

Credit : 5

Hours/Week : 6

Code: RR1PZO1

Medium of instruction: English

SEMESTER - I (For students admitted from 2015 onwards)

CC1- ANIMAL PHYLOGENY AND BIODIVERSITY

Unit-I

Phylogeny of invertebrates: Protozoa- phylogenetic origin and evolution of the class Metazoa. Various theories of origin of metazoa. Bilateria- theories and origin. Coelomata - definition of Coelom - different modes of origin of coelom. Trilobites- structure and significance

Unit-II

Phylogeny of invertebrates: Mollusca- origin and evolution of mollusca –fossil ammonites and their significance. Minor phyla: general characters, morphology, anatomy and affinities of rotifers, Phoronida and Chaetognatha

Unit-III

Phylogeny of vertebrates: Geological time scale. Jawless vertebrates- characteristic features of lampreys- earliest vertebrates; ostracoderms- characteristic features and classification- Cephalaspidea, Anapsida, Cyclostomata, Pteropsida and coelolepis. Evolutionary position of Ostracoderms. Primitive jawed vertebrates- origin of jaws, acanthodians, appearance of placoderms- orders of placoderms.

Unit-IV

Origin of Reptiles: Amphibian and reptilian features of seymouria, mammal like reptiles, aquatic reptiles, flying reptiles, rise and fall of dinosaurs. Fossil Birds. 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 centers, Loss of biodiversity. Fundamental causes- IUCN categories. 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 – Specify wild life protection Act

REFERENCE BOOKS

- 1. J.K.,DEVASAHAYAN AND N. INBAMANI,1987.**Animal Phylogeny.RV.Publications, Virudhunagar.IndiaGlobal Biodiversity strategy, **1992.**Report by world resources Institute (WRI), The World Conservation Union and United Nations Environmental Programme (UNEP).
- 2. KAPOOR, V.C., 1995.**Theory & Practice of Animal Taxonomy. Oxford & IBH Publishing Co., New Delhi.
- 3. SOLBRIG, O.T., VAN EMDEN, H.M. AND VAN OORDT, P.G.W.J.1995.** Biodiversity and Global change. CAB international, Wallingford, U.K.

Question pattern

(Marks :75)

Time:3Hours

Part A : $10 \times 2 = 20$ Marks Answer All Questions (Two Questions from each Unit)

Part B: $5 \times 5 = 25$ Marks Answer All Questions (Either or type–Two questions from each Unit)

Part C : $3 \times 10 = 30$ Marks Answer ant Three Questions (One Question from each Unit)

Credit : 5

Hours/Week : 6

Code: RR1PZO2

Medium of instruction: English

SEMESTER - I (For students admitted from 2015 onwards)

CC2 - CELL AND MOLECULAR BIOLOGY

Unit - I

Structure and functions of membrane system, Glycoconjugates and proteins in membranesystems – Ion transport – Na, K, ATPase, Mitochondria, Molecular basis of ATP synthesis. Properties of cytoplasm.

Unit - II

The law of DNA constancy and C-value paradox; cot curves: classes of DNA (Palindromes, High repetitive, Middle repetitive, unique Sequences); structure and organization of chromatin; chromosomal banding, banding techniques and sister chromatid differentiation.

Unit - III

Gene: Modern concept of Gene, fine structure of Gene. DNA: Evidence of DNA as genetic material, DNA structure Eukaryotic genome organization (coding and non-coding sequences, Satellite DNA); DNA damage and repair, DNA replication, Forms of DNA (A, B, Z DNA).

Unit - IV

RNA: Structure of transfer, ribosomal and messenger RNA, Molecular mechanism of transcription in Prokaryotes and eukaryotes. Reverse transcription - post transcriptional modifications and processing of mRNA.

Unit - V

Genetic Code: Properties of Genetic code. Studies of Codon and Anticodon. Protein Synthesis: Molecular mechanism of protein synthesis, post-translational modification of Protein, Regulation of gene expression in prokaryotes and eukaryotes, Attenuation and antitermination, Operon concept.

REFERENCE BOOKS

1. Molecular Cell Biology Darnell et. al. St Brooks WH.
2. Molecular Biology of the cell Albert's et. al. Gard and pub.
3. Cell and Molecular Biology Karp John Wiley & Sons. Genes Levine Wiley.
4. Molecular Biology of the Gene Watson Benyman.
5. Cell and Molecular Biology DeRobertis Saunders.

Question pattern

(Marks :75)

Time:3Hours

Part A : $10 \times 2 = 20$ Marks Answer All Questions (Two Questions from each Unit)

Part B: $5 \times 5 = 25$ Marks Answer All Questions (Either or type—Two questions from each Unit)

Part C : $3 \times 10 = 30$ Marks Answer ant Three Questions (One Question from each Unit)

Credit : 5

Hours/Week : 6

Code: RR1PZO3

Medium of instruction: English

SEMESTER - I (For students admitted from 2015 onwards)

CC3 - BIOCHEMISTRY AND BIOTECHNIQUES

Unit - I

Carbohydrates: Classification, structure and properties and functions. Metabolism – Glycolysis, Glycogenolysis, TCA cycle, Glycogenesis and Glyconeogenesis, HMP shunt pathway, ETP system.

Unit - II

Proteins: Classification based on chemical structure, function and solubility; properties, primary, secondary and tertiary. Amino acids: Structure, classification, properties and metabolism. Enzymes: Classification, Kinetics, Co-factors, Enzyme inhibition, Enzyme substrate compounds.

Unit - III

Lipids: Classification, properties - saturated and unsaturated fatty acids – steroids, cholesterol and lecithin. Nucleic acids: DNA structure and properties, DNA synthesis - nucleotides. Different types of RNA: mRNA, rRNA and tRNA.

Unit - IV

Principles and applications of centrifuges - Principles of sedimentation - Preparative Ultra centrifuges, Analytical Ultra centrifuges, Gradient centrifugation. Principles and applications of Electron microscopy - SEM, TEM, STEM. Chromatography - Paper, Column, TLC, HPLC and GC.

Unit-V

Principles and applications of electrophoresis- PAGE, AGE, Autoradiography, Geiger Muller - Scintillation counter- Solid and liquid. Principle and applications of Colorimeter - Beer-Lamberts law- Visible and UV Spectrophotometer-Atomic absorption Spectrophotometer and NMR.

Reference:

1. Biochemistry, by D. Voet and J.G. Voet, 2004. John Wiley & Sons, USA
2. Biochemistry, by R.H. Garrett and C.M. Grisham, (3rd Edition) 2007. Saunders College Publishers.
3. Braun, R.P. Introduction to Instrumental Analysis, McGrawHill.
4. Wilson & Walker, Principles and Techniques of Biochemistry and Molecular Biology, 6th Edn, Cambridge, Univ. Press.

Question pattern

(Marks :75)

Time:3Hours

Part A : $10 \times 2 = 20$ Marks Answer All Questions (Two Questions from each Unit)

Part B: $5 \times 5 = 25$ Marks Answer All Questions (Either or type—Two questions from each Unit)

Part C : $3 \times 10 = 30$ Marks Answer ant Three Questions (One Question from each Unit)

Credit : 5

Hours/Week : 6

Code: RR1PZOP1

Medium of instruction: English

SEMESTER - I (For students admitted from 2015 onwards)

**CC4 - ANIMAL PHYLOGENY AND BIODIVERSITY, MOLECULAR CELL BIOLOGY
&BIOCHEMISTRY AND BIOTECHNIQUES -PRACTICAL – I**

ANIMAL PHYLOGENY AND BIODIVERSITY

Spotters: Peripatus, ammonoids, Limulus, trilobite, nautilus, latimaria, protopteris, Archaeopteryx, sphenodon and eater.

MOLECULAR CELL BIOLOGY

1. Preparations of temporary mount of Onion root tip to study the different stages of mitosis.
2. Preparations of temporary mount of grasshopper testis to study the different stages of meiosis.
3. To enumerate the RBC and WBC count using haemocytometer.
4. Estimation of haemoglobin using Sahli Haemoglobinometer.
5. Mounting and cytological examination of polytene chromosomes, Barr bodies, chironomus
6. Measurement of the size of cells and subcellular components by micrometer.

BIOCHEMISTRY AND BIOTECHNIQUES

1. Structure and operation of pH meter.
2. Preparation of buffers: Phosphate buffer and citrate buffer.
3. Colorimetric/ Spectrophotometric estimation of the following biomolecules:
 - a) Total free amino acids, b) Proteins, c) Carbohydrates d) Lipids
 - e) Estimation of sodium, potassium and chloride in blood.
4. Separation of amino acids by Paper chromatography.
5. Separation of proteins by SDS-PAGE (Demonstration).
6. Quantitative estimation of DNA using colorimeter (Diphenylamine reagent) or spectrophotometer.

MARKS DISTRIBUTION

Animal phylogeny and Biodiversity 10 marks

Biochemistry and Biotechniques 20 marks

Cell and Molecular Biology 20 marks

Record 05 marks

Viva-voce 05 marks

Total 60 marks

Credit : 4

Hours/Week : 6 Code: RR1PZOEL1

Medium of instruction: English

SEMESTER - I (For students admitted from 2015 onwards)

EC1 - SERICULTURE AND APICULTURE

Unit-I

History of Sericulture: Types of Silkworm - Mulberry, Tasar, Muga and Eri. Mulberry Silkworms: Morphology and life cycle of silkworms. Silkworm rearing: Rearing house and equipments. Rearing racks and trays, disinfectants, rearing appliances, black boxing, Chawki rearing, bed cleaning, mountages, harvesting of cocoons,

Unit-II

Silkworm diseases and their management: Pebrine, Flacherie, Grasserie, Muscardine and Aspergillosis. Silkworm pests, parasites and their management: Uzi fly, Dermestid beetles; Silk reeling techniques; Quality assessment of silk fibre. Selection of raw material for reeling, Storage and preservation of raw materials. Marketing and the role of Central Silk Board in the Development of sericulture.

Unit-III

Moriculture - Mulberry Species – Classification, distribution, cultivation, irrigation and common varieties used in India. Hasvesting – various methods -leaf picking – shoot leaf harvesting- branch cutting. Chemical composition and nutritional values of Mulberry leaves. Propagation of Mulberry plant – sowing – sampling and plantation methods. Classification of disease of mulberry. Moriculture : Food and feeding habits of silkworm

Unit-IV

Natural bee colonies and their yield. Types of bee hives - structure - location and care and management. Setting up an apiary: Langstroth hives and Newton's hive, brood and storage chambers, iron frames and comb sheets, drone excluder, rearing equipments, handling of bees- managing bees for honey production- managing bees for crop pollination.

Unit-V

Diseases of honey bees and their management, Honey harvesting and extraction process; physicochemical analysis of honey. Uses of honey and beeswax in Indian medicine.

REFERENCE BOOK

1. Manual of Silkworm Rearing: Manual of Mulberry Cultivation by Food and Agricultural Organization (FAO), United States.
2. **YOSHIMARO TANAKA**. Sericology, Central Silk Board, 99-B, Meghdoot, Merine Drive, Bombay-2.
3. **YOKOYAMA, T.** synthesized science of Sericulture.
4. **KOVALEVE, P.A.** Silkworm breeding Stocks, Central Silk Board, Merine Drive, Bombay.
5. **SHARMA P.L. AND SINGH, S.H.** and Book of Bee keeping

Question pattern

(Marks :75)

Time:3Hours

Part A : $10 \times 2 = 20$ Marks Answer All Questions (Two Questions from each Unit)

Part B: $5 \times 5 = 25$ Marks Answer All Questions (Either or type–Two questions from each Unit)

Part C : $3 \times 10 = 30$ Marks Answer ant Three Questions (One Question from each Unit)

Credit : 5
Hours/Week :6Code: RR2PZO4
Medium of instruction: English
SEMESTER - II (For students admitted from 2015 onwards)

CC5-GENETICS

Unit – I:

Introduction to genetics–Mendel’s laws of inheritance–experiments–Mono–testing pheno types–dohybrid cross–incomplete dominance–over dominance–co–dominance and blood types–multiple alleles–blood group system–Rh and ABO incompatibility–gene interaction–epistasis.

Unit – II:

Chromosome and Mutations: Sex chromosomes – determination of sex. Barr bodies – cytoplasmic inheritance – Linkage – complete and incomplete linkage. Crossing over–definition – mechanism – Chromosome mapping – Chromosome: Numerical changes: aneuploidy, euploidy (haploidy and polyploidy). Structural changes–deletion, duplication, translocation, inversion.

Unit – III:

Nature of Genetic Material: DNA is the genetic material–biochemical evidences, RNA viruses–Fine structure of gene–cistron, recon and muton–Gene expression and regulation in prakaryotes–Lac Operon–Gene regulation in Eukaryotes–Britten and Davidson’s model. Gene mutations–spontaneous mutation: Base pair substitution, Frame shift mutation and inducible mutations–suppressor mutations–mutagens.

Unit – IV:

Microbial Genetics: Genetics of bacteria–transformation, conjugation, transduction, introduction to plasmids, movable genes. Genetics of viruses–life cycle of bacterio–phage–recombination in phage.

Unit – V:

Human Genetics: Human chromosome and sex determination, Syndromes and metabolic disorders–single and polygenic, eugenics, euthenics and eupenic. Pedigree studies.Human genome project.

REFERENCE BOOKS

1. DANIEL, L. HARTL (1994) Genetics (III Edn) Jones and bartlet publishers, Boston.
2. ELOF AXEL CARLSON (1985) Genetics, Tata McGraw Hill Publishing Co.
3. JENKINS, J.B. (1975) Genetics, Houghton Mifflin Co., Boston.
4. ROBERT, H. TAMARIN (1996) Principles of Genetics, WCB Publishers.
5. RUTHWELL, M.W. (1978) Human Genetics Prentices Hall of India Pvt., Ltd.,
6. STRICKBERGERMONOR, W. (1996).Genetics, Prentices Hall of India Pvt., Ltd.,

Question pattern

(Marks :75)

Time:3Hours

Part A : $10 \times 2 = 20$ Marks Answer All Questions (Two Questions from each Unit)

Part B: $5 \times 5 = 25$ Marks Answer All Questions (Either or type–Two questions from each Unit)

Part C : $3 \times 10 = 30$ Marks Answer ant Three Questions (One Question from each Unit)

Credit : 5

Hours/Week : 6

Code: RR2PZO5

Medium of instruction: English

SEMESTER - II (For students admitted from 2015 onwards)

CC6-DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY

Unit – I

History and theories of developmental biology - Gametogenesis – Testis – Spermatogenesis – Spermatozoa - Ovary – Oogenesis – Ovum (egg) - Fertilization – Changes of sperm and ovum – Formation of Zygote - Gradient of Egg – cleavage – Fate maps - Blastula, gastrula in frog.

Unit - II

-Organogenesis - Development of brain, eye, ear in frog - Development of limbs, heart and arterial venous system in chick - Development of foetal membrane in chick - Development of embryo in mammals and placentation in mammals

Unit – III

Parthenogenesis - Regeneration – Metamorphosis - *In vitro* fertilization - Test tube baby- GIFT, ZIFT, ICSI -Birth control measures

Unit – IV

Antibodies – Structure – classes and distribution of immunogenicity – antibody diversity – production of antibodies – B and T lymphocytes – immune response – primary and secondary. Components of B and T lymphocytes – T cell receptor diversity.

Unit -V

Antigens: Definition- properties - antigenicity and immunogenicity- antigenic determinants and haptens- types of antigens: flagella, somatic, capsular, soluble, heterophile, tumor and auto antigens. Antigen antibody interactions – precipitation, agglutination, flocculation. Complement system – activation of complements – alteration and classical pathways. Hypersensitivity – types. Vaccines – types and uses.

REFERENCE BOOK

- 1. BERRILL, N.J. (1986)** Developmental Biology, Tata Mcgraw Hill, New Delhi.
- 2. BROWDER, L.N. (1980)** Developmental Biology, Saunders College, Philadelphia.
- 3. DEUCHAR, E.M. (1976)** Cellular interaction in animal development, Chapman and Hall, London.
- 4. CHAMPION, MLD., and COOKE, A. (1987)** Advanced Immunology, K.B. Lippincott Philadelphia.
- 5. KUBY, J. (1994)** Immunology, W.H. Freeman and Co., New York.
- 6. COLEMAN, LOMBARD AND SICARD (1992)** Fundamentals of Immunology, W.M.C. Brown Publisher.

Question pattern

(Marks: 75)

Time: 3Hours

Part A : $10 \times 2 = 20$ Marks Answer All Questions (Two Questions from each Unit)

Part B: $5 \times 5 = 25$ Marks Answer All Questions (Either or type—Two questions from each Unit)

Part C : $3 \times 10 = 30$ Marks Answer ant Three Questions (One Question from each Unit)

Credit : 5

Hours/Week:6 Codes: RR2PZO6

Medium of instruction: English

SEMESTER - II (For students admitted from 2015 onwards)

CC7 - ANIMAL PHYSIOLOGY

Unit – I

Food and nutrition physiology of digestion and absorption in man – Respiration, respiratory organs, respiration pigments, transport of gases, respiratory quotient.

Unit – II

Circulation – structure of human heart, Types of circulatory system, circulatory organs, circulatory media, typical pattern of circulation, heartbeat, cardiac cycle.

Muscles: Types of muscles, chemical composition of muscles, properties of skeletal muscles, muscles contraction, kymograph – Chemoreceptor, photoreceptor and photoreceptor.

Unit – III

Nervous integration: Types of neuron – propagation of nerve impulse – synaptic transmission – Reflex action.

Excretion : Excretory products in animals – biosynthesis of urea _ structure of nephron – mechanism of urine formation – kidney failure in man- transplation-kidney stone.

Homeostatic mechanism: Ionic and osmoregulation in fresh water and marine fishes, Bioluminescence .

Unit –IV

Physiology of mammalian reproduction – reproductive cycles, oestrous cycle, sexual cycle in man, Menstrual cycle, hormonal control of reproductive cycle – birth control– pheromones.Chronobiology, circadian rhythm.

Unit –V

Endocrine glands in mammals – structure, secretion (Hormones) and function of pituitary, pineal, Thyroid, Parathyroid, pancreas, Adrenal, Testis and Ovary - Neurosecretion in animals

REFERENCE BOOKS:

1. HOAR W.S.(1987) General and comparative physiology, Prentice Hall.

2.TEDESCHI,H.(1993) Cell physiology, Molecular Dynamics, II Edn., Won C.Brown Publishers, Oxford,England .

3.WOOD, W.S.(1968) Principles of Animal Physiology, Edward arnold, London.

4. DAWSON, H. (1964) General physiology, little Brown Co., Boston.

5. ECHERT, R. and RANDALL, D. (1987) Animal Physiology, CBS Publishers and Distributors

Question pattern

(Marks: 75)

Time: 3Hours

Part A : $10 \times 2 = 20$ Marks Answer All Questions (Two Questions from each Unit)

Part B: $5 \times 5 = 25$ Marks Answer All Questions (Either or type—Two questions from each Unit)

Part C : $3 \times 10 = 30$ Marks Answer ant Three Questions (One Question from each Unit)

Credit : 5

Hours/Week:6 Codes: RR2PZOP2

Medium of instruction: English

SEMESTER - II (For students admitted from 2015 onwards)

**CC8 - GENETICS, DEVELOPMENTAL BIOLOGY, IMMUNOLOGY AND
ANIMAL PHYSIOLOGY – PRACTICAL -II**

GENETICS

Drosophila–culture, Mutants, Identification of sex, Blood groups: ABO and Rh–grouping, Human Karyo typing & Chromosomal abnormalities. Hardy Weinberg law & calculation of gene frequencies for dominant, recessive and co–dominance traits and multiple alleles.

DEVELOPMENTAL BIOLOGY

Preparation of sperm suspension in bull and observation of live and smeared Spermatozoa.

Mounting chick blastoderm

Effect of thyroxine or iodine on metamorphosis of frog.

IMMUNOLOGY

Identification of lymphoid organs in a vertebrate.

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

Immuno diffusion and immune electrophoresis – Demonstration

ANIMAL PHYSIOLOGY

Estimation of oxygen consumption in fish

Estimation of haemoglobin in human blood

Salt loss and salt gain in fish

Enumeration of RBC in human blood

Enumeration of WBC in human blood

Survey of digestive enzymes in cockroach

Test for urea and sugar in urine sample

Quantitative estimation of amylase activity

Quantitative estimation of ammonia and urea

Spotters: BP apparatus, Stethoscope and ECG

Marks distribution

Genetics	15 marks
Developmental Biology and Immunology	20 marks
Animal Physiology	15 marks
Record	05 marks
Viva – voce	05 marks
Total	60 marks

Credit : 4

Hours/Week : 6

Code: RR2PZOEL2

Medium of instruction: English

SEMESTER - II (For students admitted from 2015 onwards)

EC2 - AQUACULTURE & VERMICULTURE

Unit – I

History - General principles and economics of different kinds of aquaculture and productivity of culture ponds - Principles governing the selection of species for culture - Physical and chemical characteristics of water bodies: freshwater, brackish water and marine water. Types of culture – traditional – extensive, semi-intensive, intensive.

Unit – II

Site selection, preparation of fish farm, Types of ponds - breeding pond, hatchery unit, brooders pond, nursery pond, stocking pond and rearing pond. Maintenance and management along with control of weed, pest and predators. Maintenance of p^H , measures for concentration of oxygen and ammonia. Feeds for cultivable species – natural, supplementary and artificial feeds.

Unit – III

Freshwater fish culture: Indian major carp and common carp. Types of culture – Monoculture, monosex-culture, poly culture and composite fish culture. Integrated fish farming - paddy cum prawn culture and duck cum pig cum fish culture. Sewage fed fish culture – culture of pearl oyster and edible oyster. Major diseases of culture fishes – Prevention and treatment. Fish processing technology - curing, canning.

Unit –IV

Earthworm – Systematics – types- epigeic, anecic, endogeic. Diversity, distribution and biology. Nature of soil environment requirement. Food, digestive capability, respiratory requirements, life cycle and adaptation. Earthworm in organic waste management – Recycling of waste through vermicomposting.

Unit – V

Methodology of vermicomposting- soil structure- raw material required, environmental, pre-requested, feeding harvesting and storage of vermi compost. - Vermin enrichment. Composition of vermin – composting and vermin wash – coir, cow dung, agriculture. Physical, chemical and biological parameter of vermicast. Earth worm in medicine, economic uses of vermiculture.

REFERENCE BOOKS

1. **G.SANTHANAKUMAR and AM SELVARAJ.** 2002. Concept of aquaculture, Meenam Publication Nagercoil.
2. **K.C.JAYAMAN.** 1999. The freshwater fishes of Indian region. Narendra Publishing House, Delhi.
3. **V.G.JHINGRAN.** 1988. Fish and fisheries of India. Hindustan Publishing Co (India), Newdelhi.
4. **EDWARDS, C.A. and LOFT, J.R.,** 1977. Biology of Earthworms, 3rd Edition, Chapman Publications.
6. **AGARWAL, S.C** 1994 A hand book of fish farming. Narendra Publishing House, New Delhi.

****Vist to aquaculture farm and processing unit is compulsory**

Question pattern

(Marks: 75)

Time: 3Hours

Part A : $10 \times 2 = 20$ Marks Answer All Questions (Two Questions from each Unit)

Part B: 5×5=25 Marks Answer All Questions (Either or type–Two questions from each Unit)
Part C : 3 ×10 =30 Marks Answer ant Three Questions (One Question from each Unit)

Credit : 5

Hours/Week : 6

Code: RR3PZO7

Medium of instruction: English

SEMESTER - III (For students admitted from 2015 onwards)

CC9-BIOTECHNOLOGY AND NANOTECHNOLOGY

Unit- I

Gene Transfer and Gene targeting: Gene cloning - General concept, restriction endonucleases, enzymatic tools for gene cloning, linkers and adaptors, cloning vectors. Gene Targeting-Targeted gene transfer. Knockout mice. Transgenic fish and mammals (Mice and Sheep etc.). Animal cloning. Biosafety issues and Bioethics in animal genetic engineering.

Unit- II

Cell culture and established cell line: Culture media required for animal cell culture. Isolation of animal tissue. Disaggregation of tissues (physical and enzymatic methods). Establishment of primary cell lines and continuous cell lines. Characterization of cultured cells. Valuable products from cell culture- tPA, blood factor VIII, Erythropoietin (EPO)

Unit -III

Manipulation of cultured cells and tissues: Scaling up of animal cell culture. Cell synchronization. Cell transformation, tissue engineering - 3-D culture, artificial skin and artificial cartilage.

Stem cells: Types, characteristics, tissue healing, therapy, application in Research and Industry

Unit -IV

In vitro fertilization (IVF): Introduction to infertilities in human male and female. Ovary stimulation. Oocyte recovery and uptake. Sperm preparation. IVF and embryo transfer, assisted reproductive technologies (ART). IVF in cattle, Sexing of sperms and embryos, embryo splitting.

Unit - V

Nanobiology

Introduction - types of nanomaterials: nano rods, nanowires, nanoparticles, nanocapsules, nano membranes, nanomeshe, nanofibres, nano catalysts, carbon nano tubes. Methods of preparation of nanomaterial-outlines: top down and bottom up approaches-emulsifiers, homogenizers and MOCVD Applications of nanobiology - future perspectives and problems.

REFERENCE BOOKS

- 1. B SINGH, S K GAUTAM, and M S CHAUHAN. 2014.** Textbook of animal biotechnology. TERI Publications, New Delhi. pp620.
- 2. MANJULASHENOY. 2007.** Animal Biotechnology. Laxmi Publications Limited, New Delhi
- 3. PORTNER, R. 2014.** Animal Cell Biotechnology. Humana Press. Pp498.
- 4. MURTY, B.S., SHANKAR, P., RAJ, B., RATH, B.B., MURDAY, J. 2013.** Textbook of Nanoscience and Nanotechnology. Co-publication with Universities Press (India) Pvt. Ltd. pp244.

Credit : 5

Hours/Week : 6

Code: RR3PZO8

Medium of instruction: English

SEMESTER - III (For students admitted from 2015 onwards)

CC10 -RESEARCH METHODOLOGY AND BIOSTATISTICS

Unit – I

Research: selection of research problem-stages in execution of research-thesis writing-research report writing -sources of information: classical sources: journal, reviews, monographs, citing references bibliography. Modern sources- internet-digital library-biological databases (literature)

Unit - II

Books -Journals: types peer reviewed; online journals. Types of journal articles.Choice of journal for publication. -MS preparation for publication. Impact factor and citation index and H index Introduction to plagiarism.

Unit - III

Biometry-Variables (qualitative and quantitative; continuous and discontinuous) – Data (primary and secondary data), tabulation and classification of data. Measures of central tendency (mean, mode median).

Unit- IV

Measures of dispersion (SD, SE). Comparison of means-Hypothesis testing-Use of statistical tables and levels of significance-T-test; Chi-square test; One way ANOVA (with simple model sums)

Unit -V

Bivariate relationships-Correlation and regression-uses, types, applications. Introduction to Statistical Packages (SPSS; MS-Excel)

REFERENCE BOOKS

1. Biostatistics. 2010. P.Ramakrishnan. Saras Publications.
2. An introduction to biostatistics. 2005. N. Gurumani. MJP Publishers, Chennai.
3. Research Methods. Tips and Techniques.2008. G. Vijayalakshmi and C.Sivapragasam.MJP Publishers, Chennai.
4. Biostatistical Analysis. Jerrold H Zar. 1999. Pearson Education Inc

Question pattern

(Marks :75)

Time:3Hours

Part A:10×2=20 Marks Answer All Questions (Two Questions from each Unit)

Part B:5×5=25 Marks Answer All Questions (Either or type – Two questions from each Unit)

Part C: 3×10=30 Marks Answer any Three Questions (One Question from each Unit)

Credit : 5
Hours/Week : 6 Code: RR3PZO9
Medium of instruction: English
SEMESTER - III (For students admitted from 2015 onwards)

CC11- COMPUTER APPLICATIONS AND BIOINFORMATICS

Unit-I

Introduction to computer-generation-types (Based on size and Functional)- Hard ware-Basic components of Computer-Input and Out devices with examples, CPU and Memory Unit) and Introduction of Software -Operational (Unix, Linux, Windows and DOS commands) and Application software (NOTEPAD, WORD, EXCEL, POWERPOINT).

Unit- II

Databases management system (DBMS) - CD-ROM database retrieval - ONLINE database retrieval - basics of computer networks and its application-Internet-email

Unit-III

HISTORY, SCOPE AND IMPORTANCE

Definition and History of Bioinformatics, sequencing development - aims and tasks of Bioinformatics - applications of Bioinformatics - challenges and opportunities

Unit-IV

DATABASES - AND THEIR USES

Nucleotide sequence databases- Primary nucleotide sequence databases (EMBL, GeneBank, DDBJ) Secondary nucleotide sequence databases (UniGene, SGD, EMI Genomes). Protein sequence databases - primary databases (SwissProt/ TrEMBL, PIR), secondary databases (Pfam, PROSITE) Protein structure databases – Primary databases (Protein Data Bank) and secondary databases (SCOP, CATH) bibliographic databases and virtual library - specialized analysis packages

Unit-V

SEQUENCE ALIGNMENT METHODS - Sequence analysis of biological data- sequence formats-PAIRWISE sequence analysis and multiple sequence analysis methods for optimal alignments; using gap penalties and scoring matrices

GENOMICS AND PROTEOMICS -Introduction to genomics- Prokaryotic and Eukaryotic Genomes: Structure, Organization Genome mapping –introduction - Proteomics: Principles, tools and applications.

REFERENCE BOOKS

1. **S.C. RASTOGI & OTHERS**, Bioinformatics- Concepts, Skills, and Applications, CBS Publishing, 2003.
2. **S. IGNACIMUTHU, S.J.**, Basic Bioinformatics, Narosa Publishing House, 1995.
3. **T K ATTWOOD, D J PARRY-SMITH**, Introduction to Bioinformatics, Pearson Education, 1st Edition, 11th Reprint 2005.
4. **C S V MURTHY**, Bioinformatics, Himalaya Publishing House, 1st Edition 2003.
5. **STEPHEN A. KRAWETZ, DAVID D. WOMBLE**, Introduction To Bioinformatics A Theoretical and Practical Approach, Humana Press, 2003.
6. **HOOMAN H. RASHIDI, LUKAS K. BUEHLER**, Bioinformatics Basics-Applications in Biological Scienceand Medicine, CRC press, 2005

Question pattern

(Marks :75)

Time:3Hours

Part A:10×2=20 Marks Answer All Questions (Two Questions from each Unit)

Part B:5×5=25 Marks Answer All Questions (Either or type – Two questions from each Unit)

Part C: 3×10=30 Marks Answer any Three Questions (One Question from each Unit)

Credit : 5
Hours/Week: 6 Codes: RR3ZOP3
Medium of instruction: English
SEMESTER- III (For students admitted from 2015 onwards)

CC12- BIOTECHNOLOGY AND NANOTECHNOLOGY, RESEARCH METHODOLOGY & BIostatISTICS, COMPUTER APPLICATIONS & BIOINFORMATICS AND ENTOMOLOGY – PRACTICAL - III

BIOTECHNOLOGY AND NANOTECHNOLOGY

Isolation of DNA from animal tissue
Isolation of RNA from animal tissue
Electrophoretic separation of proteins and nucleic acids
Western blot technique – Demonstration only
Study of Fermenter (By Visit)

RESEARCH METHODOLOGY & BIostatISTICS

Index card preparation Demonstration & Abstract writing
Review writing & Manuscript writing (Demonstration)
Problems related to mean, median, mode, standard deviation, Chi-Square test, Students 't' test, Correlation and regression

COMPUTER APPLICATIONS & BIOINFORMATICS

Analysis of data using Excel, Generation of graphs using excel
Powerpoint presentation.
Spotters: Input devices & Output devices

ENTOMOLOGY

Methods of collection and preservation of insects
Identification of insects general and major pests.
Study of life cycle of House fly/ Mosquito/Silkworm/ House fly
Sex identification of insects
Study parasitic and predatory insects
Insecticides and plant production applications.
Damages caused by insects of plants

Marks distribution

Biotechnology & Nanotechnology	20 marks
Research Methodology & Biostatistics	10 marks
Computer applications & Bioinformatics	10 marks
Entomology	10 marks
Record	05 marks
viva – voce	05 marks
Total	60 marks

Credit : 4

Hours/Week :6

Code: RR3PZOEL3

Medium of instruction: English

SEMESTER - III (For students admitted from 2015 onwards)

EC3-ENTOMOLOGY

Unit-I

General characters of Class Insecta, diversity and adaptive features of insect Outline classification up to orders with examples. An introduction to beneficial and harmful insects.

Unit- II

Structure of insect-Structure of head-sutures -types of head in various insects Thorax, its structure, segmentation, sclerites, modification -Components mouthpartsTypes of antenna, Structure of abdomen Structure of leg -articulation -modification with reference to mobility Structure and modifications of eyes and antenna Origin and development of wings -venation – mechanism of flight -wing coupling

Unit- III

Internal organs –Digestive system: structure, modifications and thesis functions Circulatory system-Organs of circulation-Haemolymph-Haemocytes with functions -Mechanism of circulation-Excretory system-Physiology of excretion-Excretory products

Unit -IV

Insect behaviour -Feeding behaviour: types of feeding and damage, host range, Specialisationand host selection-Reproductive behaviour: mate location, mating frequency and oviposition

Unit -IV

Endocrine glands and their secretions.Physiology of insect growth and development-Metamorphosis, polyphenism and diapause.Physiology and biochemistry of insect cuticle and moulting process.

REFERENCE BOOKS

- 1. CHAPMAN, R. F. (1998).** The Insects: Structure and Function. 4th Ed. Cambridge University Press.
- 2. GILLOTT, C.(2005)** Entomology. 3rd ed. Springer Online Book
- 3. GULLAN, P. J. & CRANSTON, P. S. (2005).** The Insects –an outline of Entomology. 3 ed. Blackwell Publishing.

Question pattern

(Marks :75)

Time:3Hours

Part A:10×2=20 Marks Answer All Questions (Two Questions from each Unit)

Part B:5×5=25 Marks Answer All Questions (Either or type – Two questions from each Unit)

Part C: 3×10=30 Marks Answer any Three Questions (One Question from each Unit)

Credit : 4
Hours/Week :6 **Code: RR4ZOP4**
Medium of instruction: English
SEMESTER – IV (For students admitted from 2015 onwards)

**CC13 -MICROBIOLOGY, ENVIRONMENTAL BIOLOGY & EVOLUTION -
PRACTICAL - IV**

MICROBIOLOGY

Laboratory rules- cleaning of glassware – methods of sterilization – Media preparation – Liquid and solid
– Fixing and staining bacterial sample – Simple and gram staining.
Enumeration of bacteria colonies by serial dilution technique – Culture technique: Pour plate-Spread –
Streak plate.

ENVIRONMENTAL BIOLOGY

Total dissolved solids
Estimation of water quality parameters: Dissolved oxygen, salinity, chloride,pH
Carbonate and bicarbonate
Calcium
Nitrates
Phosphates and silicates
Identification of freshwater and marine plankton
Pollution parameters: BOD, COD, Indicator organisms.
Spotters: Secchi Disc, Colorimeter, pH meter, thermometer

EVOLUTION

Study of fossils
Study of finger prints
Observation of genetic polymorphism using preserved specimens

**** Visit to different habitats (National parks and Sanctuaries, sea shore, polluted areas)**

Marks distribution

Microbiology		20 marks
Environmental biology	20 marks	
Evolution		15 marks
Record		05 marks
Viva – voce		05 marks
Total		60 marks

Credit :4

Hours/Week : 6

Code: RR4PZOEL4

Medium of instruction: English

SEMESTER - IV (For students admitted from 2015 onwards)

EC4- MICROBIOLOGY

Unit – I

Scope of microbiology – Classification of microbes –Whittaker’s classification-Numerical taxonomy – Bergey’s manual. Salient features of virus, mycoplasma, rickettsia, Chlamydia, bacteria, algae, fungi and protozoans.

Unit - II

Structure and physiology of bacteria viruses.Culture of bacteria-growth curve-culture media-laboratory equipments- culture methods.

Unit-III

Microbial control: physical and chemical methods for the control of microorganisms. Antimicrobial agents.Mode of action and side effects.

Unit –IV

Medicinal microbiology: diseases caused by bacteria (tuberculosis, syphilis, gonorrhoea) virus (polio, AIDS), fungus (dermatitis, botulism) and protozoa (amoebic, dysentery, malaria)

Unit –V

Aero microbiology – Aero microflora of hospitals and houses – aero allergens.Aquatic microbiology – microbes in water methods of detection – role of microbes in sewage treatment. Microbes used in decomposition of waste. Industrial Microbiology – Alcohol, organic acids, vitamins and antibiotics production. Dairy Microbiology – microbiology of milk products – milk borne disease.

REFERENCE BOOKS

- 1. PELCZER, M.J. REID, R.D. and CHAN, E.C.S (1996).** Microbiology, 5th Edn. Tata McGraw Hill Publishing Company Ltd. New Delhi.
- 2. ANANTHANARAYANAN, T, and JAYARAM PANIKER, C.K. (2000).** Text Book of microbiology, 6th Edn, Orient Longman Ltd, Madras.
- 3. DAVID FREIFELDER (1998).** Microbial Genetics, Narosha Publishing House, New Delhi.
- 4. POWER, C.B and DIGNAWALA, H.F. (1982).** General Microbiology, Vol. I & II Himalaya Publishing House, Bombay.
- 5. MICHAEL T. MADIAGN, JOHN M. MARTINKL, JACK PARKER (1997).** Biology of Microorganism, 8th Edn., Prentice Hall International Inc., USA.

Question pattern

(Marks :75)

Time:3Hours

Part A:10×2=20 Marks Answer All Questions (Two Questions from each Unit)

Part B:5×5=25 Marks Answer All Questions (Either or type – Two questions from each Unit)

Part C: 3×10=30 Marks Answer any Three Questions (One Question from each Unit)

Credit : 4

Hours/Week : 6

Code: RR4PZOEL5

Medium of instruction: English

SEMESTER - IV (For students admitted from 2015 onwards)

EC5 -ENVIRONMENTAL BIOLOGY AND EVOLUTION

Unit – I

Ecosystem – Structure and dynamics of ecosystem (food chain, food web, trophic level, energy flow and pyramids)– Interaction between environment and biota. Energy and nutrient flow: Primary and secondary productivity, Nutrient cycles – Nitrogen, phosphorus, Carbon and sulphur in nature.

Unit - II

Biotic community – Concepts – Stratification – ecological niches – ecotone and ecological succession – Population growth – Biotic potential Regulation of population size –Population interactions.

Unit – III

Population – Sources – effects and control of Air, Water, Noise, Thermal, Pesticides, Heavy metals and Radiation population – Environmental Impact Assessment (E.I.A) – Definition, steps and methods.

Unit - IV

Origin of life – evolution of life- theories and concepts – Darwinism, Lamarckism, Neo Darwinism, Neo Darwinism- evidences of evolution – modern theories of evolution –sources of variation.

Unit – V

Origin of species – isolation mechanism –orthogenesis – evolution of horse and man- zoogeography – mimicry and colourations in evolution – adaptive radiation.

REFERENCE BOOKS

- 1. ODUM, E.P (1996), Fundamental of Ecology (III Edn), Nataraj Publishers, Dehradun.**
- 2. BHATIA, H.S. 1998: A Text book on Environmental Pollution and Control, Galgotia, New Delhi**
- 3. CLARKE, G.L. 1963. Elements of Ecology, Wiley Eastern Limited. New Delhi.**
- 4. PAUL COLINVAUX, 1986: Ecology. John Wileyans Sons, N.Y.**

