

NATIONAL COLLEGE (AUTONOMOUS), TIRUCHIRAPALLI – 1

M.Sc., ZOOLOGY – Course Structure under CBCS

(Applicable to the candidates admitted from the academic year 2013-2014 onwards)

Semester	Paper No.	Title of the Paper	Instr Hrs/ Week	Credit	Exam Hrs.	Marks			Total
						Internal	External		
							W	O	
I	CC I	Biology of Invertebrates and Chordates	6	5	3	25	75		100
	CC II	Cell and Molecular Biology	6	5	3	25	75		100
	CC III	Genetics	6	5	3	25	75		100
	CC IV P	PRACTICAL-I (Pertaining to Biology of Invertebrates and Chordates, Cell and Molecular Biology and Genetics)	6	5	4	25	70	5	100
	EC I	Bio-Instrumentation and Research Methodology	6	4	3	25	75		100
		Total	30	24					500
II	CC V	Animal Physiology	6	5	3	25	75		100
	CC VI	Biotechnology	6	5	3	25	75		100
	CC VII	Microbiology	6	5	3	25	75		100
	CC VIII P	Practical – II (Pertaining to Animal Physiology, Biotechnology, Microbiology)	6	5	4	25	70	5	100
	EC II	Bio-Statistics & Bio-Informatics	6	4	3	25	75		100
		Total	30	24					500
III	CC IX	Developmental Biology and Evolution	6	5	3	25	75		100
	CC X	Biochemistry and Biophysics	6	5	3	25	75		100
	CC XI P	PRACTICAL – III (Pertaining to Developmental Biology & Evolution, Biochemistry & Biophysics) (CC – IX & X).	6	5	4	25	70	5	100
	EC III	Aquaculture	6	4	3	25	75		100
	EC IV	Environmental Biology and Management	6	4	3	25	75		100
		Total	30	23					500
IV	CC XII	Immunology	6	5	3	25	75		100
	CC XIII	Entomology	6	5	4	25	70	5	100
	EC V	Wild life biology	6	4	3	25	75		100
		Project (Dissertation 75 marks & Viva Voice – 25 Marks)	12	5	-	75	-	25	100
		Total	30	19					400
				90					1900

There will be oral test for all practical examinations. The oral test will carry 5 marks in the external component.

BIOLOGY OF INVERTEBRATES AND CHORDATES – P13ZY1

Semester : I

Core Course: I

Instruction Hours/Week: 6

Credit: 5

UNIT - I : Biology of Invertebrates

Symmetry in animal organization – Significance of coelom – Significance of Metamerism – Evolution of Metamerism – Locomotion in Annelids – Nutrition in Polychaetes, Molluscs and Echinoderms.

UNIT - II

Developmental and comparative system of respiration, circulation, excretion and nervous system of invertebrates.

UNIT - III : Biology of Chordates

Integumentary system – Skin of Mammals – Glands – Hairs – Scales – Horns- Skin Pigments. – Comparative study of digestive system and circulatory system of chordates – Dentition in Mammals – Stomach in Mammals - Evolution of Aortic Arches.

UNIT - IV

Respiration in Fishes : Pulmonary respiration in Tetrapods.

Excretory system : Types and evolution of kidneys.

Reproductive system: Accessory reproductive glands

Appendicular skeleton – Pectoral and Pelvic girdles of different classes.

UNIT - V

Minor Phyla: Rotifera, Phoronida and Cheatognatha- Invertebrate fossils- Evolutionary trends and Phylogenetic importance of Trilobites, Ammonoids, Belemnoids, Nautiloids, Echinoid fossils and Vertebrate fossils.

References Books

1. Ayyar, E.K., and Ananthakrishnan, T.N. (1992). A Manual of Zoology. Vol. II (Chordata). Visvanathan Publishers.
2. Barnes, R.D. (1982) – Invertebrate Zoology, IV Ed., Holt Saunders – International Edition.
3. Barrington, E.J.W.(1979) Invertebrate Structure and Function, II Ed., ELBS and Nelson.
4. Hymen, G.H., The Invertebrates, Vols. I to VII, Mc Graw Hill Book Co Inc., New York.

5. Kent, G.C. (1976), Comparative Anatomy of the Vertebrates, McGraw Hill Book Co Inc., New York.
6. Kotpal, R.L., (2002), Minor Phyla., Rastogi Publication, Meerut.
7. Vasantika Kashyap (1997), Life of Invertebrates, Vikas Publishing House Pvt. Ltd., New Delhi.
8. Waterman, A.J., (1971), Chordate Structure and Function, The Macmillan Company.

CELL AND MOLECULAR BIOLOGY – P13ZY2

Semester : I

Core Course: II

Instruction Hours/Week: 6

Credit: 5

UNIT – I

Plasma membrane – Ultra structure – Modifications, Functions: Permeability, Osmosis, Passive transport, Active transport, Permease system, Endocytosis, Exocytosis and Phagocytosis.

Nucleus- Ultra Structure, composition at molecular level, Functions of Nuclear envelope in the transport between the nucleus and cytoplasm, Nucleolus- ultra structure and function

UNIT – II

Mitochondria – Energy transduction. Endoplasmic reticulum, Golgi complex- Morphology, structure, role in secretion, protein sorting transport and functions. Lysosome and Centrosome – Morphology, Chemistry and functions.

UNIT – III

Watson and Crick's model for DNA replication – Unidirectional and Bidirectional DNA replication – Role of RNA primers in DNA replication- Satellite DNA – Types of Non genetic RNA- Mechanism of prokaryotic – transcription and eukaryotic transcription – Role of ribosomes and RNAs in protein synthesis.

UNIT – IV

Characteristics of cancer cells- Types of tumors-Apoptosis and its relevance in cancer-cellular oncogenes – Tumor viruses- Environmental carcinogens – Tumor suppressor genes: RB genes and P53 – Application of molecular biology to cancer prevention and treatment.

UNIT – V

Cell study – Micrometry – Cell fractionation techniques – Cytophotometry – Immunocytochemistry – Cytochemical staining and detection methods of Carbohydrates, protein, lipids, DNA and RNA.

References Books

1. Verma, P.S. and Agarwal, V.K. (1998) Concept of Microbiology, Chand & Co Ltd. Delhi.
2. Powar, C.B. (1997), Essentials of Cytology, Himalayan Publishing House, New Delhi.
3. Gupta, P.K. (1999), A Text Book of Cell and Molecular Biology, Rastogi Publication, Meerut.
4. De Robertis, E.D..P. and De Robertis, E.M.F. (1987), Cell and Molecular Biology, VIII Ed. Lea and Febiger, Philadelphia.
5. Bruce Alberts and Dennis Brey, (1994), Molecular Biology of the Cell. 3rd Edition. Garland Publishing, Inc. New York and London.
6. Becker and Deamer, (1991), The World of the Cell. 2nd Edition. The Benjamin and Cumming Publishing Company, Inc. California.
7. Alberts et al., (2002), Molecular Biology of the Cell. 4th Edition, Garland Science, a member of the Taylor and Francis group, New York, USA.

GENETICS – P13ZY3

Semester : I

Core Course: III

Instruction Hours/Week: 6

Credit: 5

UNIT – I

Gene interaction and types: Epistasis, Additivity, Modifiers, Lethality – Linkage- Linkage in Human beings – Somatic Cell Hybridization – Mechanism of crossing over – Gene Mapping in Chromosome by crossing over method. Structure of Gene – cistron, muton, recon, introns and exons- overlapping genes.

UNIT – II

Gene families – RNA splicing – Cis-trans splicing – tRNA Processing – DNA recombination at the molecular level – Role of Rec A and REc B C D enzymes - Gene Regulation in Prokaryotes: The Operon concept *lac* operon, *trp* operon and *ara* operon system in bacteria.– Gene regulation in eukaryotes: Short term and long term regulation.

UNIT – III

Bacteria: Genetic material – Para sexual process in bacteria transformation, conjugation, sexduction and transduction- Mapping of bacterial chromosomes- Biology of Plasmids – Transposon – Types and mechanism of transposition. Phages: Genetic material – recombination in phages – Fine structure of rII locus in T4 phage, Lytic and Lysogenic cycle.

UNIT – IV

Chromosomal aberrations – DNA Damage and repair mechanisms – Molecular basis of mutations. Genetic basis of cancer-Carcinogen, Genes in populations – Hardy –Weinberg principle and gene frequency- Factors affecting Hardy –Weinberg equilibrium.

UNIT – V

Inborn errors of metabolism: Phenylketonuria, alkaptonuria, albinism, Lesh-Nyhan syndrome, ADA deficiency, galactosemia, G6PD deficiency, Tay Sach's disease and Gaucher's disease. Human Karyotype: preparation and analysis – chromosomal syndromes in man. Genetic counseling, Prenatal diagnosis, Altering genetic traits.

Reference Books

1. Benjamin Levin, (2005) Genes VIII, Oxford University Press, New York.
2. Daniel L.Hartl (1996) Genetics, III Ed., Jones Barlett Publishers. Boston.
3. David Friefelder (1998) Microbial Genetics, Narosa Publishing House, New Delhi.
4. Elaine Johansen Mange and Arthur P. Mange (1994) Basic Human Genetics, Sinour Associates, Inc., Sunderland, Massachusetts.
5. Jenkins, J.B. (1983) Human genetics, The Benjamin Cummings Publishing Co.
6. John D. Hawkins (1996) Gene Structure and Expression, III Ed., Cambridge University Press.
7. Robert H. Tamarin (1996) Principles of Genetics, WCB Publishers.
8. Strickberger Monnroe, W. (1996) Genetics, Prentice Hall of India Pvt. Ltd., New Delhi.
9. Ursula Goodenough (1984) Genetics, Saunders College Publishing Co., London.
10. Watson J D et al (1987) Molecular Biology of gene, IV Ed., The Benjamin Publishing Company Inc., UK.

PRACTICAL-I (Pertaining to Biology of Invertebrates and Chordates, Cell and Molecular Biology and Genetics) – P13ZY4P

Semester : I

Core Course: IV

Instruction Hours/Week: 6

Credit: 5

1. INVERTEBRATES AND CHORDATES.

A. Mounting : Teleost – Scales
Honey bee - sting.

B. Dissection : Frog - V Cranial and spinal nerves using virtual laboratory.

2. CELL BIOLOGY

A. Cytological techniques : Micrometry – Measurements using ocular and stage micrometers – cell volume (Embryonic Cells separated from early gastrula of frog)

B. Histochemical techniques : Fixation – Chemical fixation – Freezing, Drying, Freeze-drying, staining, Conventional and cytochemical. – Histochemical localization of DNA, RNA, Lipids, proteins vital staining.

C. Study of different types of cells. – Blood cells – Differential count in human samples.

3. MOLECULAR BIOLOGY

Isolation of DNA from animal tissue.

Isolation of plasmid DNA from Bacteria (Demo)

4. GENETICS

Drosophila Culture – Identification of mutants and sexes –

ABO Blood groups & Rh- genetic significance.

Human Karyotyping and Pedigree analysis

Hardy – Weinberg Law and calculation of gene frequency.

ELECTIVE COURSE I : BIO-INSTRUMENTATION AND RESEARCH METHODOLOGY - P13ZY5E

Semester : I

Elective Course: I

Instruction Hours/Week: 6

Credit: 4

UNIT – I

Principles and uses of analytical instruments: Balances, pH meter, Spectrophotometer, Densitometric Scanner, Spectrofluorometer, Radioactive counters, Centrifuge and Microscopy-Basics. SEM, TEM: Principles and applications.

UNIT – II

Separation techniques in biology: Molecular separation by Chromatography, (Paper, Column, Thin Layer, Adsorption, Ion Exchange, HPLC), Electrophoresis, (native, SDS, - PAGE, AGAROSE etc.), Organelle separation by centrifugation (different types).

UNIT – III

Determination of energy value of biological material: Wet combustion method – description of the unit, operation and estimation of calorific value. Bomb calorimetry method: Description of Bomb calorimeter – operation and estimation of calorific value.

UNIT – IV

Research: Definition, Sources for Literature, Experimental Design, Components of research report (Introduction, Materials and Methods, Results and Discussion, Summary, References) Experimental Design (Presentation of Data in the form of Tables and Figures) Evaluation of Data (Statistical Analysis).

UNIT – V

Details of Popular Magazines and periodicals (monthly, quarterly and half-yearly journals and reviews).

Online browsing of research articles: infonet, infolibnet and Pubmed.

References:

1. N. Gurumani 2006. Research Methodology for Biological Sciences MJP Publishers.
2. Veerakumari, L. Bioinstrumentation.

ANIMAL PHYSIOLOGY – P13ZY6

Semester : II

Core Course: V

Instruction Hours/Week: 6

Credit: 5

UNIT - I

Homeostatic mechanisms: Thermoregulation: Temperature compensation in poiklotherms- Temperature regulation in homeotherms : Tolerance to high temperature – tolerance to cold and freezing- physiology of hibernation and activation.

Osmotic and ionic regulation : Response to hypertonic media with reference to crustaceans and fishes. Adaptation to pressure : High altitude –buoyancy

UNIT - II

Nervous co-ordination: Ionic basis of excitability – resting membrane potential – electrogenesis, propagation of action potential – interneuron transmission – electrical synapses – chemical synapses – neurotransmitters.

Animal electricity: Electric organs- production of electric discharge – functional significance.

UNIT - III

Excretion: Ammonia toxicity – detoxification pathways – excretion to different habitat.

Receptor mechanism- Mechano reception – Muscle receptors- pressure receptors- Gravity receptors - Photoreception- Retinal pigments- Photochemistry of vision.

UNIT - IV

Bioluminescence: Occurrence – physical aspects- chemistry of light production- functional significance – Animal behaviour: Biological clock- endogenous rhythm- circadian rhythm- circannual and lunar periodicity – Zeitgeber-entrainment – physiological basis of learning and memory.

UNIT - V

Physiology of reproduction – Mammalian reproductive physiology – reproductive cycles- Hormonal control – molecular mechanism of hormone action- prostaglandins, Reproductive disorders.

References Books

Text Books

1. Hoar, W.S. 1987, General and Comparative Physiology, Prentice Hall.

2. Turner, C.D.& Bagnara, J.T. 1976, General Endocrinology, 6th Ed. W.B.Saunders Co.

Reference Books

1. Beck, 1971 , Human Design, Harcourt Brace Joronorich Inc.
2. Dawson, H. 1964, General Physiology, Little Brown Co. Boston
3. Echert, R. and Randall,D. 1987, Animal Physiology, CBS Publishers and Distributors.
4. F.N. 1971. Animal Function, Principles and Adaptation, Macmillan Co. London.

BIOTECHNOLOGY – P13ZY7

Semester : II

Core Course: VI

Instruction Hours/Week: 6

Credit: 5

UNIT - I

Introduction to Biotechnology, Scope and application. Current developments: Animal Biotechnology – Goat, Fish, Rat and Cow.

Transgenic process in animals- methods, applications.

Genome analysis- Human genome project.

UNIT - II

Animal Cell culture technology- methods involved – applications – cell lines – Gene transfer – techniques- used in animal cells and eggs- stem cell culture and preservation – cell culture based processes and products – hormones- enzymes, regulatory molecules and therapeutics.

UNIT - III

Industrial Biotechnology: Fermentation – types of fermentors, Inoculum, Inoculum size, Fermenter designs- Upstream and downstream processing – product recovery and purification – Production of alcohol, enzymes, vitamins and single cell proteins – Improvement of inoculum- source for better production.

UNIT - IV

Biotechnology in Medicine: Production of monoclonal antibodies, Making hybridoma – Production of Insulin, growth hormone, interferon, recombinant vaccines, subunit vaccines and live vaccines.

UNIT - V

Diagnosis of genetic disorders by RFLP, PCR, OLR assay and Northern, Southern and Western Blotting – Treatment of Cancer – Bone marrow transplantation – GVH diseases, Gene Therapy : *Ex vivo* and *in vivo* gene therapy, Embryonic stem cell methods, Gene silencing.

Reference Books.

1. Babiuk, L.A. John, P. Phillips and Murray (1989) *Animal Biotechnology*, Pergamon Press, Oxford.
2. Brown, C.M., Campbell, I and Priest, F.G. (1988) *Introduction to Biotechnology*, Blackwell Scientific Publications, U.K.
3. Gor Dard and Lucassen,E. (1993) *In vitro* culture of Animal cells, Butterworth – Heinemann Publications.
4. Higgins, I.J., Best, D.J. and Jones, J. (1988) *Biotechnology-Principles and Applications*. Blackwell Scientific Publications, Oxford, London, Edinburgh.
5. Keshav Trehan (1996), *Biotechnology*, New Age International Pvt. Ltd. Publishers, New Delhi.
6. Marx. J.L.(1989) *A Revolution in Biotechnology*, Cambridge University Press.
7. Mc Neil and Harvey L.M. (1990) *Fermentation*, Blackwell Scientific Publications.
8. Peter Snustad. D and Michale J. Simmons, (2012) *Genetics*, VI th ed., John Willey and Sons
9. Old, R.W and Primrose, S.B, (1989) *Principles of Gene Manipulation*, Blackwell Scientific Publications.
10. Primrose, S.B.(1989) *Modern Biotechnology*. Blackwell Scientific Publications, Oxford, London, Edinburgh.
11. Prentis, S.(1985) *Biotechnology New Industrial Revolution*, Orbis, London.
12. Smith John, E.(1988) *Biotechnology*, Edward Arnold, London.
13. Watson, J.D. *et al.*, *Recombinant DNA*. Scientific American Books, W.H. Freeman and Company, New York.
14. Mathavan, S., 1988, *Production of Foreign protein in Silk worm larvae*. Madurai Kamaraj University, pp 1-95.
15. Ganga, G and Sulochana Chetty, 1999. *An Introduction to Sericulture*, Oxford & IBH Publishing Co., Pvt. Ltd.

MICROBIOLOGY – P13ZY8

Semester : II

Core Course: VII

Instruction Hours/Week: 6

Credit: 5

UNIT - I

General Features and Classification of Bacteria, Virus, Yeast, Actinomycetes and Fungi.
Structure and Life Cycle of Bacteria and Virus: DNA (T₄ Phage) Virus and RNA (HIV) Virus.

UNIT - II

Bacterial growth and nutritional requirements – Microbial culture- Environmental parameters – methods of maintenance of culture – culture of microorganisms – Types of culture media – preparation of culture media – culture characteristics of bacteria : Gram's staining techniques.

UNIT - III

Microbiology of air, water and soil. Food Microbiology – Microbes of milk and food-methods of detection, pasteurization and food poisoning; food preservation, Environmental Microbiology – role of microbes in environment protection and management.

UNIT - IV

Fermentation process-microbial role in fermentation production of alcohol, vinegar, pharmaceuticals, organic acids, amino acids, enzymes and fuels.

Agriculture: Biological nitrogen fixation; *Nif* genes, Nitrogen fixers – Bio fertilizers-bio pesticides (Bt, NPV).

UNIT - V

Pathogenicity, Infection, Virulence – Causative agents – Modes of transmission – control measures of diseases – Diptheria, Tetanus, TB, Typhoid, Gonorrhoea, Syphilis, Polio, AIDS, Viral Hepatitis A & B.

Microbial control: Physical and chemical methods. Antimicrobial agents (Antibiotics).

Text Books:

Pelezar, Chan and Kreig, 1993), Microbiology, Tata Mc Graw Hill Pub. Co. Ltd., New Delhi.

Reference Books

1. Suila, S.B. & Santhanam, S. 2001, General Microbiology, Oxford and IBH.
2. Thomas, C.G.A, 1998, Medical Microbiology, ELBS Publications.
3. Ananthanarayanan, R. and Jayaram Panikar, C.K. 2000, Text Book of Microbiology, Orient Longman, Chennai and Hyderabad.
4. Pelezer, M.J. & Reid, R.D. 1965, Microbiology, Mc Graw Hill Company. New York.
5. Powar, C.B. and Diginawala, H.F. 1987, General Misrobiology-Vol.I & II. Himalaya Publishing House, Bombay.
6. Sharma, P.D. 1993, Microbiology – Rastogi Publications, Meerut.

PRACTICAL – II (Pertaining to Animal Physiology, Biotechnology, Microbiology – P13ZY9P)**Semester : II****Core Course: VIII****Instruction Hours/Week: 6****Credit: 5****A. ANIMAL PHISIOLOGY:**

Quantitative estimation of amylase activity.

Quantitative estimation of ammonia and urea.

Rate of salt loss and salt gain in fish using different experimental media.

B. BIOTECHNOLOGY

Demonstration of Agarose gel electrophoresis, SDS PAGE

Spotters : Models of PCR, Southern Blotting, Vectors.

C. MICROBIOLOGY

Culture techniques: Culture of bacteria – Bacterial growth curve- Antibiotic sensitivity (Gram staining +ve and –ve), Differential staining. Preparation of culture media- Agar medium.

Serial dilution technique & pour plate.- Culturing of bacterial broth, slants, plating, streaking.

Equipments in Microbiology: - Inoculation loop – Autoclave – Laminar flow hood – Spotters related to theory – Estimation of coliform bacilli in sewage water and drinking water, Replica plating.

Reference Books:

Cappuccino, J.G. and Sherman, 1999, Microbiology – A Laboratory manual, Addison Wesley Pub.

ELECTIVE COURSE – II : BIO-STATISTICS & BIO-INFORMATICS – P13ZY10E**Semester : II****Elective Course: II****Instruction Hours/Week: 6****Credit: 4****BIO-STATISTICS****UNIT – I**

Sampling methods, Graphic presentation of Data- Scatter diagram, Bar diagram, frequency polygon, line graphs and Pie charts – Descriptive statistics: Measures of central tendency – mean, median and mode. Measures of dispersion: Range, quartile deviation, variance, Standard deviation, Standard error, Coefficient of variation. 95% confidence interval.

UNIT – II

Hypothesis testing – tests of significance: Student's t test (paired and unpaired tests). Chi square test, One way and two way analyses of variance (F-values)

BIOINFORMATICS**UNIT – III**

Bioinformatics: Definition, Scope, Data base, Sequence Databases – Nucleotide and Protein. Sequencing Analysis: Genomics and Proteomics, Tools of Bioinformatics: NCBI, EMBL, GENE BANK, SWISS-PROT, PDB, MMBD, FASTA and BLAST format.

UNIT – IV

Comparison of sequences -- Methods to access and download genome sequences of several organisms-- Sequence Alignments (CLUSTAR Analysis).

UNIT- V

Homology, Phylogeny and Evolutionary Tree : Homology and Similarity, Phylogeny and relationships, Molecular Approaches to Phylogeny and Phylogenetic Analysis Database. Drug Discovery.

Reference Books:

1. Sokal, R.R. and F.J. Rohlf 1981, Introduction to Biostatistics, WH Freeman & Co. USA.
2. Zar, J.H. 1984, Biostatistical analysis, Prentice Hall, New Jersey, USA.
3. Anderson, T.W. 1983, An Introduction to Multivariate Analysis, John Wiley.
4. Johnson AR & W.D. Wichern, 1988, Introduction to applied multivariate analysis.
5. Irfan Ali Khan and Atiya Khanum 2003, Fundamentals of Bioinformatics, Ukaaz Publications Hyderabad, India.
6. Murthy, C.S.V. 2003, Bioinformatics, Himalaya Publishing House, Mumbai, Delhi, Nagpur, Bangalore- India.
7. Subramanian, C. 2004, A Text Book of Bioinformatics, Dominant Publishers and Distributors, New Delhi, India.
8. Orpita Bosu and Simminder Kaur Thukral, 2007. Bioinformatics, Published by Oxford University Press, New Delhi, India.

DEVELOPMENTAL BIOLOGY AND EVOLUTION – P13ZY11

Semester : III

Core Course: IX

Instruction Hours/Week: 6

Credit: 5

UNIT – I

Ultra structure of sperm and egg. Structural modifications of mammalian sperm and their activity. Fertilization , Activation of egg cytoplasm, Infertility, Super ovulation, ICSI, GIFT- Embryo cloning, IVF and Test tube baby.

UNIT – II

Hormonal control on growth and metamorphosis of insects and amphibians- Formation of limb bud in amphibian, Induction of early limb bud, Cell death and ageing. Regeneration in various Invertebrates and Vertebrates, Mechanism and factors influencing regeneration.

UNIT – III

Embryonic stem cell and stem cell differentiation. Genes in development, Gene expression, regulation of early embryonic development in Drosophila, Homeotic selector genes. Organizers, Induction, Spemann and Mangold experiments, Molecular biology of the Nieuwkoop center, Regional specification of induction.

UNIT – IV

Origin of Life: Process and Theories. Population genetics and evolution: Classical hypothesis, Balance hypothesis, Panmixis, Genetic drift.

Selection in action in evolution

UNIT – V

Races to species, Adaptation pattern, Behavioral adaptations and strategies, Sexual competition and Selection, Isolating mechanisms, Mode of speciation. Evolution of man and future evolution of man.

References

1. Balinsky, B.L. 1981. An introduction to Embryology V Ed. Saunders Co. Philadelphia.
2. Berrill, N.J. 1986. Developmental Biology, Tata McGraw Hill, New Delhi.
3. Gilbert, S.F. 1995, Developmental Biology, II Edn. Sinauer Associates Inc. Publishers. Massachusetts, USA.
4. Castri, F.D. and Younes, T. 1996. Biodiversity: Science and development. CAB. Int. Wallingford, UK.
5. Gurubachan. S. Miglani, 2006. Developmental Genetics. I.K. International Publishing House Pvt.Ltd.
6. Dobzhansky, T., Ayala, F.J., Stebbins, G.L. and Nalentine, J.W. 1975. Evolution. Surjeet Pub. and Co., New York.
7. Strickberger, M.W. 1996. Evolution: Jones and Barlett Pub.Inc., London.
8. Verma P.S. and Agarval, Cell Biology, Genetics, Molecular Biology and Evolution 2010. Chand and Co

BIOCHEMISTRY AND BIOPHYSICS – P13ZY12**Semester : III****Core Course: X****Instruction Hours/Week: 6****Credit: 5****UNIT – I**

Proteins: Structure and classification, Physicochemical properties of amino acids, Essential amino acids, Glycogenic and Ketogenic amino acids, Metabolism of tyrosine, Functions of proteins and amino acids. **Lipids :** Classification, Fatty acids, Triglycerides, Compound lipids, Phospholipids, Sphingolipids, Glycolipids, Steroids, Prostaglandins, Oxidation of fatty acids and Ketosis.

UNIT – II

Carbohydrates: Classification, Structure and Properties of mono, di and polysaccharides (Starch, Glycogen, Chitin and Proteoglycan, Acid Mucopolysaccharides, Glycoproteins). Biosynthesis of Glycogen, Glycolysis, Krebs's cycle, HMP pathway and Gluconeogenesis.

UNIT – III

Enzymes: Structure, Mechanism of enzyme action, Enzyme kinetics, Theories of Enzyme kinetics. Enzyme inhibitors, Allosteric enzymes and Coenzymes.

Hormones: Hypothalamic releasing hormones and function, Mechanism of hormone action, Peptide hormones, Adenylate cyclase, cyclic AMP mechanism- Ca^{++} , Phosphoinositol, Steroid hormones and Transcriptional control.

UNIT – IV

Concept of free energy: Laws of Thermodynamics, Biological energy transducers, Radiation biophysics, Ionizing radiation, Interaction of radiation with matter, Measurement of radiation (Dosimetry), Radioactive isotopes (Radio nuclides), Biological effects of radiation, Radiation protection and Therapy.

UNIT – V

Principles of X-ray diffraction, UV, NMR, ESR, Spectroscopy. Principles and applications of light, Fluorescence and Electron microscopes.

References

1. Veerakumari, L. 2005. Biochemistry. MJP Publishers.
2. Lehninger, A. L., Nelson D.K and Cox, M.M., 1993. Principles of Biochemistry, CBS Publishers and Distributors, New Delhi.
3. Stryer, L., 1988. Biochemistry, W.H. Freeman and Company, New York.

4. Voet, D., Judith, G. Voet, Charlott, W., Pratt. 1999. Fundamentals of Biochemistry, John Wiley and Sons. Inc.
5. Rama Rao, A.V.S.S. Biochemistry UBSPD.
6. Narayanan, L.M. Nallasingam, K. Arumugam, N. 2006. Biochemistry. Saras Publications.
7. Gopalakrishnan, 2002. Radiation Biology.
8. Daniel, M. 1992. Basic Biophysics for Biologists, Wiley International, New Delhi.
9. Narayanan, P. 2007. Essentials of Biophysics. II Edn. New Age International Pub.

PRACTICAL – III (Pertaining to Developmental Biology & Evolution, Biochemistry & Biophysics) (CC – IX & X) - P13ZY13P

Semester : III

Core Course: XI

Instruction Hours/Week: 6

Credit: 5

Developmental Biology

Preparation of sperm suspension in frog / bull and observation of the spermatozoa, Sperm motility study in frog semen. Storage methods (Theory).

Effect of thyroxin or iodine on metamorphosis of frog (Demonstration only).

Regeneration in Tadpole.

Evolution

Fossils : Nautiloid, Ammonoid, Trilobite.

Biochemistry

Preparation of solutions – normality, molarity, percentage.

Buffer preparation – determination of pH using pH meter and Paper

Quantitative estimation of amino acid, protein, carbohydrate and lipids in tissue samples.

Biophysics

Colorimeter : Determination of optical density of samples using standards. Draw a standard curve.

Experimental verification : Beer and Lambert's law.

Chromatography – Separation of aminoacids in different samples (Paper) and TLC

Electrophoresis: Separation of serum proteins (Demonstration only).

ELECTIVE COURSE – III : AQUACULTURE – P13ZY14E**Semester - III****Elective course: III****Instruction hrs /week: 6 hrs.****Credit : 4****UNIT – I**

Scope of Aquaculture, Cultivable species of fishes and shrimps, Advantages of Aquaculture, Production trends - National and International Scenario.

UNIT – II

Hatchery techniques : Post Larval shrimps production.

Culture methods of various fresh water fishes and Marine shrimps, Selection of site, Selection of species, Types of farming : Traditional, Semi intensive, Intensive and Integrated farming.

UNIT – III

Culture of carp species: Ornamental fresh water fish culture, Commercial and Socio-economic importance. Pearl oyster culture

UNIT – IV

Farm management: Construction of semi intensive earthen ponds, Water source, daily management practices and Drainage system. Stocking of Post Larval shrimps in culture pond. Composition of feed: Types of feed: Live feed Wet and dry feeds. Harvesting, Processing , Preservation and marketing.

UNIT – V

Fish disease management: Common bacterial, viral, fungal and parasitic diseases, Symptoms and treatment.

Social, economical and environmental problems in Penaeid prawn culture.

Government organizations : MPEDA, CIBA, CIFA, NIOT, NIO and CMFRI.

References

1. Arumugam.N. 2008. Aquaculture, Saras Publications.
2. Rath, R.,K. 2000. Freshwater Aquaculture. Scientific Publishers, PO No 91, Jodhpur. India
3. Jhingran, AVG, 1991, Fish and Fisheries of India, Hindustan Publishing Co.
4. Baradach, JE, JH Ryther and WO McLarney, 1972, Aquaculture. The farming and Husbandary of Fresh water and Marine Organisms. Wiley Interscience, New York.

ELECTIVE COURSE – IV : ENVIRONMENTAL BIOLOGY AND MANAGEMENT – P13ZY15E**Semester : III****Elective Course: IV****Instruction Hours/Week: 6****Credit: 4****UNIT – I**

Scope of Ecology, its relevance to mankind, Ecological interfacing, Abiotic factors: Water, Light, Temperature and Soil. Biotic Factors: Animal relationships: Positive, negative interactions, Intra specific and Inter specific competition.

UNIT – II

Ecosystem: Concepts and ecosystem management, Fresh water ecosystem, Pond and River ecosystem. Food chain, Food web, Trophic levels, Energy flow. Intertidal fauna: Rocky, Sandy and muddy shore fauna. Ecosystem: Cybernetics, Technoecosystems. Development to human ecology.

UNIT – III

Population: Definition, Natality, Mortality, Population fluctuation, Dispersal and Age. Community ecology: Types and Characteristics, Ecological succession. Natural resources: Renewable and non renewable, resources management. Remote sensing techniques. Biodiversity: Types, Mega diversity with reference to India and Conservation of biodiversity.

UNIT – IV

Ecological and Societal gaps, Global sustainability, Long term transitions. Human designed and Management systems. Environmental Laws and Acts pertaining to environmental population and management.

UNIT – V

Pollution: Types, Biological effects and control. Air pollution, Water pollution, Sewage and Solid waste disposal and management, Green House Effect, Ozone layer and its significance. Global warming, Acid rain. Biomagnifications, Eutrophication, Environmental Impact Assessment (EIA), Biological indicators and their role in environmental monitoring, Bioremediation, Biodegradation of heavy metals and oil pollution.

References:

1. Clarke, G.L. 1954, Elements of Ecology. John Wiley & Sons. NY.
2. Kendeigh, S.C. 1961. Animal Ecology, Printice Hall,.
3. Odum, E.P. 1971. Fundamentals of Ecology, W.B. Saunder's Co. Philadelphia.
4. Odum, E.P and Barrett, G.W. 2005. Fundamentals of Ecology. Thompson Brooks / Cole (EWP) 5th Ed.
5. Rastogi, V.B. and M.S. Jayuaraj 1989, Animal Ecology and Distribution of Animals, Kedarnath Ramnath.
6. Arumugam, N. 2005. Concepts of Ecology. Saras Publications.
7. Sharma, P.D. 1990. Ecology and Environment. Rastogi Publications. Meerut.
8. Southwick,C.H. 1976. Ecology and the quality of Environment. D.Vas Nostrand Co.
9. Verma, P.S. and V.K. Agarwal, 1996. Principles of Ecology. S.Chand & Co. New Delhi.

IMMUNOLOGY– P13ZY16

Semester : IV

Core Course: XII

Instruction Hours/Week: 6

Credit: 5

UNIT – I

Immunity : Innate, acquired and passive. Immune system: Lymphoid organs: Primary and secondary- structure and functions, Cells of the immune system: Lymphocytes, T & B - Lymphocytes, Polymorphonuclear cells, Macrophages and Lymphokines.

UNIT – II

Antigen: Antigenic determinants, Types.

Antibody: Immunoglobulins – structure and functions.

Complement: Nomenclature, classification activation and function.

UNIT – III

Immune response: Primary and secondary, Mechanism of humoral and cell mediated,. Immunity to infections- bacterial and viral. Immunoprophylaxis: Toxoids and Vaccine, Immunization schedule.

UNIT – IV

Hypersensitivity: Types – I, II, III and IV, Autoimmune disorders, Immunodeficiency diseases, Tumor immunity, Major Histocompatibility Complex, Transplantation immunity.

UNIT – V

Immunotechniques: Agglutination test, Precipitation test, Immunodiffusion, Immunoelectrophoresis- Qualitative and Quantitative, Immunofluorescence, Widal test, VDRL

test, Hybridoma technology, Radioimmunoassay, Enzyme Linked Immunosorbent Assay (ELISA).

References:

1. Chakravarthy, A.K., 1993. Immunology, Tata McGraw Hill Publishing Company, New Delhi.
2. Roitt, (3rd Edition) 2002. Immunology Crover Medical Publishing Company, London.
3. Barret, J. T., 1983, A text book of Immunology. (5th Edition) The C.V. Mosly Company.
4. Weinn, D.M. and Steward, L. 1993. Immunology. Singapore Publishers Private Ltd.
5. Kuby, J. 1994, Immunology, WH Freeman and Co, New York.

ENTOMOLOGY – P13ZY17

Semester : IV

Core Course: XIII

Instruction Hours/Week: 6

Credit: 5

UNIT – I

Insects Taxonomy: Basis of insect classification. Key characteristics with common South Indian examples. Morphology: Head, Segmentation and sutures. Wings: Venation, Appendages in Apterygotes.

UNIT – II

Physiology: Integumentary system, Structure and chemistry, Physiology of moulting. Digestive system: Structure and physiology.

Respiration: Aerial and Aquatic.

Circulatory system: Structure of heart, Mechanism of haemolymph circulation. Haemolymph and its composition: Haemocytes and their functions.

UNIT – III

Excretory system: Malpighian tubules and their functions

Nervous system: Structure, Neurotransmitters, Structure and function of compound eye.

Reproductive system: Male and female reproductive systems.

Endocrine system: Endocrine control of moulting and metamorphosis, Role of hormones in male and female reproduction. Neuroendocrine system of insects.

UNIT – IV

Economic importance of insects : Biology of honey bee, Silk moth and Lac insect. Culture methods, Appliances used and problems related to their cultures.

Biology, damage caused and control methods of common insect pests of agricultural importance: Paddy, Sugarcane, Coconut, Brinjal and Pests of stored products.

UNIT – V

Principles of Insect control: Prophylactic measures, Cultural, Mechanical, Physical and Biological methods. Parasites, Predators. Chemical methods: Pesticides, Classification, Mode of action, Toxicity, Insecticide resistance to environmental safety. Non conventional methods, use of insect growth regulators (IGR), Repellents, Antifeedants, Pheromones and Chemosterilants. Integrated Pest Management.

References:

1. Mani, M.S. 1982. General Entomology, Oxford and IBH Publishing Co. New Delhi.
2. Snodgrass, R.F., 1985. Principles of Insect Morphology. McGraw Hill & Co. New York.
3. Wigglesworth, V.B. 1992, Physiology of Insects. IX Ed. Chapman and Hall London.
4. Chapman, R.F., 1992. The Insects Structure and Function. Hodder and Broughton Ltd., Kent, U.S.A.
5. Nayar, K.K., Ananthakrishnan, T.N. and David, M., 1995. General and Applied Entomology. Tata McGraw Hill Pub. Co., Ltd., New York.
6. Vasantharaj David, B., 2001. Elements of Economic Entomology and Applied Entomology, Oxford and IBH Publishing Co., New Delhi.
7. Rathinaswamy, T.K., 1986. Medical Entomology, S. Viswanathan and co., Madras.

ELECTIVE COURSE V : WILD LIFE BIOLOGY – P13ZY18E

Semester : IV

Elective Course: V

Instruction Hours/Week: 6

Credit: 4

UNIT – I

Wildlife concept, Importance of Wildlife conservation:- ecological, ethical, educational, scientific, commercial, aesthetic, and recreational.

Conservation methods:- In situ conservation-sanctuaries, national parks, biosphere reserves, Ex situ conservation-captive breeding, modern zoo, safari, nocturnal zoo.

UNIT – II

Inventory studies:-Total species list, total genera or families list, parallel-line searches, encounter rates, documenting rarities, sample collection: labeling, preservatives, collection of plants, collection of fungi, collection of invertebrates, collection of fishes, collection of amphibians, collection of reptiles, collection of birds and collection of mammals.

UNIT – III

Conservation priorities: IUCN classification - extinct, critically endangered, endangered, vulnerable, conservation dependent, low risk, data deficient, not evaluated. Flagship species,

Umbrella species, Hotspots, Important Bird Areas, Tiger Reserves. Protected areas of Tamilnadu.

UNIT – IV

Wildlife census techniques: Direct count: Line transects, Point counts. Mark-recapture. Indirect count: pellet count, calls, sent mark, camera trap, radio telemetry, remote sensing. Behavioural sampling: Events, States, Focal-sampling, Scan sampling,

UNIT – V

Conservation project: A. Tiger project- Tiger species, distribution, threats, conservation action taken, B. Elephant project: Elephants species, distribution, threats, conservation action taken. C. Crocodile Project-crocodile species, distribution, threats, conservation action taken. D.Vulture crisis in India, Wildlife Laws.

References

1. Sutherland W.J.2000.The conservation hand book: research, management and policy
Blackwell Science Ltd
2. Martin and Bateson, 2007. Measuring Behaviour. Cambridge University Press.
3. Andrawartha, H.C. and L.C. Birch. 1974. The distribution and abundance of animals. The University of Chicago press, London.
4. Agarwal, V.P. 1980. Forests in India. Oxford and IBH Publishing Co. New Delhi.
5. Davis, M. 1981, Infectious diseases of wild mammals. The IOWA state.
6. Giles, R.H. 1984. Wild life management techniques. The wild life society, Washington and Natraj Publishers, Dehra Dun.
7. Saharia, V.B. 1982. Wild life in India. Nataraj Publishers, Dehra Dun.

PROJECT WORK - P13ZYP19

Semester : IV

Project

Instruction Hours/Week: 12

Credit: 5

PROJECT WORK

(Dissertation 75 marks & Viva Voice – 25 Marks)
