

SEMESTER- I

CC I - FUNCTIONAL MORPHOLOGY, PHYLOGENY & PALAENTOLOGY OF INVERTEBRATES AND CHORDATES

Int:25
Ext: 75

Exam Hrs :3
Subject Code : PZA

Objectives:

To give a thorough understanding in the morphology, mode of life of Invertebrates and vertebrate animals.

To acquire an in-depth knowledge on the palaeontology in animal world

To develop an holistic appreciation on the phylogeny, relationships and adaptations in animals

A.INVERTEBRATES

Organization

18 hours

Symmetry in animal organization – Asymmetry, radial, biradial and bilateral symmetry – Significance.

Coelom – Evolution of coelom. Acoelomate, pseudocoelomate, coelomate groups (Schizocoel, Enterocoel, mesenchyme) – Significance.

Metamerism – Evolution of metamerism – Pseudometamerism, cyclo metamerism, corn theory, embryological theory – Significance.

Locomotion

18 hours

Movement in Annelids, Molluscs and Echinoderms.

Nutrition:

Filter feeding in Polychaetes, Molluscs and Prochordates.

Respiration

Gills and trachea in Arthropods – Respiration in Molluscs.

Circulation

Circulation in Arthropods and Molluscs.

Phylogeny

Phylogeny of phylum Protozoa, Bilateral, Annelida & Mollusca

Unit-II

18 hours

Excretion

Different types of excretory organs in invertebrates – their structure and function.

Nervous System

Primitive types – Coelenterates and nerve net; advanced types – Nervous system in Annelids, Molluscs and Arthropods.

Chemical Co-ordination

Endocrine glands in Crustaceans and Insects – Pheromones and allele chemicals.

Unit-III

18 hours

Reproduction

Pattern of sexual and asexual reproduction – Invertebrate larval forms and their phylogenetic significance.(Annelids, Molluscs, Arthropods and Echinoderms.)

Invertebrate Fossils

Evolutionary trends and phylogenetic importance of Trilobites, Ammonoids, Belemnoids, Nautiloids, Echinoderm fossils.

Minor Phyla,

Organisation and affinities of 1. Chaetognatha, 2. Rotifera, 3. Sipunculida,
4. Phoronida. Echiura, , Brachipoda, Onychophora

B. CHORDATES

A. Comparative study and functional Morphology of vertebrates.

Unit-IV

18 hours

Digestive System

Alimentary canal and associated glands

Respiratory System

Gill respiration in cyclostomes and fishes – Pulmonary respiration in tetrapods.

Circulatory System

Types & evolution of heart and aortic arches.

Excretory System

Types & evolution of kidneys.

Origin of Chordates.

Unit-V

18 hours

Nervous System

Brain and spinal cord – cranial nerves, spinal nerves and visceral nerves – Autonomic nervous systems – Sympathetic – Parasympathetic.

Reproductive System

Reproductive systems – Accessory reproductive glands.

Reptiles – origin and adaptive radiation

Origin of birds and mammals

Vertebrate Fossils

Evolutionary significance of Ostracoderms, Placoderms, Crossopterygians, Labyrinthodonts, Dinosaurs, Archaeopteryx and Mesozoic mammals.

TEXT BOOKS:

Invertebrates:

1. **BARNES, R.D.** (1982), Invertebrate Zoology, IV Ed., Holt Saunders International Edition.
2. **BARRINGTON, E.J.W.** (1979), Invertebrate Structure and Functions, II Ed., ELBS and Nelson.
3. **MOORE, R.C., LOLICKER** and **FISCHER, A.G.** (1952), Invertebrate Paleontology, McGraw Hill Book Co., Inc., N.Y.

Chordates:

1. **WATERMAN, A.J.** (1971), Chordate Structure and Function, The Macmillan Company.

REFERENCES:

Invertebrates:

1. **HIGHNAM, K.C.** and **HILL, L.** (1979), The Comparative Endocrinology of Invertebrates, ELBS & Edward Arnold (Publishers) Ltd., London.
2. **HYMAN, G.H.**, The Invertebrates, Vol. I to VII, McGraw Hill Book Co., Inc., N.Y.
3. **VASANTIKA KASHYAP** (1997), Life of Invertebrates, Vikas Publishing House Pvt. Ltd., New Delhi.
4. **KOTPAL, R.L.**, Minor Phyla, Rastogi Publication, Meerut.

Chordates:

1. **COLBERT, H. EDWIN** (1989), Evolution of the Vertebrates, II Ed., Wiley Eastern Limited, New Delhi.
2. **HARREY POUGH, JOHN B. HEISHER, WILLIAM N. McFARLAND** (1990), Vertebrate Life, Macmillan Publishing Co., N.Y.
3. **JOLLIE, M.** (1962), Chordate Morphology, Reinholt Publishing Corporation, N.Y.
4. **KENT, G.C.** (1976), Comparative anatomy of the Vertebrates, McGraw Hill Book Co., Inc., New York.
5. **ROMER, A.S.** (1974), The Vertebrate Body, W.B. Saunders, London.
6. **ROMER, A.S.** (1979), HYMAN's Comparative Vertebrate Anatomy, III Ed., The University of Chicago Press, London.
7. **WEICHERT, C.K.** (1965), Anatomy of the Chordates, McGraw Hill Book Co., N.Y.
8. **NEWMAN, N.H.** (1961), Phylum Chordate, The University of Chicago Press,

Chicago.

Semester -I

CC- II – CELL AND MOLECULAR BIOLOGY

Int:25

Ext: 75

Exam Hrs :3

Subject Code : PZB

CELL BIOLOGY

UNIT – I

18 hours

Cell membrane: Molecular organisation- molecular models – cell permeability – cell surface differentiations and cell – cell communication – secretion and endocytic pathways.

Structure and functions of cells: Cell organelles – Mitochondria, Golgi complex, Endoplasmic reticulum, Ribosomes and Lysosomes. Peroxisome. structure & function of cytoskeleton and its role in motility

Methods of cell study : Micrometry – cell culture methods – cell fractionation technique – cytochemical staining methods – cytophotometry – immunochemistry and autoradiography

UNIT – II

18 hours

Nucleus: Nucleoplasm and cytoplasmic relationship-Hammeling's experiment, isolation techniques; ultrastructure of nuclear envelop and nucleoplasm.

Chromosomes:–Biochemistry – Organization of chromatin; Chromosomal types – polytene and lamp brush chromosome.

Cell division:Cell cycle and mitosis- significance of mitosis; meiosis and reproductive cycle- regulation and significance of meiosis. cell cycle-(steps - regulation and control)

MOLECULAR BIOLOGY

UNIT – III

18 hours

Nucleic acid: DNA and RNA types, their topology and functions

DNA replication: Types of replication- conservative, dispersive and semiconservative methods; Process of replication - Origin, replication fork, regulation in prokaryotes and eukaryotes; Role of enzymes and other protein factors in DNA synthesis.

DNA damage: Sources and types of DNA damage; Nuclear versus mitochondrial DNA damage; Senescence and apoptosis; DNA damage and mutations.

DNA repairing mechanism: Excision repair, SOS repair and mismatch repair.

UNIT IV

18 hours

RNA synthesis: Process of transcription- preinitiation, initiation, promoter clearance, elongation and termination; role of enzymes and other protein factors; Measuring and detecting transcription; reverse transcription; synthesis of mRNA in prokaryotes and eukaryotes; synthesis of rRNA; synthesis of tRNA; RNA processing- capping and polyadenylation. RNA editing, Splicing.

UNIT V

18 hours

Genetic code: Process of translation – initiation, elongation and termination and post translational process; role of enzymes and proteins in protein synthesis – Genetic code.

Gene regulation: Lac operon- Structure, genetic nomenclature, lactose analogs, regulation in cyclicAMP and uses in molecular biology; Trp operon- repression and attenuation.

Protein transport: Intracellular compartments and protein sorting; vesicular traffic in secretory and endocytic pathway, transport from ER through Golgi to lysosome and endosome.

Control of gene expression at transcription level regulation of phages, virus,, Prokaryotic and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing.

Text Books:

1. **R.M.Shukla** ,(2005)A Text Book of cell Biology , Dominant Phblishers and Distributers , New Delhi-110002.
2. **Dipak Kumar Kan, Soma Halder**, (2009), Cell biology, Genetics , Molecular Biology, New Central Book Agency , NewDelhi.

REFERENCES

CELL BIOLOGY

1. **DeRobertis, E.D.P. , F.A., Saez, and E.M.R. De Robertis Jr.** 1975. Cell biology. W.B. Saunders Company, Philadelphia.
2. **Du Praw, E.J.** 1968. Cell and Molecular Biology. Academic Press New York.
3. **Giese, A.C.** 1962. Cell Physiology. W.B. Saunders Company, Philadelphia.
4. **Freifelder D** 1996. Molecular Biology, 2nd edition, Narosa Publishing house
5. **Lewin, B.** 2000. Genes VII Oxford university press.
6. **Stryer, L.** 1995. Biochemistry. W.H. Freeman and company.
7. **Voet, D and Voet, J.** 1995. Biochemistry, 2nd edition. John Wiley and Sons Inc.
8. **.Brude Alberts,Bennis-Brey Lewis,Martin Raff Kiety- Roverts and James D.Wastern**(1963).Molecular Biology of the cell,GARLAND publishing Inc,New York and

SEMESTER I

CC III – GENETICS AND EVOLUTION GENETICS

Int:25
Ext: 75

Exam Hrs :3
Subject Code : PZC

Objectives:

To give an in-depth understanding on the principles and mechanisms of inheritance

To help study the fine structure and molecular aspects of genetic material

To provide an opportunity to learn the importance of inheritance in Man

To provide an understanding on the process and theories in evolutionary biology

To expose students to the basics and advances in Evolution

UNIT – I

18 hours

Principles of Mendelian inheritance; Interaction of genes; Multiple alleles; Polygenic inheritance; Linkage and crossing over; Gene mapping in drosophila; Somatic crossing over in Drosophila. Sex determination in animals; Sex-linked inheritance in man and Drosophila Eukaryotes –Fine structure of gene – Cistron, muton, recon, exon, intron, Mechanism of homologous recombination. Role of recombinase and chromosome mapping. Operon concept, regulatory mechanism in eukaryotes, attenuation and antitermination - Environmental regulation of gene expression

UNIT –II

18 hours

Genes in populations – allelic and gene frequencies – implications of Hardy-Weinberg principle – Factors affecting Hardy-Weinberg equilibrium.

Gene mutations – Chromosomal and point mutations, spontaneous and inducible mutations, reversible and suppressor mutations. Mutagens – Physical, chemical and biological. Teratogens and induced birth defects.

Nuclear transplantation - Cell fusion : homokaryons and heterokaryons - Cytoplasts and karyoplasts

Extra-chromosomal inheritance with reference to mitochondrial DNA, plastids, kappa particles, plasmids, episomes and chloroplasts.

UNIT – III

18 hours

Inborn errors of metabolism: disorders of amino acid metabolism – PKU, alkaptonuria and albinism; disorders of purine metabolism – Lesh-Nhyan syndrome and ADA deficiency; disorders of carbohydrate metabolism – galactosemia and G₆PD deficiency; disorders of lipid metabolism – Tay Sach's disease and Gaucher's disease.

Haemoglobin disorders – Sickle cell anemia and thalassemia.

Human Karyotype preparation and chromosomal syndromes in man – Down, Turner and Klinefelter syndromes.

EVOLUTION

UNIT – IV

18 hours

Origin and Evolution of Life-theories of origin of life- modern concept of origin of life -origin of basic biological molecules, abiotic synthesis of organic monomers and polymers- origin of Prokaryotes- origin of eukaryotic cells

Present status of the concept of natural selection – genetical theory of natural selection – evidences for the role of natural selection

Neo – Lamarckism – present concept of recapitulation – genetic and non-genetic variations – origin and evolutionary significance.

Polymorphism and selection – definitions, transient polymorphism, balanced polymorphism, genetic polymorphism, enzyme polymorphism and selection advantages. Fossils- fossilization and its significance.

Geological time scale - eras, periods and epochs

Unit V

18 hours

Polyploidy and evolution – genetic assimilation – genetic speciation – species concept – evolutionary trends – canalization of selection – orthoselection.

Molecular evolution – gene evolution, evolution of gene families, molecular drive, assessment of molecular variation, punctuated equilibria and neutrality theory.

Evolution of population – from races to species, adaptation pattern, behavioural adaptations and strategies, sexual competition and selection, isolating mechanisms, mode of speciation and evolutionary rate.

Adaptation - Nature and types of adaptation – Adaptive trends - Quantifying adaptation - Batesian and Mullerian mimicry and evolution.

Evolution of human brain ,communication,speech and language. Evolution of culture

GENETICS

Text Book

- 1) **S.Verma** and **V.K.Agrawal**, Genetics(2000),S.Chand and company Ltd.,
- 2) **N. Arumugam**, genetics and Evolution, Saras publication
- 3) **R.P. Meyyan**, genetics and Evolution, Saras publication
- 4) Girish Chopra, R.C. Gupta, Evolution & Genetics – R. Chand & Co 1998.
- 5) **R.M. Shukla** , Molecular genetics- Dominant Publishers & Distributors,2001.

References

1. **Altenburg**, E. 1970. Genetics. Oxford and IBH Publishing Company, New Delhi.
2. **Burns, G.W.** 1969. The Science of Genetics. The Mac Millan Co. New York.
3. **Gardener, E.J.** 1972. Principles of Genetics. John Wiley & Sons. Inc. New York.
4. **Levine, R. P.** 1968. Genetics. Holt, Rinehart and Winston Inc. New York.
5. **Lewin, B.** 1986. Genes. Wiley Eastern Ltd. New Delhi.
6. **Rothwell, N. V.** 1978. Human Genetics. Printice Hall of India.
7. **Sinnott, E.W. L.C. Dunn** and **T. Dobzhansky.** 1959. Principles of Genetics. Tata McGraw Hill, New Delhi.
8. **Srb, M.A. and R.D. Owen.** 1960. General Genetics, W.H. Freeman & Co., San Franscisco.
9. **Winchester, A.M.** 1967. Genetics, Oxford and IBH Pub. Co., New Delhi.

Evolution

TEXT BOOK

- 1) **Strikberger , M.W.** (1996). Evolution. Jones and Barlett publishers Inc., London.
- 2) **Dobzhansky, T., Ayala, F.J., Stebbins, G.L. and Valentine, J.W.** (1975). Evolution. Surjeet Publications.

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REFERENCES

- 1) **Dodson, E.O. and Dodson, P.** (1976). Evolution : Process and Product (II Edn), Van Nostrand Company, New York.
- 2) **Dowdeswell, W.H.** (1963). The Mechanism of Evolution, Arnold-Heinmann India, Delhi.
- 3) **Joha, A.P.** (1992). Gene and evolution, The Macmillan Co., New Delhi.
- 4) **Merrel, D.P.** (1962). Evolution and Genetics : The Modern theory of Evolution. Holt, Rinehart and Winston Inc., New York.

SEMESTER I
CC – IV - MICROBIOLOGY

Int :25

Exam Hrs : 3

Ext: 75

Subject Code : PZD

Objectives:

To provide an over view of the microbial world, its structure and function

To give students an intensive and in-depth learning in culture techniques

To familiarize the learner with the applied aspects of microbiology

UNIT I :

18 hours

History and Scope of microbiology - Outline classification of microorganisms – Bacteria, fungi, algae, and virus. Morphology and fine structure of bacterial cell – cell wall peptidoglycan in gram positive and gram negative bacteria - reproduction of bacteria , fungi, algae and viruses (lytic and lysogenic cycles).

UNIT II :

18 hours

Bacterial growth and nutrition requirements, Culture techniques - media preparation -types of culture media , isolation and preservation of pure culture, Aerobic and anaerobic culture techniques – Wet mount - Hanging drop - staining methods - dyes - simple - differential and special staining techniques - acid fast stain, spore stain, capsule stain, staining for pure and mixed cultures. culture of bacteria , methods and maintenance of culture; Gram staining.

UNIT III:

18 hours

Microbes in food - Role of microbes in food production; Dairy and non-dairy products - fermented foods and alcoholic beverages.

Microbes of milk, food contamination , poisoning and spoilage – sources, symptoms and prevention of food borne infections – Bacterial and fungal toxins – methods of detection and detoxification – food sanitation in food manufacture

Microbes in fermentation – production of ethanol, lactic acid, vinegar, vitamins, microbial enzymes, fuels and Pharmaceuticals(antibiotics vaccines).

UNIT IV:*18 hours*

Role of microbes in environmental management. 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 V :*18 hours*

Causative agents, modes of transmission, symptoms, diagnosis and control of the following diseases in Man : Bacterial Disease : Pneumonia, Diphtheria, Rheumatic fever, Whooping cough, Tuberculosis, Meningitis, Botulism, Typhoid, Cholera, Gonorrhoea, Plague and leprosy. Viral diseases – Influenza, Measles, Mumps, Chicken pox, hepatitis, Poliomyelitis, Rabies, Japanese encephalitis, Yellow fever and HIV infection (AIDS).

Recommended Text Books

1. **PELCZER, M.J., REID, R.D. and CHAN, E.C.S.** (1996), Microbiology, V Ed., Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. **ANANTHANARAYANAN, T and JAYARAM PANIKER, C.K.** (2000), Text Book of Microbiology, VI Ed., Orient Longman Ltd., Madras.

References

1. **Pelzer, M.J., R.D. Reind and ECS. Chan,** Microbiology (McGraw Hill)
2. **Purohit, S.S,** Microbiology, Fundamentals and Applications (Agro botanical Publications)
3. **Patel, A.H.** Industrial Microbiology (Tata McGraw-Hill)
4. **Ross, F.C.,** Introductory Microbiology (Bell and Howell Company, London)
5. **Dubey, R.C.** Microbiology, S.chand Co., New Delhi.

PRACTICAL – I

CC V - FUNCTIONAL MORPHOLOGY, PHYLOGENY & PALAENTOLOGY OF INVERTEBRATES AND CHORDATES, GENETICS, MICROBIOLOGY AND CELL AND MOLECULAR BIOLOGY

Int :40

Exam Hrs : 3

Ext: 60

Subject Code : PZEY

A. INVERTEBRATES and CHORDATES

1. Taxonomy

TAXONOMY OF INVERTEBRATES

1. Taxonomy.

Phylum: Protozoa

Euglena, Amoeba , Plasmodium

Phylum:Porifera

Sycon, .Spongilla

Phylum:Coelentrata

Physalia, Aurelia, Sea anemone

Phylum:Platyhelminthes

Planaria, Fasciola, Taenia

Phylum:Aschelminthes

Ascais

Phylum:Annelida

Nereis, Earthworm, Leech

Phylum: Arthropoda

Penaeus, Scolopendra, Scorpion, Peripatus

Phylum:Mollusca

Chiton, Dentalium, Aplysia, Mytilus, Sepia

Phylum:Echinodermata

Antedon, Cucumaria, Echinus

TAXONOMY OF CHORDATES

SUB PHYLUM: PROTOCHORDATA

Amphioxus, Balanoglossus, Ascidian, Petromyzon

Pisces: Shark , Echenein, Ophiocephalus, Anguilla, Exocoetus, Syngnathus ,

Amphibia: Ichthyophis, Salamandra, Bufo, Chelone, Sphenodon, Naja, Crocodile,

Aves : Parrot , Owl, Sparrow

Mammals: Bat, Rabbit, Rattus

2. Mounting

Nereis	–	Parapodium
Lepas	–	Mouthparts
Prawn	-	Appendages
Sea urchin	–	Pedicellaria , Aristotle’s lantern
Teleost –		Scales
Honeybee	–	Sting

3. Spotters

Invertebrate larval forms.

Invertebrate fossils – Ammonoids, Belemnoids, Nautiloids and Echinoclem fossils.

Minor Phyla – Chaetognatha, Rotifera, Phoronida and Sipunculida.

4. Dissections

Video clipping of dissection of 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 of shark, frog, calotes, rat using Apple quick time software.

5. Culturing of Animals

A visit to atleast any 2 of following: Vermiculture, apiculture, sericulture, ornamental fish culture, poultry or dairy farm or Biofertilizer or Biopesticide Industry in order to evoke interest in self employment.

B. CELL AND MOLECULAR BIOLOGY

Micrometry

Camera Lucida Drawings

Human Buccal Smear

Blood Smear – Cockroach, Man.

Cytochemical detection of Carbohydrates, Proteins, Lipids, DNA and RNA.

C. GENETICS

Drosophila culture – Identifications of Normal, mutants & sexes

Blood groups ABO & Rh their genetic significance.

Pedigree analysis.

Human karyotyping & Chromosomal abnormalities.

Hardy Weinberg law & Calculation of gene frequencies for dominant, recessive & co-dominant traits and Multiple alleles.

D. MICROBIOLOGY

Culture techniques – culture of bacteria.

Bacterial growth curve – Counting and Antibiotic susceptibility test. Measurement of bacteria – Preparation of smears and simple staining. Specific staining – negative staining & Gram staining.

SEMESTER - II

CC VI - DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY

Int:25
Ext: 75

Exam Hrs : 3
Subject Code : PZF

Objectives:

To introduce the concepts and process in developmental biology

To understand the genetic mechanisms and the unfolding of the same during development

To expose the learner to the new developments in embryology and its relevance to Man

DEVELOPMENTAL BIOLOGY

UNIT – I

18 hours

Gametogenesis – Spermatogenesis – Cells in seminiferous tubules, spermiogenesis, structure and types of sperm

Egg: Origin of egg - growth of oocyte - synthesis and accumulation of macromolecules in the oocyte – vitellogenesis -nuclear activities during oocytes growth. Hormonal and nervous control of ovulation

Egg as a developmental system: Organization of egg, cytoplasm before and after fertilization - polarity and symmetry of egg.

Egg cortex: Nature and role in amphibian development.

UNIT – II

18 hours

Fertilization: Bio-chemical aspects of egg activation - molecular events during fertilization. Polyspermy

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.

Cleavage : Patterns - Chemical changes - role of nucleus and cytoplasm in cleavage - totipotency - Nuclear transplantation - nuclear clones.

Mechanisms and significance of.Blastulation and Gastrulation,

Morphogenetic movements: selective affinity of cells - metabolism and gene activity during gastrulation. formation of germ layers in animals; embryogenesis

UNIT – III

18 hours

Organizer concept: Primary and secondary organizers - nature of induction - mechanism - gradients in the determination. Tissue interactions: Lens development.

Cell differentiation : Chemical and cellular factors - differential gene activity.

Ageing and alteration in developmental potentials: Gene regulation of aging.Scenesence.

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.

Immunology

UNIT –IV

18 hours

Immunity – Humoral and cell mediated immunity. Lymphoid organs in Man – primary lymphoid organs, secondary lymphoid organs; Cells of the immune systems ; Haemopoiesis – Antigens, Haptens, Epitopes and Paratopes; Immunoglobulins – structure and classes of immunoglobulins; Complement - Classic pathway – Alternate pathway – Biological functions of complement – complement fixation tests; Hypersensitivity.

UNIT – V

18 hours

Immunodeficiency diseases – primary and secondary immunodeficiency – AIDS – Life cycle – Transmission of HIV – Symptoms – Diagnosis, treatment for AIDS ; Immunization - Active and passive immunization – Monoclonal & Polyclonal antibodies; Immunological techniques – precipitation – VDRL test – Immunodiffusion – Immunoelectrophoresis – Agglutination – Blood typing – Widal test – Coomb's test – passive agglutination – Immunofluorescence – ELISA – HLA typing -RIA

Text Books:

1. **C.U.Rao** Immunology (2005) , Narosa Publishing House, New Delhi.
2. **Verma and Agarwal** (2006) Developmental Biology
3. **Veera Bala Rastogi, M.S.Jayaraj** – Developmental Biology – Kedar Nath, Ram Nath.

References

1. **Balinsky, B.I.** 1975. An Introduction to Embryology. Saunders, Philadelphia.
2. **Beril, N.J.** 1974. Developmental Biology. Tata McGraw -Hill Publishing Company Ltd. New Delhi.
3. **Ebert, J.D.,** 1966. Interacting systems in Development. Holt, Rinehart and Winston, New York.
4. **McEwen, R.S.** 1969. Vertebrate Embryology. Oxford & IBH Publishing Co., New Delhi.
5. **Nelson, O.E.** 1953. Comparative Embryology of the Vertebrates. The Blackston Company, New York.
6. **Patten, B..M.** 1958. Foundations of Embryology. McGraw - Hill Book Company Inc., New York.
7. **Waddington, C.H.** Principles of Development and Differentiation. The Mac Millan Company, New York.
8. **Ivan Roitt,**1994. Essential immunology. 8th edition Black well science Ltd.
9. **Sites D.P and J.D, Stobo.** Basic and clinical immunology.
10. **Nasora,** 2006. Immunology. 2nd edition Narosa publishing house Ltd.
11. **David P. Stites, Abba I. Terr,** Basic & Clinical immunology 8th edition, a Lange medical book publishers.

SEMESTER II

CC VII - BIOCHEMISTRY, BIOPHYSICS AND BIOTECHNIQUES

Int:25
Ext: 75

Exam Hrs : 3
Subject Code : PZG

Objectives:

To understand the chemical nature of life and life process

To provide an idea on structure and functioning of bio molecules

To generate an interest in the subject and help students explore the new developments in biochemistry

To learn the biophysical properties and functioning of life processes

To introduce the tools and techniques available for studying biochemical and biophysical nature of life

To equip the learner to use the tools and techniques for project work/ research in biology

BIOCHEMISTRY

UNIT I :

18 hours

Water and minerals – functions and hormonal regulation of mineral metabolism – pH – buffers, Structure, properties and classification of carbohydrates, proteins and lipids Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). – their metabolism, hormonal regulation. Classification of enzymes , enzyme kinetics – Mechanism of enzyme action – regulation of enzymatic activity – Co-enzymes – Isoenzymes – functions of enzymes – Energy rich compounds and their roles, Fat- Soluble and water Soluble Vitamins. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation,

mechanism of enzyme catalysis, isozymes

Metabolism of amino acids nucleotides and vitamins

BIOPHYSICS

UNIT II :

18 hours

Visible spectrum – Beer Lambert's law and its application – Electromagnetic radiation – Uses of X-rays. UV rays and radio waves; Lasers and their uses in biology – Principles and applications of Colorimetry and Spectrophotometry – Laws and application of thermodynamics. Radioactivity – natural and artificial – half life – Measurement of Radioactivity: Geiger-Muller counter and Scintillation counter – Principles and applications.

BIOTECHNIQUES

UNIT III :

18 hours

Microscopy – Magnification, Resolution and Numerical aperture. Compound, Phase contrast and Electron microscopes (SEM & TEM), Confocal. Camera lucida, Micrometry – Principle and their applications. Microtomy – types of microtomes – fixation, embedding, sectioning, staining and mounting procedures. Microtechnique principles, preparation of permanent slides for whole mounts and tissue sections.

UNIT IV :

18 hours

pH – pH meter and electrodes – buffers – acid base balance – Handerson Hasselbach equation.
Homogenization – Centrifugation – types of centrifuges: Clinical, High speed and Ultra Centrifuges.

Principle and applications of colorimetry and spectrophotometry.

Spectroscopy : Flame emission spectroscopy, Atomic absorption spectroscopy, Nuclear Magnetic resonance

spectroscopy (NMR), Circular dichroism spectroscopy, ESR spectroscopy, Mass spectroscopy.

UNIT V :

18 hours

Chromatography – paper, thin layer, column, gas and liquid chromatography – Principles and application.
Electrophoresis – Paper, gel (horizontal & vertical), Agarose gel and SDS – PAGE -
Immunoelectrophoresis –MALDS: Principles and applications.

BIOCHEMISTRY

Text Books:

1. **Meyyan R.P** and **Arumurugam N.**, Biochemistry, Saras Publication

References :

- 1.**Hoar, S.W.**, 1978. General and Comparative Physiology, Prentice Hall, London, New York.
- 2.**Prosser, O.D.** and **Brown, A.F.** (Jr), 1961. Comparative Animal Physiology, W.B.Saunders Co., New York, London.
- 3.**Verma, P.S.**, **Tyagi, B.S.**, and **Agarwal**, Animal physiology, Saras Publication, S.Chand and Co., New Delhi.
- 4.**Arumugam, N.**, Animal Physiology, Saras Publication
- 5.**Raghunath Narvekar** – 2008, Hand book of Biochemistry-Adhyayan publishers & Distributors.
- 6.**Sharma Dushyant Kumar** – 2010, Biochemistry – Narosa publishing house.

BIOPHYSICS AND BIOTECHNIQUES

Text book

1. **Subramanian, M.A.**, 2005. Biophysics principles and techniques, MJP Publishers.
2. **Berry, A.K.** 1988. A text book biophysical chemistry, EMKAY Publication, New Delhi.

References

1. **Ackerman, E.** 1967. Biophysical science, prentice Hall Inc., India.
2. **Casey, E.J.** 1969. Biophysics: Concepts and mechanics, Affiliated East Press.
3. **Daniel, M.** 1989. Basic Biophysics for Biologists. Agro Botanical Publishers (India), Bikaner.
4. **Pattabhi(Vasantha)** and **Gautham** -2010, Biochemistry - Narosa Publishing house.
5. **Annie** – 2010, Biochemistry & Biotechniques – Saras Publications.
6. **Kumarasamy.V** -2012,Biophysics & Bioinstrumentation- Saras Publication.

SEMESTER -II
CC- VIII - APPLIED BIOTECHNOLOGY

Int:25
Ext: 75

Exam Hrs : 3
Subject Code : PZH

Objectives:

To give an intensive and in-depth learning in the field of biotechnology

To understand the modern biotechnology practices and approaches with an emphasis in technology application, medical, industrial, environmental and agricultural areas

• To familiarize the students with public policy, biosafety, and intellectual property rights issues

UNIT I

18 hours

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 II

18 hours

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 III

18 hours

Industrial and Microbial Biotechnology – Fermentation technology: Fermentors, Selection of microbes, Fermentation medium – Production of Penicillin, Vitamin B¹², 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 IV

18 hours

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 V

18 hours

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.

Intellectual Property Rights –copy right, trade marks, patents, industrial design rights and trade secrets

Text books:

1. **Dubey, R.C** (2008) A text book of biotechnology. S. Chand and Company, New Delhi.
2. **Sathyanarayana, U** (2005) Biotechnology. Books and Allied P.Ltd. Kolkata.
3. **Kumar H.D** (1991) A text book of biotechnology – Affiliated East west.
4. **Trehan (keshav)** (1990), Biotechnology –Wiley Eastern Ltd.
5. **Jogand s.v** (1993), Advances in Biotechnology -Himalaya.
6. **Rana s.v.s** (1990) Recent trends in Biotechnology & Biosciences society of Bioscience.
7. **Sohal (Harvinder s) ; Srivastava (Asok.k)** (1994), Ashish Publishing House.
8. **Ignacimuthu .s** (1995) , Basics Biotechnolgy - Tata Mcgraw Hill.
9. **Purohit s.s Mathur s.k** - Biotechnology: Fundamental and application –Agrobios goel.
10. **Abbasi (SA) Ramasami E**(1999), Biotechnology methods of pollution control.
11. **Bahadur (Bir),ED** , Essential of biology & biotechnology.
12. **Lohar(Prakash.s)**(2004) Biotechnology.

Reference:

1. **Bains, W.** (1998). Biotechnolgy from A to Z. Oxford University Press, Oxford.
2. **Dubey, R.C.** (2006). Text book of Biotechnology, S.Chand & Company Ltd. Ram Nagar, New Delhi
3. **Ranga, M.M.** (1999). Animal Biotechnolgy. Agrobios (India) Jodhpur.
4. **Trevan, M.D, Boffery, S. Goulding, K.H. &Stanbury, P.** (1984). Biotechnology:
The Biological Principles. Tata McGraw Hill Publishing company Limited, New Delhi.

SEMESTER – III

PRACTICAL -II

CC IX - DEVELOPMENTAL BIOLOGY, IMMUNOLOGY, BIOCHEMISTRY, BIOPHYSICS, BIOTECHNIQUES AND BIOTECHNOLOGY,

Int :40

Ext :60

Exam Hrs: 3

Subject Code : PZIY

A. 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.

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

B. Immunology

Identification of lymphoid organs in rat / mouse.

Preparation of antigen and raising of antibody – RBC and sperm proteins.

Determination of human blood group by haemagglutination test and assessment of specificity of antigen – antibody reactions.

Detection of the presence of precipitating antibody (IgG) with soluble antigen by precipitin ring test.

Detection of the specific reactivity of precipitating antibody (IgG) with soluble antigens by double immunodiffusion (Ouchterlony) test.

Detection of the specific reactivity of precipitating antibody (Igg) with fractionated antigens by immunoelectrophoresis, Vidal- test.

C. Biochemistry

1. Estimation of total protein in biological sample.
2. Estimation of total carbohydrate in biological sample.
3. Estimation of Amino acids in muscle & liver tissue of chick
4. Buffer preparation – determination of pH using pH meter.

D. Biophysics

Colorimeter--Determination of Optical Density of samples using Standards.

Centrifuge-Preparation of samples using low and high speed centrifuges.

Chromatography-

Separation of free sugars in different samples (Paper).

Separation of neutral lipids (TLC).

Electrophoresis-Separation of human serum proteins (Demonstration only).

E. Biotechniques :

Micrometry, fixation, embedding, serial sections, cytological staining, mounting of tissues, organs and embryos.

F. Biotechnology

Isolation of genomic DNA

Plasmid isolation

Agarose gel electrophoresis of DNA

DNA fragmentation using restriction enzymes (Demonstration)

Blotting technique (southern and western) Demonstration only

SEMESTER – II

EC I – FISHERY BIOLOGY & FISH PROCESSING TECHNOLOGY

Int-25

Ext-75

Exam Hrs:3

Subject Code : PZE1

UNIT I

18 hours

World and Indian Fisheries – Prospects and Problems – Plans, Policies and Current Status of Indian Fisheries.

Marine fisheries ; Sardines, Mackerels, Sciaenids, Ribbonfish, Silver bellies, Pomfrets, Carangids, Sharks, Shrimps, Prawns, Crabs, Lobsters, Mussels and Clams

Inland fisheries ; Freshwater – riverine, reservoir, pond and cold water fisheries- Spawning and breeding habits of fishes.

Estuarine and brackish water fisheries.

UNIT II

18 hours

Culture fisheries : Integrated fish farming technology – rice – cum – brackish water fisheries, rice-cum-common carp culture, fish –cum-duck culture, Sewage – fed fisheries – monosex culture – polyculture. Ornamental fish culture.

UNIT III

18 hours

Fish Gears and Crafts used in South Indian Fisheries.

Fish endocrinology – Induced breeding – techniques – examples.

Fish Pathology : Parasites – Protozoan, fungal, bacterial, worms and arthropods.

UNIT IV

18 hours

Assessment of fish stocks : Marking and recapture method, area sampling method, biostatistical method, egg count method, hydroacoustic method, remote sensing.

Age and Growth : Scale method, otolith method, other skeletal parts as age indicators, length – frequency method, length – weight relationship and condition factor.

Population studies : estimation of population size, marking, tagging, population dynamics, population models.

Fish Processing and Preservation technology Salting, Icing, Sundrying, Smoking, Canning, Tinning, and Freezing techniques, Cold Storage, Brine water, brief account on transport and marketing. Lay out of Processing Plant - Factory Hygiene and Sanitation, Fish products and by products

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.
3. **PILLAI, T.V.R.** (1993) Aquaculture : Principles and Practices. Fishing News Agency, London.
4. **AGARWAL, S.C.** 2006. History of Indian Fisheries. Daya publication.
5. **SRIVASTAVA, C.B.L.** A Text Book of Fishery science and Indian Fisheries. Kitab Mahal Publishers.

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 Agrilculture 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 Pbulishers 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. **SUBBHA RAO** (1986) Economics of Fisheries, Daya Publishing House, New Delhi.
 11. **TRIVEDI, K.K.** (186) Fisheries Development : 2000 A.D. Association of Indian Fishery Industries and Oxford and IBH Publishing Co., Pvt. Ltd., New Delhi.
 12. **UMA SHARMA., AND GROVER, S.P.**, (1982), An Introduction to Indian Fisheries, Bishen Singh Mahendra Pal Singh, Dehra Dun. Prediction
 13. **RAJAGOPALASAMY, C.B.T & VELAYUTHAM, P.** 1999. Quality control of Fish and Fishery products.
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SEMESTER – III

CC X - ANIMAL PHYSIOLOGY AND ENDOCRINOLOGY

Int-25

Ext-75

Exam Hrs :3

Subject Code : PZJ

ANIMAL PHYSIOLOGY

UNIT I :

18 hours

Homeostatic mechanism - Osmo and Ionic regulations in Fishes; Temperature and pH regulations in animals; Acclimatization to high altitudes; Hydrostatic pressure; Buoyancy, Nutrition – Nutritional requirements, types, essential, aminoacids, and fatty acids – vitamins and their role. Respiration – Respiratory pigments and their functions. Exchange of gases – transport of O₂ and CO₂ – regulatory mechanisms; Haemoglobin – Chemistry – structure – Respiratory quotient-neural and chemical regulation of respiration.

UNIT II :

18 hours

Circulation – Heart, heart beat, cardiac rhythm and regulation; coagulation; Types of transport mechanisms, blood pressure, ECG; Excretion – Excretion in relation to different habitats – Detoxification pathways of Ammonia, Uric acid and urea formation, Vertebrate Nephron – mechanisms of urine formation and acid base balance.

Nervous system - Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture

UNIT III :

18 hours

Chemistry of muscular contraction, Photoreceptor – Vertebrate eye, photo chemistry, visual information and adaptations of eye. Phonoreceptor – Vertebrate ear, physiology of hearing; Electric organs, Bioluminescence – chemistry and control; Chronobiology – Biological rhythm and biological clock.

ENDOCRINOLOGY

UNIT- IV:

18 hours

Introduction and scope of endocrinology

Endocrine glands in vertebrates and feedback system in endocrine regulation of vertebrates. Pituitary gland (Adenohypophysis , Pars Intermedia and Neurohypophysis) - Characteristics, structural organization , biosynthesis, regulation and functions of hormones .Hypothalamic regulation for release of pituitary hormones

Pineal gland -hormones and their role in photoperiodic response
in vertebrates

Thyroid gland -- characteristics, structural organization, synthesis and

functions of hormones.

Parathyroid gland- structure, synthesis and functions of hormones

UNIT-V:

18 hours

Pancreas -Structure ,hormones and their functions.

Adrenal gland- Structural organizations, biosynthesis and functions of cortical and medullary hormones

Gonadial gland-Structure of mammalian testis and ovary - male and female sex accessory organs - hormones of testis and ovary - estrous and menstrual cycle - hormones of pregnancy - parturition - hormonal control of lactation.

ANIMAL PHYSIOLOGY

- 1.Arumurugam, N., Animal Physiology, Saras Publication-kanyakumari.
- 2.Verma, P.S., Tyagi, B.S, and Agarwal, Animal physiology, Saras Publication, S.Chand and Co., New Delhi.

References:

- 1.Prosser C.L, Brown, F.A. 1965. Comparative Animal physiology W.B.SandersCompany London.
- 2.Nagabhushnam. R, Kodarkar. M.S., and Sarojini,R. 1983. Text book of Animal Physiology, Oxford& IBH publishing co. New Delhi.
- 3.Bykov . K.M., 1960. Text book of physiology . Foreign languages publishing house , Moscow.
4. Hurkat, P., Mathur. C., A book of Animal physiology. S.Chand & co (PVT) Ltd., Ram Nagar, New Delhi
5. Hoar, S.W., 1978. General and Comparactive Physiology, Prentice Hall, London, New York.
6. Malcolm.S.Gordon – Animal Physiology – principles and Adaptations- Macmillan Publishing co. Inc _ Newyork.

ENDOCRINOLOGY

References :

1. Haris, G.W. and B.T. Donovan. 1968. The Pituitary Gland. S. Chand and Co.,
2. Bentley, P.J. 1985. Comparative vertebrate endocrinology, Second Edition, Cambridge University Press. Cambridge.
3. Mac Hadley. 1992. Endocrinology, 3rd Edition. Prentice - Hall Inc. A Simon & Schuster Company, Englewood Cliffs, New Jersey. USA.
4. Ingleton, P.M. and J.T. Bangara. 1986. Fundamentals of comparative vertebrate endocrinology, Kluwer Academic Publishers
5. Turner, C.D. and J.T. Bangara. 1986. General endocrinology. Saunders International Student edition. Toppan Company Limited. Tokyo.
6. Prakash S Lohar Endocrinology, Hormones and Human Health.
7. Ashoke Kumar Boral – Mammalian endocrinology – New central Book Agency(P) ltd – London.
8. Rao.C.V. A Text book of Immunology Narosa Publishing house – Chennai.
9. Peter Wood – Understanding Immunology – Pearson Education ltd – Chennai.

SEMESTER III

CC XI – BIOSTATISTICS AND COMPUTER APPLICATION IN BIOLOGY

Int-25

Ext-75

Exam Hrs :3

Subject Code : PZK

BIOSTATISTICS

UNIT – I

18 hours

Bio-statistics: Definition - methods of data collection - Primary data and Secondary data

Sampling techniques: essentials of sampling – census method - sampling methods – Simple random sampling – Stratified random sampling and Systematic random sampling –

Tabulation of data. Diagrammatic and graphical representation of data- Definition, methods of merits and demerits. Measures of central tendency – mean, median and mode.

UNIT – II

18 hours

Measures of dispersion: standard deviation, standard error, co-efficient of variation.

Correlation analysis (Karl Pearson's and Spearman's Rank)

Regression analysis – simple linear.

UNIT – III

18 hours

Probability and theoretical distributions: Normal, Binomial and Poisson

Tests of significance: 't'-test, Chi-square and Goodness of fit, 'F' test - Analysis of variance (ANOVA) - One-way. Descriptions of Two Way and Multiway ANOVA .

COMPUTER APPLICATION IN BIOLOGY

UNIT – IV

18 hours

Introduction to computer: History of computer – components of a computer – block diagram – input devices – output devices-classification of computer – computer virus.

Computer Programming concepts: Algorithms, Flowchart.

Computer operating system: DOS and WINDOWS

UNIT – V

18 hours

MS office application:

- | | | |
|------|----------------|------------------|
| i) | Word Processor | : MS - Word |
| ii) | Data Processor | : MS - Excel |
| iii) | Presentation | : MS Power point |

Computer application: Office automation: E-mail and Internet.

Applications of statistical packages: SPSS

TEXT BOOKS:

1. S.P.GUPTA – Statistical Methods, S. Chand & son, Educational Publishers- New Delhi.
2. Pillai, R.S.N. and Bagavathi. 2009. Statistics. S. Chand, New Delhi.
3. Gurumani, N. 2002. An introduction to Biostatistics. MJP Publishers, Chennai.
4. Gopi, 2011. Evolution Biostatistics & computer application. Saras publication.
5. Arumugam, N. 2010. Biostatistics Computer Application, Bioinformatics instrumentation. Saras publication.

REFERENCES:

1. Sokal, R.R. and F.J. Rohlf. 1981. Biometry. W.K. Freeman. San Francisco.
 2. Taxali. R.K. 1997. PC Software made simple. Tata McGraw Hill Publishing Company Ltd., New Delhi.
 3. Bailey, N.T.J.(1997) , Statistical Methods in Biology, III Ed., Cam.University Press, N.Y.
 4. Palanichamy.D. and Manoharan, M.Statistical Methods for biologist (Palani Paramount Publications). Gupta R.K.,S.P.Test Book of statistic.
 5. Zar,J.H., 1996 .Biostatistical Analysis,
 6. SOKAL,R. and JAMES, F.(1973), Introduction to Biostatistics, W.H. Freeman and Company Ltd., Tokyo, Japan.
 7. P.N.Elhance. Fundamentals of Statistics, Kitab Mahal, Allahabad.
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SEMESTER – III

EC III – COASTAL AQUACULTURE

Int-25

Ext-75

Exam Hrs :3

Subject Code : PZE3

UNIT I

18 hours

Coastal Aquaculture : Definition,overview,status and importance.

Criteria of selecting suitable site for aquaculture – fundamentals of survey, designing and lay out of aquaculture ponds

Criteria for selection of species for Coastal Aquaculture

UNIT II

18 hours

Biology of major cultivable species of seaweeds, fin and shellfishes : freshwater prawns – shrimps – molluscs – fishes

Culture techniques – Traditional. extensive, modified extensive, semi intensive, intensive and super intensive. mono and poly culture, integrated and organic farming.

Open sea farming – raceways – cages – pens – rafts – racks

UNIT III

18 hours

Shellfish Culture : Shrimps,prawns,crabs, fattening of crabs,lobsters,oysters,mussels and cephalopods.

Fish Culture : Milk fish,mullets,Asian sea bass.

Seaweed Culture.

UNIT IV

18 hours

Hatchery techniques – induced maturation and spawning – natural seed resources – hatchery production of fin and shellfish seeds

Farm management – Water quality management – Temperature – salinity – dissolved oxygen – pH – hardness – nutrients – ammonia – hydrogen sulphide

Feed management – feed ration – feeding schedule – feed broadcasting – partial feeding – feed acceptance – types of feeds – live and formulated feeds

UNIT V

18 hours

Health management – disease diagnosis and treatment – prophylactic measures – probiotics – immunostimulants Role of R & D institutions

Coastal zone management – legal issues – Government policies – Aquaculture Authority of India

Text Book:

1. **Dr.V.B.Sakhare** – Reservoir fisheries and Ecology – Mangalam Publications,L-21/1.St.No.5,Shivaji margnear Kali Mandir,Delhi-53.
2. **A.C.Lorg**,Fish feeding and Integrated fish farming,Cyber Tech Publications,New Delhi.

Reference Books :

1. **Bardach, J.E., J.H.Ryther & W.O. McLarney**; Aquaculture, Wiley-Inter Science, 1972.
 2. **Huet, M & J. Timmermans**: Text Book of fish culture: Breeding and cultivation of fish, 2nd ed., fishing News Book Ltd., 1986.
3. **Pillay T.V.R.** Aquaculture Principles and Practices, Fishing News Books, 1981.
4. **Robert, R.Stickney**: Principles of Aquaculture, John wiley & Sons Inc. 1984.
- 5.**Santanam R, N. Ramanatham & G. Jagathesan**: Coastal Aquaculture, CBS Publishers and Distributors, 1990
- 6.**Imai T.**:Aquaculture in shallow seas, Amerind Pub. Co.,1977.
- 7.**Jhingran V.G** : Fish and Fisheries of India,Hindustan Pub. corp., 1982.
- 8.**Milne P.H.**: Fish & Shellfish farming in Coastal waters, FNB Ltd., 1972.
- 9 **Srivasta.C.B.**. Fisheries Science And Indian Fishery- Kital Mahal 22A- Sangai Nadu, Allahabad.
- 10.**Venkataramanujam,N.Ramanathan** , Introduction to Fishery Science- Janshi Publications 102-A. Palayamkottai Road.Tuticorin – 628 008.
- 11.**Shammi.Q.J. Bhatinagar.A.S.** – Applied fisheries – Updesh Purohit for agrobios(Indian), Jodhpur.
- 12.**Yadav.B.N.** – Fish and Fisheries – Daya Publishing house
- 13.**Rounsefell .G.A.HamyEverHart** – Fishery Science. Method & Application – International Books & Periodicals supply services.
- 14.**Kurian.C.V. Sebatian.V.O.** – Prawns and Prawn fisheries of India. Hindustan Publishing corporation – Delhi.
- 15.**Shailendra Ghosh** – Fisheries and aquaculture management – Adhyayan publication & Distributors.

SEMESTER – III

EC II - BIOINFORMATICS

Int-25
Ext-75

Exam Hrs :3
Subject Code : PZE2

UNIT I:

18 hours

Objectives of Bioinformatics, kinds of data used, Data integration, Data analysis, Carriers in Bioinformatics, Scope of bioinformatics – Useful bioinformatics sites – Bioinformatics in Pharmaceutical industry – Bioinformatics orientation in IT industry.

UNIT II:

18 hours

Biological sequences – DNA, RNA and Protein - Structure and Functions of Biomolecules- Introduction to Databases – Biological databases – Information available in Biological databases – Searching biological databases – Sequence and Structural databases – Nucleotide Sequence Databases - NCBI, GENE BANK, EMBL DDBJ. Protein Sequence databases – Swissprot, PIR – Structural database (PDB, CATH, and SCOP).

UNIT III:

18 hours

Sequence alignment – Methods of pair wise alignment – Algorithms– Needleman & wunch algorithm – Smith waterman algorithm – Amino acid substitution matrices – PAM – BLOSUM - Multiple sequence alignment (MSA) – Clustal W

UNIT IV:

18 hours

Phylogenetic analysis: Concept of trees, Methods of Phylogenetic analysis - Distance matrix methods, Characters based methods- Steps on Constructing alignments and phylogenies.

UNIT V:

18 hours

Conceptual models of protein structure – Predicting Protein structure and function from sequence – Determination of structure – feature detection – secondary structure prediction – predicting 3 D structure - the relationship of protein three – dimensional structure to protein function

TEXT BOOKS:

1. **Dr.A.John De Britto**,Bioinformatics, St.Xaviers College, Palayamkottai.
2. **Jason.T.L.Warg**, Data mining in Bioinformatics,TBH Publishers,Mohamed Zaki.J Distributors.3 Nallathambi st, Chennai.
3. **Sailesh Kumar Aggarwal**, A Introduction to Bioinformatics, Arise Publishers & Distributors4648/1, 21-Ansari Road, Darya Gang, New Delhi.

REFERENCES :

1. **Attwood, T.K. and D.J. Parry Smith.** 2002. Introduction to Bioinformatics. Pearson Education Publication, Delhi.
2. **Dan E. Krane and Michael L. Raymer.** 2003. Fundamental concepts of Bioinformatics. Pearson Education Publication, Delhi.
3. **Irfan A. Khan.** 2003. Recent advances in Bioinformatics. Ukaaz Publications, Andhara Pradesh.
4. **Irfan A. Khan and Atiya Khanum.** 2002. Emerging trends in Bioinformatics. Ukaaz Publications, Andhara Pradesh
5. **Sundara Rajan, S. and R. Balaji.** 2002. Introduction to Bioinformatics. Himalaya Publishing House, Delhi.
6. **Gautham.N.**Bioinformatics Databases and algorithms,Narosa Publishing House,www.narosa.com.
7. **Zoe Lacroix Terence Critchlow**, Bioinformatics, Managing Scientific data, Morgan Kaufmann publishers.
8. **Darbeshwar Roy.** Bioinformatics, Narosa publishing house, New Delhi.
9. Jean Michel Claverie, Cedric Notredame, Bioinformatics. A Beginner's guide, Wiley India(p) ltd, New Delhi.
10. **Shuiqingye.** Bioinformatics a Practical approach.

BASICS OF BIOINFORMATICS PRACTICAL LAB

Sequence database analysis (including Nucleotide sequence and Protein sequence database)

Structure database analysis (including PDB, MMDB)

Sequence alignment analysis – Blast, Fasta, Clustal W

Phylogenetic analysis – Phylodraw

Protein Structure Analysis – Expasy – Primary, Secondary, Tertiary Structure

BIOSTATISTICS AND COMPUTER APPLICATIONS

E. BIOSTATISTICS

Problems related to

Chi-square test

Student's t – test

Correlation

Regression

F. COMPUTER APPLICATIONS

Analysis of Data using Excel software packages, univariate and multivariate analysis of data.

SEMESTER – III

PRACTICAL – III

CC XII - ANIMAL PHYSIOLOGY AND MICROTECHNIQUE

Subject Code : PZLY

INT-40

EXT-60

ANIMAL PHYSIOLOGY

30hrs

1. Quantitative estimation of amylase activity.
2. Effect of substrate concentration and activity of salivary amylase
3. Effect of enzyme concentration and activity of salivary amylase
4. Effect of pH concentration and activity of salivary amylase
5. Quantitative estimation of Protein
6. Study of Oxygen consumption in fish
7. Effect of thyroxin on the respiratory metabolism of fish

ENDOCRINOLOGY

30hrs

1. Demonstration of endocrine organs in vertebrates (any one)
2. Demonstration of reproductive system in vertebrates (Rat/Mouse)
3. Histological study of Pituitary, Adrenal, testis, ovary corpus, intestine, pancreas, and thyroid gland

A record of laboratory work and twenty slides sectioning slide section (20 slides) shall be submitted at the time of practical examination.

BIOSTATISTICS

15hrs

Problems related to

- Chi-square test
- Student's t – test
- Correlation
- Regression

COMPUTER APPLICATIONS

15hrs

Analysis of Data using Excel software packages, univariate and multivariate analysis of data.