009. Biotechnology (Revised Edition), Saras Publications, Kanyakumari.U
7. Lohar, P.S. 2009. Bioinformatics, MJP Publishers, Chennai.
8. Ramawat, K.G. and Goyal, S. 2009. (Fourth Revised Edition). Comprehensive Biotechnology, S.Chand and Company Ltd, New Delhi.
9. Rastogi, S.C., Mendiratta, N. and Rastogi, P. 2011 (Third Edition). Bioinformatics Methods and Applications: Genomics, Proteomics and Drug Discovery. PHI Learning Private Limited, New Delhi.
10. Sharma, V., Munjal, A. and Shanker, A. 2011-2012. A Text Book of Bioinformatics. Rastogi Publications, Meerut, India.
11. Smith H, J, Smith & William. 1988. Introduction to the Principles of Drug Design, 2nd ed, Wright London.
12. Sundaralingam, R. and V.Kumaresan. 2008. Bioinformatics. Saras Publication. Nagercoil.
13. Sundararajan, S and Balaji, R. 2003. Introduction to Bioinformatics. Himalaya Publishing House, Delhi.
14. Thiagarajan, B. and Rajalakshmi, P.A. 2009. Computational Biology, MJP Publishers, Chennai.
15. Westhead, D.R., Parish, J.H and Twyman, R.M. 2003. Bioinformatics. Viva Books Private Ltd., New Delhi.
16. Xiong, J. 2013 (Reprint). Essential Bioinformatics. Cambridge University Press, New York, USA.

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## **CORE COURSE IX**

### **ENVIRONMENTAL BIOLOGY**

#### **Objectives:**

The main aim of this paper is to give information about the environment of biotic and abiotic factors, bio-geo chemical cycles, Habitat, population ecology, pollution and their control measures. The toxicant related with environment, the toxic effects in different fields and to find out the environmental pollutants.

#### **UNIT I**

Abiotic factors: Water, soil, light. Biotic factors; Intra (Aggregation, colony formation, social organization) and inter specific associations (Neutralism, symbiosis and antagonism). Structure and function of an ecosystem: - Autotrophic and heterotrophic producers, consumers - pyramids - primary and secondary productivity - methods of measurements - different trophic level - energy flow in an ecosystem - food chain - food web -.characteristics of different biomes. Interaction between environment and biota, Energy and nutrient flow

#### **UNIT II**

Nutrient cycles - Nitrogen, phosphorus, Carbon and sulphur in nature - role of microbes in environment. .Biotic community - Concepts - Stratification - ecological niches - ecotone and ecological succession. Population ecology and biological control. Population growth - Biotic potential Regulation of population size -Population interaction - Human population and urbanization.

#### **UNIT III**

Habitat Ecology-fresh water, marine, estuary, terrestrial, forest and desert. Biodiversity-basic concepts, types, hot spots of bio diversity. Wildlife conservations and management - International / National policies and conservation strategies of Biodiversity management. Remote sensing, Satellite images - Aerial photography - Thermal and infrared images, radar in ecological applications. Instrumentation - GPS, radio telemetry and satellite telemetry techniques used in ecological research. GIS techniques in ecological research.

#### **UNIT IV**

Environmental Pollution: Effects and control measures of Air, Water, Soil, Marine pollution. Acid rain, Ozone layer depletion. Bio accumulation - Bio magnification, BOD, COD, TDS, TSS. EIA - Steps in EIA - Methods of EIA. Acute toxicity - Chronic toxicity - Assessment of safety/risk. Natural resources - sustainable development - survey. Energy resources - environmental quality standards - soil conservation.

## UNIT V

Toxicology: types of toxins - Pesticide toxicity: Pesticides and their types – Insecticides – Herbicides – fungicides – rodenticides – nematicides – fumigants. Properties and effects of pesticides on organisms – acute and chronic effects, biological monitoring and regulation. Toxicological methods: Acute, sub-acute chronic and special tests. Statistical concept of toxicity - Concentrations. Response relationship – Margin of safety, Toxicity curve, Cumulative toxicity, and toxicity of chemical mixture.  $LC_{50}$  and  $LD_{50}$  - bioremediation of toxic substances.

### Text Books:

1. Chapman, B.C and Reigs. M.J. 1997. Ecology principles and application. Cambridge University Press, U.K.
2. Clark, G.C. 1963. Elements of ecology. John Wiley and Sons Inc., New York.
3. Odum, E.P. 1996. Fundamentals of Ecology (III Ed.). Nataraj Publishers, Dehradun. P 574.

### Reference Books:

1. Ahmad, Y.J and Sammy, G.K. 1985. Guidelines to Environment Impact Assessment in developing countries. Hodder and Stoughton Ltd., London.
2. Asthana, D.K and Asthana, M. 2001. Environment problems and solutions. S. Chand and Co., New Delhi.
3. Bhatia, H.S. 1998: A Text Book On Environmental Pollution And Control, Galgotia, New Delhi.
4. Kumar, H.D. 1997. Modern concepts of ecology. Modern Printers, New Delhi. P 478.
5. Paul Colinvaux, 1986: Ecology. John Wiley And Sons, N.Y.
6. Srivastava, R.P. and Saxena, R.C.1989. Textbook of Insect toxicity. Himansha publications, Rajasthan.
7. Trivedi, P.R and Gurdeepraj, K. 1992. Environmental biology. Akashdeep Publishing House, New Delhi.
8. Williams.R.T 1959. Detoxification mechanisms. Wiley. New York.

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## **CORE COURSE X**

### **IMMUNOLOGY**

#### **Objectives:**

The main aim of this paper is to obtain knowledge about immune systems, cells of immunity and its role in protection of our body. Antigen, antibody concepts, hypersensitivity, MHC and complement pathways. Different immunological techniques used in the clinical testing.

#### **UNIT I**

Introduction to immune system. Innate and Adaptive immunity – Lymphoid system: Primary and secondary lymphoid organs, tissues. Cells of immune system: lymphoid lineage, myeloid lineage. Molecules- complement, acute phase proteins, interferon, lymphokines and cytokines.

#### **UNIT II**

Antigens: Types of antigens – factors of antigenicity. T cell and B cell epitopes, haptens, adjuvants and carriers. Antibodies: Ultra structure of immunoglobulin, types, paratopes, characteristics and functions. Monoclonal and polyclonal antibodies. Antibody receptors- T cell receptors (TCR), Genes for TCR, TCR diversity. Immune response- Humoral and cell mediated immune response.

#### **UNIT III**

Hypersensitivity: Definition and classification; Types- I, II, III, IV and V. Major Histocompatibility Complex (MHC): Genomic organization, MHC molecules, peptide binding. Complement activation: Classical and Alternate pathway. Transplantation immunology: Types of grafts- Allograft rejection- Prevention of allograft rejection.

#### **UNIT IV**

Vaccination: Principle, antigen as vaccines, subunit vaccines, recombinant vaccines, anti idiotypic antibodies as vaccines, Vaccination schedule for humans. Tumour immunology: Tumour antigens- Immune response to tumours- Immunotherapy to tumours- Tumour vaccines. Autoimmune diseases. Immunodeficiency- inherited and acquired.

#### **UNIT V**

**Immunotechnology:** Clinical methods for detection of antigens and antibodies: Immunodiffusion: Ouchterlony analysis-Double immunodiffusion. Immunoelectrophoresis. Binder- Ligand assays: RIA, ELISA, EMIT. Histocompatibility testing: HLA typing- RFLP method, PCR method.



Autoimmune disease detection: Rheumatoid arthritis, Hepatitis – B virus test.  
Immune complex detection: Rossette Forming Array, Plaque Forming Array.

**Text books:**

1. Janis Kuby.1997.Immunology.W.H.Freeman & company, New York.

**Reference Books:**

1. Arumugam, N.*et al.*, 2005. Immunology and Microbiology, Saras Publications, Kanyakumari.
2. Kannan, I. 2007 Immunology, MJP Publishers, Chennai.
3. Rao,C.V.2006.Immunology. Narosa Publishing House, New Delhi.
4. Ivan M. Roitt *et al.*, Essential Immunology. XII Edition, Wiley- Blackwell Publishers.UK.
5. Shetty, N. 2006. Immunology. New Age International (P) Limited, Publishers. New Delhi.

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## **CORE PRACTICAL IV**

### **ENVIRONMENTAL BIOLOGY & IMMUNOLOGY (P)**

#### **Environmental Biology**

1. Report on ecological collection representing different habitats and their adaptations – sandy, muddy, rocky shores fauna
2. Animal Association: Parasitism, Symbiosis, Mutualism and Commensalism
3. Hydrological studies of water samples with special reference - Chlorides, silicates, calcium, total hardness, phosphates and nitrates – pH, dissolved oxygen and BOD, CO<sub>2</sub>, Carbonates and Bicarbonates.
4. Quantitative and qualitative estimation of marine & freshwater plankton.
5. Estimation of primary productivity
6. Determination of LC<sub>50</sub>

#### **Immunology**

1. Histology of lymphoid organs in Mouse
2. Preparation of antigen and raising of antibody – RBC and sperm proteins.
3. WIDAL test for typhoid detection
4. RPR test for Syphilis detection
5. Mancini's Single Radial immunodiffusion
6. Ouchterlony's Double immunodiffusion
7. Demonstration of Ig G by precipitation ring test
8. Demonstration for haemagglutination
9. Immuno- electrophoresis of human serum and anti-human serum (Demonstration)

#### **Spotters:**

Lymph node, Lymphocytes, Vaccine, ELISA, RIA.

**A record of laboratory work shall be submitted at the time of practical examination**

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## **ELECTIVE COURSE V (A)**

### **SERICULTURE**

#### **Objectives:**

The main aim is to give information about the culture of silkworm. It gives an idea for the self-employment opportunities to the students. The role of different research organizations and funding agencies to promote Sericulture.

#### **UNIT I**

Sericulture: Definition, history and present status; silk route. Mulberry and types of non-mulberry sericulture. Commercial varieties of mulberry plants used in Sericulture in India. Requirement for Mulberry Cultivation - Soil - Climatic conditions: Temperature, photoperiod, humidity and rainfall. Mulberry management: Land preparation- Irrigation- Manuring - Propagation of mulberry plant- Plantation methods. Profitable cultivation and Harvesting. Diseases of mulberry – fungal, bacterial, viral and Nematode diseases, Deficiency diseases and their remedial measures

#### **UNIT II**

Silkworm taxonomy and distribution. Univoltine, Bivoltine and Multivoltine races. Exotic and indigenous races in India. Life cycle of Mulberry Silkworm: Egg, larva, pupa and adult, life span. Morphology: Egg, Larvae: Mouth parts, legs, prolegs, spiracles, eyes, claspers and integumentary hair and sexual markings. Pupa: Sexual dimorphism. Adult: Mouth parts, antenna, wings and external genitalia - Silk glands: Structure, development and mechanism of silk synthesis - Hormonal control on metamorphosis, diapause, silk synthesis and reproduction.

#### **UNIT III**

Silkworm rearing: Rearing house -CSB model. Early age and late age rearing. Rearing appliances- Mountages- types of mountages and disinfectants. Seed: Collection of disease-free layings (DFLs), incubation, Hatching and Brushing- Feeding and rearing, spacing, cleaning and dusting. Mounting and cocoon production: spinning of cocoons. Harvesting, preservation, assessment, storage. Transportation: Cocoons, record maintenance, cost of cocoon production, leaf cocoon ratio.

#### **UNIT IV**

Silkworm diseases : Etiology, Structure, Symptoms, Preventive measures and control of viral diseases - Nuclear polyhydrosis virus (NPV) and Cytoplasmic, polyhydrosis virus (CPV) Infectious flacherie virus (FV) and Densonucleosis virus (DNV) Noesma bombycis (Pebrine disease). Bacterial diseases- Bacterial septicemia Bacterial gastroenteric disease Bacterial toxicosis . Fungal Diseases

-White muscardine, Green muscardine, Yellow muscardine. Silkworm pests—Tachinid Fly (Uzifly) Trycholga bombycis, Dermistid beetles, Dermestes cadniverinus—Vertebrate and other silkworm pests and their control.

## **UNIT V**

**SILK TECHNOLOGY:** Selection of Cocoon for reeling - Quality of cocoon - Physical and chemical properties of silk fibre. Raw materials for silk reeling - Cocoon processing - Cocoon drying- stifling, Cocoon sorting and preservation: deflossing. Marketing organization for Cocoon and Yarn - Raw silk manufacture - Silk by-products: Reeling waste and its utility in spun silk industry utility of pupae. Role of Central Silk Board and Directorate of Sericulture in extension programmes - Sericulture organization at state and national levels.

### **Text Books:**

1. Ganga, G. and Sulochana Chetty, J. 2003. An Introduction to Sericulture (2<sup>nd</sup> Edition). Oxford and IBH Publishing co. Pvt-Ltd., New Delhi.
2. Ullal, S.R. and Narasimhanna, M.N. 1979. Hand book of Practical Sericulture. Central Silk Board, Bombay.
3. Taxima, Y. 1972. Hand Book of Silkworm Rearing. Fuji Publication, Tokyo.

### **Reference Book:**

1. Handbook of silkworm Rearing: Agriculture and technical manual-1, Fuzi pub. Co. ltd., Tokyo, Japan 1972
2. Jolly, M.S. Director, CSR & TI, Mysore Appropriate sericultural Techniques: Ed.
3. Krishnaswamy S. 1986. Improved method of rearing young age silkworm: reprinted CSB, Bangalore.
- Narasimhanna M.N. 1988. Manual of silkworm egg production, CSB, Bangalore
4. Sengupta, K. Director, 1989. A guide for bivoltine sericulture: CSR & TI, Mysore
5. Shukla, G.S. and Upadhyay, V.B. 1997. Economic Zoology. Rastogi Publications, Meerut.
6. Tomar, B.S and N. Singh. A Text Book of Applied Zoology. 2007. Emkay publications. Delhi.
7. Wupang-chun and da-chung 1988. Silkworm rearing:, FAO, Rome.

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## **ELECTIVE COURSE V (B)**

### **AQUACULTURE**

#### **Objectives:**

The main aim is to give information about the culture of fishes and crabs. It gives an idea for the self-employment opportunities to the students. The role of different research organizations and funding agencies to promote aquaculture.

#### **UNIT I**

Definition- Scope of aquaculture- Aquaculture in India, Role of aquaculture on economic development, constraints in aquaculture, organization related to aquaculture and fisheries, types of aquaculture- Freshwater aquaculture, coastal aquaculture and marine aquaculture. Fresh water culturable fishes, marine water culturable fishes.

#### **UNIT II**

Fish ponds-Definition, breeding ponds, nursery ponds, rearing ponds, culture ponds (stocking ponds). Preparation of pond for fish culture, management of fish ponds, water quality management of fish ponds. Importance and composition of feeds; types of feed, wet and dry feeds, Artificial and live feeds- Artemia, Diatoms, Daphnia and Spirulina cultures.

#### **UNIT III**

Types of cultures – Extensive culture, Intensive culture and semi-intensive culture, monosex culture, monoculture, polyculture, cage culture and pen culture. Integrated fish farming – paddy cum fish culture, Animal husbandry cum fish culture, sewage fed fish culture. Culture practices : Major carps, Prawns, Lobster, Pearl Oyster, Edible Oyster Mussels and seaweeds.

#### **UNIT IV**

Fish disease management: Common bacterial, viral, fungal, protozoans and crustaceans diseases, their symptoms and treatment. Aquatic pollution – Definition, causes, ecological effects and control of water pollution. Hypophysation- Definition, principle and procedure of hypophysation – collection, preparation and injection of pituitary extract, selection of breeders, mechanism of pituitary action and advantages of hypophysation.

#### **UNIT V**

Genomic manipulation- Hybridization, Androgenesis, Gynandrogenesis and Polyploidy. Harvesting and transport of fish and its products. Fish preservation and fish processing technology – By products of fish and its uses. Marketing of

fishery products, Government organizations in Aquaculture. ICAR, CMFRI, CIFRI, CICFRI, CIFA, CIBA, CIFT & MPEDA.

**Text Book :**

1. Pillay, T.V.R. 1995. Aquaculture principles and practices. Fishing News Books, Blackwell Science Ltd., Oxford.
2. Shanmugam, K. 1990. Fishery biology and Aquaculture. Leo Pathipagam, Madras.
3. Santhanam, Sugumaran and Natarajan, P. 1997. A Manual of freshwater aquaculture. Oxford and IBH Pub. Co. Ltd., New Delhi.

**Reference Books:**

1. Arumugam.N. 2008. Aquaculture Saras Publications, Nagercoil.
2. Baradach, JE, JH Ryther and WO McLarney (1972) Aquaculture. The farming and Husbandry of Freshwater and Marine Organisms. Wiley Interscience, New York.
3. Chadar, S.L. 1980. Hypophysation of Indian major carps. Satish Book Enterprise, Agra, PP.146
4. Exporters manual and Documentation. 1999. Jain Book Agency. New Delhi.
5. Jhingran.V.C. 1991. Fish and fisheries of India, Hindustan Pub. Cord. New Delhi.
6. Kurian,C.V and Sebastin. 1992. Prawn and prawn fisheries of India, Hindustan Pub. Cord. New Delhi.
7. Rath, R.K. (2000) Freshwater Aquaculture. Scientific Publishers, (India), PO.Box.91, Jodhpur.

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