YADAVA COLLEGE

(An Autonomous Co-Educational Institution

Re-accredited with "A" Grade by NAAC

Affiliated to Madurai Kamaraj University)

Govindarajan Campus, Thiruppalai, Madurai – 625014.

PG & RESEARCH DEPARTMENT OF ZOOLOGY

BOARD OF STUDIES MEETING

09 APRIL 2018

B.Sc. Zoology Programme

CBCS (2018 – 2019 onwards)

DEPARTMENT OF ZOOLOGY

B.Sc. ZOOLOGY

COURSE CONTENT

Semester	Sub. Code	Title of the Paper	Teaching Hrs / Week	Credits	Evaluation			Examination Hours
					Internal	External	Total	
I		Paper I – Tamil	6	3	25	75	100	3
		Paper I – English	6	3	25	75	100	3
		Paper I – Invertebrata	8	7	25	75	100	3
		Paper II – Lab in Invertebrata-I	2	1	40	60	100	3
		Paper I – Chemistry	4	4	25	75	100	3
		Environmental Science	2	2	25	75	100	3
		Communicative English – I	2	2	25	75	100	3
		TOTAL	30	22				
II		Paper II – Tamil	6	3	25	75	100	3
		Paper II – English	6	3	25	75	100	3
		Paper III – Chordata	8	7	25	75	100	3
		Paper IV – Lab in Chordata- II	2	1	40	60	100	3
		Paper II – Chemistry	4	4	25	75	100	3
		Value Education	2	2	25	75	100	3
		Communicative English – II	2	2	25	75	100	3
		TOTAL	30	22				

Semester	Sub. Code	Title of the Paper	Teaching Hrs / Week	Credits	Evaluation			Examination Hours
					Internal	External	Total	
III		Paper III – Tamil	6	3	25	75	100	3
		Paper III – English	6	3	25	75	100	3
		Paper V – Cell and molecular biology	4	4	25	75	100	3
		Paper VI – Lab in Cell and molecular biology- III	2	1	40	60	100	3
		Paper III – Chemistry	4	4	25	75	100	3
		Paper I – Botany- Plant Diversity - I	4	3	25	75	100	3
		NME - Health Education	2	2	25	75	100	3
		Communicative English – III	2	2	25	75	100	3
		TOTAL	30	22				
IV		Paper IV – Tamil	6	3	25	75	100	3
		Paper IV– English	6	3	25	75	100	3
		Paper VII – Developmental biology	4	4	25	75	100	3
		Paper VIII – Lab in Developmental Biology – IV	2	1	25	75	100	3
		Paper IV – Chemistry	4	4	25	75	100	3
		Paper I – Botany- Plant Diversity – II	4	3	25	75	100	3
		NME-Apiculture	2	2	25	75	100	3
		Communicative English – IV	2	2	25	75	100	3
		TOTAL	30	22				

Semester	Sub. Code	Title of the Paper	Teaching Hrs / Week	Credits	Evaluation			Examination Hours
					Internal	External	Total	
V		Paper IX – Genetics and Evolution	**6**	**6**	**25**	**75**	**100**	**3**
		Paper X –Basic Biotechnology	**5**	**5**	**25**	**75**	**100**	**3**
		Paper XI – Biostatistics and Computer Applications & Bioinformatics	**5**	**6**	**25**	**75**	**100**	**3**
		Paper XII – Lab in Genetics, Evolution, Basic Biotechnology, Biostatistics, Bioinformatics and Computer Applications- V	**8**	**4**	**25**	**75**	**100**	**3**
		Paper III – Botany Taxonomy of Angiosperm	**4**	**3**	**25**	**75**	**100**	**3**
		Soft Skills – I	**2**	**2**	**25**	**75**	**100**	**3**
		TOTAL	**30**	**26**				
VI		Paper XIII – Biochemistry	**5**	**5**	**25**	**75**	**100**	**3**
		Paper XIV – Microbiology and Immunology	**6**	**6**	**25**	**75**	**100**	**3**
		Paper XV – Animal Physiology	**5**	**6**	**25**	**75**	**100**	**3**
		Paper XVI – Lab in Biochemistry, Microbiology and Immunology & Animal Physiology – VI	**8**	**4**	**25**	**75**	**100**	**3**
		Paper IV – Botany Applied Botany	**4**	**3**	**25**	**75**	**100**	**3**
		General Awareness and Current Affairs	**2**	**2**	**25**	**75**	**100**	**3**
		TOTAL	**30**	**26**				
		Total number of teaching hours: 180hrs Total number of credits : 140						

SELF STUDY PAPERS

Undergraduate Programme

Sem.	*Subject*	*Credits*	*Exam. Hrs.*	*Int. Marks*	*Ext. Marks*	*Total Marks*
III	Economic Zoology	3	3	25	75	100
IV	Human Reproduction Conception and birth control	3	3	25	75	100
V	Ornamental fish culture	3	3	25	75	100
VI	Food and Nutrition	3	3	25	75	100

Postgraduate Programme

Sem.	*Subject*	*Credits*	*Exam. Hrs.*	*Int. Marks*	*Ext. Marks*	*Total Marks*
III	Poultry	5	3	25	75	100
IV	Aquaculture	5	3	25	75	100

Certificate and Diploma course

S. No.	*Subject*	*Class*
I	Apiculture	Certificate course for UG
II	Vermitechnology	Diploma course for PG

Certificate and Diploma course

Sem.	*Subject*	*Credits*	*Exam. Hrs.*	*Int. Marks*	*Ext. Marks*	*Total Marks*
VI	Apiculture		3	25	75	100
III & IV	Vermitechnology		3	25	75	100

PAPER - I

INVERTEBRATA

Semester: I ***Hours / Week: 8***

Subject Code: ***Credit: 7***

Objectives

Invertebrata is a fundamental course to provide basic understanding of Biology of Invertebrates. This paper deals with classification and diagnostic characteristics of Phylum Invertebrata. It also deals with the comparative anatomy and organization of various Invertebrates.

UNIT I

A brief introduction to principles of taxonomy and nomenclature – Level's of Organization in animals.

Phylum Protozoa: General characters, Classification up to class level with examples. Type study-Paramecium-Structure and Reproduction - conjugation only.

General Topics: Nutrition in Protozoa. Life cycle and pathogenicity of Plasmodium, Entamoeba and Trypanosoma. Locomotion in Protozoa.

UNIT II

Phylum Porifera: General characters, Classification up to class level with examples. Type study - Sycon - Cellular structure, spicules in sponges- A brief study.

Phylum Coelenterata: General characters, Classification up to class level with examples.

Type study- *Obelia* - Structure & Locomotion.

General Topics: Canal system in Sponges, Polymorphism in Coelenterates, Coral and Coral reef formation.

UNIT III

Phylum Helminthes: General Characters, Classification up to class level with examples. Type study - Liver fluke. Nemathelminthes – Ascaris life cycle.

Pathogenic effects of - *Ancyclostoma duodenale, Wuchereria bancrofti* and their control measures.

Phylum Annelida: General characters, Classification up to class level with examples. Type study – Earthworm - External morphology, Excretion and Reproduction.

General Topics: Parasitic adaptation in Helminthes, Metamerism in annelida.

UNIT IV

Phylum Arthropoda: General characters, Classification up to class level with examples. Type Study - *Penaeus*.

Phylum Mollusca: General characters, Classification up to class level with examples. Type study – Fresh water mussel.

General Topics: Peripatus- Structure and affinities, Social life in Insects. Torsion in Gastropoda.

UNIT V

Phylum Echinodermata: General characters, Classification up to class level with examples. Type study- Starfish (*Asterias rubens*)- Water vascular system in Star fish.

General Topic: Larval forms of Echinoderms, Water vascular system in Echinodermata.

Textbook

1. N. Arumugam, N. C. Nair and S. Leelavathi (2014)**.** Text book of Invertebrates. Saras Publications. Nagercoil.

Reference Books:

1. E.L. Jordon and P.S. Verma (2005). Invertebrate Zoology –S.Chand & Co. New Delhi
2. P.S. Dhami and J.K. Dhami (2006). Invertebrate Zoology –R.Chand & Co. New Delhi.
3. R.L.Kotpal, (2005). Invertebrate Zoology. Rastogi Publications, Meerat.
4. Ekambaranatha Iyer and T.N.Ananthakrishnan (2003). A Manual of Zoology, Volume 1.Viswanathan Publications, Chennai.
5. R. L. Kotpal (2013). Modern text book of Zoology- Invertebrates. Rastogi publication, Meerut.

PAPER - II

LAB IN INVERTEBRATA

Semester : I ***Hours/Week : 2***

Subject Code : ***Credit : 1***

I. MAJOR PRACTICAL

CD/Model/Chart-Anatomical observation and comment on digestive, reproductive and nervous system of Cockroach.

Web resources - http://www.neosci.com; http://www.scienceclass.com

II. MINOR PRACTICAL

Slides/Model/Chart – Identification (draw and label)

1.Cockroach: Mouthparts.

2.Earthworm: Penial setae/ body setae.

3.Honey bee and House fly -Mouthparts.

4.Prawn -Appendages

III. SPOTTERS

Protozoa: Amoeba, Paramecium- Entire, Binary fission, Conjugation, Euglena and Ceratium

Porifera: Gemmule, Spicules

Coelentrata: Obelia colony, Medusa of Obelia, Physalia

Platyhelminthes: Liver fluke, Larval forms of liver fluke, *Taenia solium*.

Nematoda: Ascaris- Male &female.

Annelida: Nereis, Leech

Arthropoda: Prawn, Nauplius, Zoea, Mysis, centipede, millipede, Scorpion, Beneficial insects- Honey bee and Silk worm, Any two harmful insects.

Mollusca: Pila, Unio, Solen, Chiton, Dentalium, Nautilus, Octopus

Echinodermata: Star fish, Sea urchin, Sea cucumber, Echinoderm Larva – Bipinaria larva.

A visit to museum / Zoo.

Reference Books:

1. Jayasurya, Prasannakumar and N. Arumugam (2013).Practical Zoology (Volume I). Saras Publication, Nagercoil.
2. S. S. Lal (2010). Invertebrate Practical Zoology. Rastogi Publications, Meerut.

PAPER - III

CHORDATA

Semester: II ***Hours / Week: 8***

Subject Code: ***Credit : 7***

Objectives

Chordata is a fundamental course to provide basic understanding of biology of Chordates. This paper deals with classification and diagnostic characteristics of Phylum Chordata. It also deals with the comparative anatomy and animal organization of Chordates.

Unit-I: Introduction and Prochordates

General characters of Chordates, Outline classification of chordates (in brief). Prochordates - General characters, Classification up to sub phylum level with examples. Type study—Amphioxus.

General Topic: Retrogressive metamorphosis in Ascidian; Affinities of Hemichordates.

Unit-II: Pisces and Amphibia

Pisces –General characters of fishes, Classification up to sub class level with examples, Type study – Shark: Migration of fishes; Accessory respiratory organs in fishes.

Amphibia – General characters of Amphibians, classification up to subclass level with examples.

Type study- Frog: external morphology, respiratory system and reproductive system only.

General Topic: Parental care in Amphibia; Neotany in Amphibia.

Unit- III: Reptilia

General characters of reptiles, Classification up to subclass level with examples.

Type study – Calotes: external morphology, circulatory system, urinogenetal system and nervous system.

General Topic: Poisonous and non-poisonous snakes-identification. Poison apparatus and biting mechanism, first aid; Extinction of Dinosaurs

Unit-IV: Aves

General characters of Aves, classification up to subclass level with examples.

Type study – Pigeon- external morphology, respiratory system and reproductive system.

General Topics: Flight adaptation in birds and Migration of birds - Flightless birds.

Unit-V: Mammalia

General characters of mammals, Classification up to subclass level with examples.

Type study: Rabbit - external morphology, digestive system, nervous system and reproductive system.

General Topics: Egg laying mammals, Dentition in mammals and Aquatic mammals.

Textbook:

1. N. Arumugam, N. C. Nair and S. Leelavathi (2014**).** Text book of Chordates. Saras Publications, Nagercoil.

Reference Books:

1. E.L. Jordon and P.S. Verma (2006). Chordate Zoology –S.Chand & Co. New Delhi
2. P.S. Dhami and J.K. Dhami (2006). Chordate Zoology –R.Chand & Co. New Delhi.
3. R.L.Kotpal, (2005). Vertebrate Zoology. Rastogi Publications, Meerat.
4. Ekambaranatha Iyer and T.N.Ananthakrishnan (2003). A Manual of Zoology-Chordate (Volume II).Viswanathan Publications, Chennai.

PAPER - IV

LAB IN CHORDATA

Semester: II ***Hours/Week : 2***

Subject Code: ***Credit : 1***

I. Major Practical

CD/Model/Chart-Anatomical observation and Description on digestive system, urinogenital system, arterial and venous systems of Frog.

II. Minor Practical

Slides/Model/Chart – Identification (draw and label)

1. Shark: Placoid Scale
2. Dissection and observation of visceral organs of fish- (Demonstration only)
3. Frog: Brain, Forelimb and Hindlimb.

III. Spotters

Prochordata: Amphioxus entire and Balanoglossus.
Pisces: Echeneis, Hippocampus, Eel and any two local edible fishes.
Amphibia: Bufo, Rhacophorus, Axolotl larva.
Reptelia: Any two Poisonous and Non Poisonous snakes, Draco.
Birds: Any three local birds (Beaks and claws modifications).
Mammals: Bat
Osteology: Skull, Pectoral girdle & Pelvic girdle of Pigeon

Reference:

1. Jayasurya, Prasannakumar and N. Arumugam (2013).Practical Zoology (Volume I). Saras Publication. Nagercoil.
2. S. S. Lal (2010). Vertebrate Practical Zoology. Rastogi Publications, Meerut.
3. BIOLAB Series – Realistic lab activities – Anatomy & physiology of the frog, Corolina Biological Supply company, Leicester, UK, 2007.
4. The Digital Frog 2.5 – CDROM for Window and Mac version 2.5a, Didital frog International Leicester, UK, 2007. (www: digitalfrog.com)

PAPER - V

CELL AND MOLECULAR BIOLOGY

Semester: III ***Hours/Week: 4***

Subject Code: ***Credits: 4***

Objectives

This paper is designed to give an understanding on Microscopy, cytological techniques and the nature of the cell. It deals with the structure, biochemistry, functions of cell organelles and nuclear components.

Unit I: Microscopy and Cytological techniques:

Microscopy – Simple Microscope, Compound microscope – Phase contrast microscope – Electron microscope; Centrifugation – Principle and types of centrifuges, Cytological techniques: fixation – Sectioning – Staining – Mounting.

Unit II: Cell membrane and Cell organelles:

Cell types – Prokaryotic – Eukaryotic – Differences. Animal cell: Structure of cell membrane (PM) – Models to explain the cell membrane - Trilaminar and Fluid mosaic model - Chemical composition. Specializations of cell membrane – Cell organelles: Ultra structure and functions of Endoplasmic reticulum, Golgi apparatus, Mitochondria, Lysosome and Ribosomes.

Unit III: Nucleus and chromosomes:

Nucleus: Ultra structure, nuclear membrane – Nucleoplasm – Nucleolus - Chemical composition and functions. Chromosome – Structure and functions. Special types of chromosomes: Polytene – Lamp brush chromosomes– Heterochromatin and euchromatin.

Unit IV: Cell division and Cancer cells:

Cell division – Cell cycle –Amitosis - Mitosis – Meiosis – Stages and significance. Abnormal cell division: Cancer – characteristics – properties – types – causes- treatment.

Unit V: Nucleic acids and Protein synthesis:

Deoxyribonucleic acid (DNA) – Watson and Crick model – Chemical composition – functions. Ribonucleic acid (RNA) – Structure, types and functions of messenger RNA – transfer RNA – ribosomal RNA –Genetic code and its properties – Protein synthesis.

Text Books:

1. N. Arumugam, N. C. Nair and S. Leelavathi (2014). Cell biology and molecular Biology, Saras publication, Nagercoil.
2. C. P. Powar (2010). Cell Biology. Himalaya Publishing House. Mumbai.

Reference Books:

1. P. S. Verma and V. K. Agarwal (2010) – Cell biology. S. Chand & Co. New Delhi.
2. M. L. Gupta and M. L. Jangir (2000). Cell Biology. Botanica. New Delhi.
3. Ajoy Paul (2011). Text book of cell and Molecular Biology. Books and Allied Ltd. Kolkata.

PAPER - VI

LAB IN CELL AND MOLECULAR BIOLOGY

Semester: III ***Hour/Week: 4***

Subject code: ***Credit: 1***

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1. Microscopy - Compound microscope
2. Centrifugation – Centrifuge
3. Study of Mitosis using Onion root tip
4. Observation of Polytene chromosome in chironomous larva
5. Preparation of Human blood smear and observation of different forms of WBC
6. Isolation of Eukaryotic DNA from goat liver
7. Sketch of cell organelles:
   a) Nucleus
   b) Mitochondria
   c) Endoplasmic reticulum
   d) Golgi apparatus
   e) Ribosome

Spotters:

Meiotic stages – microscopic slides.

Columnar epithelium & Ciliated epithelium (Microscopic slides)

Lac Operon Model, DNA replication, clover leaf model of RNA and coding dictionary

Reference Books:

1. N. Arumugam, R. P. Meyyan and A. Mariakuttikan (2013). Practical Zoology. (Volume III). Saras Publications, Nagercoil.
2. S. Thiagarajan (2000). Practical Zoology. T. J. Publications. Tanjavur.

Non Major Elective

HEALTH EDUCATION

Semester: III ***Hours/Week: 2***

Subject Code: ***Credits: 2***

Objectives

This paper is to enlighten the students in the basic aspects of maintaining good health, hygiene & sanitation; to create awareness about communicable and Non-communicable diseases and to enlighten the general public about enjoying good health which includes body and soul.

Unit I: Concepts in community health

Concepts on health and well being - Biomedical concept, ecological concept, physiological concept and holistic concept. Determinants of health, Health indicators.
Diagnosis of diseases.

Unit II: Communicable diseases – cause, symptoms & control measures

i) Airborne infections – Tuberculosis and Asthma.
ii) Waterborne infections –Viral Hepatitis, Cholera, Typhoid.
iii) Vector borne infections –Malaria and Filariasis.
iv) Contact infections – Rabies and AIDS.

Unit III: Non Communicable Diseases – cause, symptoms & prevention

Obesity, Diabetes, Myocardial infraction, Hypertension, Stroke, Blindness, and Cancer.

Unit IV: General Health Awareness

Demography, Family Planning and Genetic counseling – basic concepts only.
Importance of Nutrition on Health, Impact of Environment on Health, Importance of planning & Management.

Unit V:

Health Education and creation of health awareness, Health Planning and Management, Community health care and International Health Organizations.

Reference Book:

J. E. Park & K. Park (1989). Textbook of Prevention and Social medicine. Banarsidas Bhamot Publishers, New Delhi.

PAPER - VII
DEVELOPMENTAL BIOLOGY

Semester: **IV** ***Hours/Week: 4***

Subject code: ***Credits: 4***

Objectives

This paper aims at providing students with comprehensive knowledge on the important aspects of ontogenetic development. It also includes many aspects like gametogenesis, fertilization, cleavage and fertilization.

UNIT I: Gametogenesis

Spermatogenesis – Spermiogenesis – Spermiation, structure of sperm; Oogenesis – Growth of oocyte, synthesis and storage of macromolecule in oocyte, Structure of Ovum on quantity and distribution of Yolk– presence or patterns of eggs – absence of shell and type of development.

UNIT II: Fertilization

Types of fertilization – Mechanism of fertilization – Encounter of spermatozoa and ova – Acrosome reaction and penetration – Cortical reaction – Fertilization membrane – monospermy and polyspermy. Physiological changes during fertilization – Amphimixis – Significance of fertilization – Parthenogenesis.

UNIT III: Cleavage

Characteristics of cleavage – Planes and patterns of cleavage – Rates of cleavage and influence of yolk – Laws of cleavage – Physio-chemical changes during cleavage – significance of cleavage – Morula - Types of blastula - Gastrulation – Fate Map – Morphogenetic movements – Gastrulation in frog.

UNIT IV: Organogenesis

Development of brain, eye and heart in chick, embryonic induction – Development of foetal membrane in chick. Placenta in mammals – Characters, classification based on the type of foetal membranes, distribution of villi, nature, contact and types of tissue involved.

UNIT V: Metamorphosis and Regeneration

Amphibian metamorphosis: morphological, physiological and biochemical changes during metamorphosis; Role of hormones in insect and amphibian metamorphosis. Regeneration – Types, mechanism and factors influencing regeneration – Wolffian regeneration.

Text Book

1. N. Arumugam, (2014). Developmental Zoology. Saras Publication, Nagarcoil.

Reference Books

1. B.J.Balinsky (1996). An Introduction to Embryology. W.B.Saunders company, London
2. P. S. Verma and V. K. Agarwal (2008). Chordate Embryology. S.Chand & Company Ltd, New Delhi.
3. Sastry and Shukla (2009). Developmental biology. Rastogi Publications, Meerut.
4. P. Arora (2000). Embryology. Himalayan Publishing House, Mumbai.

PAPER - VIII

LAB IN DEVELOPMENTAL BIOLOGY

Semester: IV ***Hours/Week: 2***

Subject Code: ***Credits: 1***

1. Observation of amphibian metamorphosis (Demonstration only)
2. Observation of tail regeneration of Tadpoles (Demonstration only)
3. Temporary Mounting of Chick blastoderm
4. Observation of life stages of any one insect

Spotters:

a. Developmental stages of Frog – Blastula, Early gastrula, Yolk plug, Neural fold, Neural Tube and Tadpole
b. Developmental stages of Chick -- 18hrs, 24hrs, 48hrs, 72hrs and 96hrs
c. Human sperm.
d. Human ova
e. Human placenta
f. Types of placenta
g. Birth control devices

Reference Books:

1. N. Arumugam, R. P. Meyyan and A. Mariakuttikan (2013). Practical Zoology. (Volume III). Saras Publications, Nagercoil.
2. S. Thiagarajan (2000). Practical Zoology. T. J. Publications, Tanjavur.

Non Major Elective

APICULTURE

Semester: IV ***Hours/Week: 2***

Subject Code: ***Credits: 2***

Objectives

This paper gives exposure to students about the application value of apiculture and to highlight the beneficial aspects of honey bee to human welfare and also to provide knowledge about the harmful enemies and diseases that attack honeybee.

Unit I:

Introduction to Apiculture and Bee Keeping. – Types of Honey bees: - ***Apis dorsata – Apis indica – Apis florea – Apis mellifera*** –Stingless bees- Meliphora- General Biology – Body structure – Mouth parts – Secretary glands – sting apparatus.

Unit II:

Social organization and division of labour – Queen – worker – Drone – Life cycle. Swarming Nauptial flight – Honey bee dances: - Language dance – round dance – wag tail dance.

Unit III:

Hive or Comb – Selection of bees for apiculture – methods of bee keeping – Indigenous method and Modern method – Tools and Equipments connected with bee keeping.

Unit IV:

Products of bee keeping: - Honey- Honey extraction – Ripeing of honey – Chemical composition of honey – Economic importance of honey:-Food value, Medicinal value and other uses – By-products of honey – Bees Wax – Bee venom.

Unit V:

Pest, Paracites and Diseases of Honey bees:- Wax moth, Wax beetle, Black ants, Birds and other enemies. Nosema, Acarine, Septicemia, Fungal and other important brood diseases.

Text Book:

N. Arumugam and Jeyasurya (2013). Economic zoology. Saras Publication, Nagercoil.

Reference books:

1. Vasantharaj David and T. Kumaraswami, (2006). Elements of Economic Entomology -
2. K.R. Ravindran, (2004). A Text Book of Economic Zoology – Dominant Publishers, New Delhi.

PAPER - IX

GENETICS AND EVOLUTION

Semester: V ***Hours/Week:6***

Subject Code: ***Credit: 6***

Objectives

This paper is designed to give an understanding of human genetics, sex determination, sex linkage, mutation and human genetics. It also aimed at evolutionary evidences, theories of evolution of horse and man.

GENETICS

Unit I: Mendelian Genetics

Mendel's experiments and laws- monohybrid and dihybrid crosses - incomplete dominance and codominance, backcross and test cross. Gene interactions – epistasis, complementary genes and supplementary factor.

Unit II: Sex determination, Sex Linkage and Crossing over

Chromosomal theory - XX – XO types; XX – XY types and geneic balance theory. Environmental mechanism, hormonal mechanism and intersex. Sex limited and sex influenced traits, Sex – linkage in *Drosophila* and in human beings – Y linked genes. Mechanism of crossing over.

Unit III: Human genetics

Multiple alleles and blood group, inborn errors of metabolism, chromosomal aberrations, mutation at molecular level – spontaneous mutation – Induced mutation, ionizing radiation, mutation – repair mechanism. Mendelian traits in man – pedigree analysis, Syndromes - Down's, Klinefelter's and Turner's. Applications of genetics in inbreeding and outbreeding – Eugenics and Euthenics - Human genome project.

EVOLUTION

Unit IV: Origin of Life, Evidences and theories of evolution

Origin of life: Oparin and Haldane theory – Urey Miller experiment.

Evidences for evolution: - Morphological: Homologous – analogous and vestigial structures; embryological, biochemical and paleontological evidences – Fossils: types, methods of fossilization – methods of dating the fossils- geological time scale.

Theories of Evolution: Lamarckism and Neo-Lamarckism, Darwinism and Neo-Darwinism – Modern synthetic theory.

Unit V: Process and Product of Evolution

Biological variations – recombination, hybridization – isolation - types and mechanism – Mimicry and colouration. Natural selection in action- industrial melanism – Speciation. Horse evolution – trends, fossil record and orthogenesis. Human evolution: organic and cultural evolution – future evolution of man.

Text Book:

1. R. P. Meyyan (2012). Genetics, Saras Publications, Nagercoil.
2. Veerbala Rastogi (2005). Organic evolution. Surjeet Publications, New Delhi.

Reference Books:

1. A. Gardner and T. Davies (2010). Human Genetics IInd Edition. Scion Publishing Ltd., Uk.
2. P. S. Verma and V. K. Agarwal (2010). Organic evolution. S. Chand & Co., Ltd., New Delhi.
3. M. W. Strickberger (1996). Genetics. Jones and Barlett Publishers, Sudbury, Massachusetts, Baston.
4. G. L. Stebbins (1998). Process of organic evolution. Surjeet Publications, New Delhi.
5. T.S. Gopalakrishnan, Itta Sambasivaiah and A.P. Kamalakra Rao (2000). Principles of organic evolution. Himalaya Pub. House, Bombay.

PAPER - X

BASIC BIOTECHNOLOGY

Semester: V ***Hours / Week: 5***

Subject Code: ***Credit: 5***

Objectives

To understand the principle and applications of Biotechnology. It also includes the tools and varieties of techniques involved in Biotechnology; gene cloning and manipulation of genes and its application in solving problems in relation to animal husbandry, agriculture and human welfare.

Unit I: Introduction and Molecular Tools

Definition- Scope and importance-Restriction endonucleases – types and their uses; DNA ligase, reverse transcriptase, DNA polymerase, terminal transferase; Linkers and adaptors.Vectors: pBR322, Ti plasmid, SV_{40}, brief note on Lambda phage and Cosmid.

Unit II: rDNA Technology

Introduction to Gene cloning and Genetic Engineering–Isolation of genomic DNA-Genomic library-construction of cDNA library-Integration of DNAfragments into vector-Transfer of rDNA into bacterial cell- Screening and selection of recombinants.

Unit III: Techniques in Biotechnology

Electroporation and Microinjection; Agarose Gel Electrophoresis; Polymerase Chain Reaction (PCR); Blotting techniques-Western, Southern and Northern – a brief study; Autoradiography and DNA Finger printing.

Unit IV: Plant Genetic Engineering

Single cell culture -*Spirulina* culture and Callus culture; Protoplast culture; Tissue culture –flask and tube culture; Transgenic plants-Biocides- Bt Killer cotton – Bio fertilizers-nitrogen fixation.

Unit V: Animal cloning and applied biotechnology

Animal cloning - Dolly; transgenic animals- fish and pig; production of insulin, growth hormone, penicillin, blood factor VII, FMD vaccine.Biosensors and Biochips.

Text book:

V. Kumaresan (2013). Biotechnology. Saras Publication, Nagercoil

Reference Books:

1. R. C Dubey (2006). A text book of Biotechnology, S.Chand &Company, New Delhi
2. S. B. Primrose (2000). Modern Biotechnology. Blackwell Scientific Publications, Oxford, London
3. P. K. Gupta (2001). Elements of Biotechnology. Rastogi Publications, Meerut.
4. M.M. Ranga (2006). Animal Biotechnology. Student Edition. Jodhpur.

PAPER - XI

BIOSTATISTICS, BIOINFORMATICS AND COMPUTER APPLICATIONS

Semester: V ***Hours / Week: 5***

Subject Code: ***Cretid: 6***

Objectives

This paper is to provide a content of biostatistics to the student community to facilitate them to apply statistics in biology and also to include them a skill in computer operation.

BIOSTATISTICS

Unit I:

Introduction: Collection of data – classification of data – tabulation – diagrammatic representations - bar, pie and line diagrams. Graphical representations of data: histogram - frequency polygon and frequency curve.

Unit II:

Measures of central tendency: mean, median and mode; Definition- individual, discrete and continuous series; Measures of dispersion – range – mean deviation – co-efficient of variation – standard deviation – standard error.

Unit III:

Correlation and Regression**:** Correlation – Introduction – types, uses and degree of correlation – graphic and mathematical methods. Regression – definition – uses; Comparison of correlation and regression – regression lines – regression equations. Probability; Chi-square test – Student 't' test.

BIOINFORMATICS

Unit IV:

Definition, Scope and applications: types of sequences – DNA, RNA and Protein sequences: biological databases – Definition, objectives, Properties, database retrieval tools: Pubmed and Sequence Retrieval System (SRS); DNA, RNA and protein data bases: DDBJ – tools: BLAST, FASTA. Application of bioinformatics tools: CLUSTAL W, PROTPARAM, SCANPS, CPG

plot, GOR, STRAP, 3D-PSSM, SWISS-MODEL, MMTK, RasMol, PHYSIP, APUP, GeneScan, Genefinder and Webcutter.

COMPUTER APPLICATIONS

Unit V:

Introduction – generation of computers and components of computer – WINDOW – MS word – MS excel – MS power point – internet – e-mail – Facebook, Twitter, Instagram & Whatsapp – web pages – web hosting – e-journals and applications of computers in biology.

Text Books:

1. N. Arumugam, A. Gopi and V. Kumerasan (2013). Biostatistics, Computer Application, Bioinformatics and Instrumentations. Saras Publication, Nagercoil.
2. R. Sundaralingam and V. Kumaresan (2012). Bioinformatics. Saras Publications, Nagercoil.

Reference Books:

1. Gurumani (2000). An introduction to Biostatistics. MJP Publishers, Chennai.
2. B. D. Sing (2004). Biotechnology. Kalyani Publishers, Chennai.
3. S. Monoharan and S. Palanichamy (2000). Biostatistics to Biologists. Paramount Publications, Palani.
4. N. Arumugam, A. Gopi and A. Meena (2013). Saras Publication, Nagercoil.

SELF STUDY PAPER

ORNAMENTAL FISH CULTURE

Semester: V ***Hours / Week: 5***

Subject Code: ***Credits: 3***

Objectives

This paper deals with the scope, culture techniques of ornamental fishes, aquarium plants, care, maintenance, marketing and economic importance of Aquarium fishes.

Unit I: Aquarium Requirements

Aquarium and ornamental fishes. World aquarium trade and present status. Accessories-Aerators, filters, lights, heaters. Water quality requirements. Different kinds of feeds. Culture of fish food organisms; preparation of dry feeds; feeding methods.

Unit II: Freshwater and Ornamental fishes

Different varieties of Ornamental fishes – Live bearers, Gold fish and Koi, Gourami, Barbs and Tetras, Angel fish and Cichlids. Broodstock development, breeding. Indigenous Ornamental fishes of Tamilnadu.

Unit III: Commercial Production of Freshwater Ornamental fishes and Plants

Requirments for commercial production units of Ornamental fishes. Commercial production of Goldfish, Live bearers, Gouramies, Barbs and Tetras, Angel fish. Mass production of aquarium plants. Natural ponds for the mass production of Ornamental fishes.

Unit IV: Aquarium Management

Setting up of fresh water, marine and reef aquariums. Maintenance of water quality. Common diseases of aquarium fishes, their diagnosis and treatment. Handling, care and transportation of fish. Temperature acclimatization, oxygen packing.

Unit V: Marketing of Aquarium fishes

Marketing of Aquarium fishes. Whole-sale markets of aquarium fish. Design of retail outlet. Export of Ornamental fishes, procedures for export. Training and promotion schemes for Ornamental fishes breeding and marketing by governmental agencies.

Text books:

1. C.S. Tharadevi and K.V.Jayashree. Home aquarium. (2009). Saras Publication, Nagercoil.

2. N. Arumugam. Aquaculture. (2009) Saras Publication, Nagercoil.

Reference book:

1. S.K.Gupta and P.C.Gupta. General and applied ichthyology (fish and fisheries). (2006). S.Chand and company Ltd.

2. C. B. L. Srivastava, Narosa publication

PAPER - XII

LAB IN GENETICS AND EVOLUTION, BASIC BIOTECHNOLOGY, BIOSTATISTICS, BIOINFORMATICS AND COMPUTER APPLICATIONS

Semester : V ***Hours / Week: 8***
Subject Code : ***Credit : 4***

A) GENETICS:

1. Verification of Mendelian ratios (Monohybrid and Dihybrid) using colour beads.
2. Verification of law of probability through coin tossing.

Spotters:

Klinefelter, Turner and Down's - Syndrome

Prepare your family Pedigree chart

Twins

Human Genome Project

Colour blindness

B) EVOLUTION:

1. Observation of Variation in finger prints of man.
2. Study of Homology – (Fore limbs of vertebrates), Analogy – (wings of an insect and bird) and Vestigeal organs- (Vermiform appendix and Coccyx vertebrae)

Spotters:

Fossils- Cast and Mould

Adaptive colouration – protective and warning

Darwin's finches

Connecting links - Peripatus and Archeopteryx

Mimicry

C) BASIC BIOTECHNOLOGY:

1. Isolation of RNA from yeast cells
2. SDS – Poly Acrylamide Gel Electrophoresis – (Demonstration only)
3. PCR (Demonstration only)

Spotters:

Restriction endonuclease

Cloning vectors – pBR322, Lamda phage, SV_{40}.

Bt –cotton

Animal cloning - Dolly

Immobilization of Enzymes

Biosensors

Plant tissue culture

Micropipette

D) BIOSTATISTICS:

1. Calculation of Mean, Median, Mode and Standard Deviation using Neem leaf serrations
2. Observation of quantitative characters (Height and Weight of the students) and calculation of 'r' value

E) BIOINFORMATICS:

1. Sequence Alignment:
    a. BLAST and FASTA
2. Databases
    a. NCBI
    b. PDB
    c. SWISS – PROT
3. Data bank
    a. Nucleotide sequences
    b. Protein sequences

F) COMPUTER APPLICATIONS:

1. Hands on experience in MS-Word, MS-Excel, and MS-Power Point.

Spotters:

Computer parts:

Input devices: Mouse and Keyboard

Storage device: CPU

Output devices: Monitor.

Pendrive, CD, DVD and MODEM

Reference Books:

1. N. Arumugam, R. P. Meyyan and A. Mariakuttikan (2013). Practical Zoology. (Volume III). Saras Publications, Nagarcoil.
2. S. Thiagarajan (2000). Practical Zoology. T. J. Publications, Tanjavur.

PAPER - XIII

BIOCHEMISTRY

Semester: VI ***Hours / Week: 5***

Subject code: ***Credits: 5***

Objective:

This paper gives comprehensive coverage of chemistry, structure and functions of macro molecules such as carbohydrates, proteins, amino acids, lipids, vitamins, enzymes and nucleic acids.

Unit I: Principles and Techniques

Concepts of pH and buffers – types of buffers - Oxidation and reduction - Isomerism and its types; Biotechnique - Colorimetry, Poteniometry, Paper chromatography and Paper electrophoresis.

Unit II: Carbohydrates

Carbohydrates –types, properties, classification and chemistry - Glycosidic linkage and biological importance of carbohydrates.

Unit III: Proteins, amino acids and nucleic acids

Proteins – Structural organization, classification of proteins. Biological significance of proteins- Myoglobin, haemoglobin and cytochromes. Amino acids – Structure, properties and classification: peptide bond. Chemistry of nucleic acids**,** structure, properties and composition of DNA and RNA and its biological importance.

Unit IV: Lipids

Lipid: types, properties, classification and chemistry of lipids, biological significance of lipids. Blood lipids – LDL and HDL.

Unit V: Vitamins, Enzymes and Hormones

Chemical nature and biochemical functions of fat soluble and water soluble vitamins.
Enzymes: classification, properties and mechanism of enzyme action – Coenzymes.
Hormones –Insulin, Glucagon, Testosterone, Oestrogen, Progestrone.

Text Book:

1. Dulsi Fatima *et al.,* (2010). Biochemistry. Saras Publications, Nagercoil.

Reference books:

1. U. Sathyanarayana and U. Chakrapani (2010). Biochemistry. Books and Allied (P) Ltd, Kolkata.
2. A.L. Lehininger, D.L Nelson and M.M. Cox (2010). Principles of Biochemistry. W.H.Freeman & Company, New York, USA.
3. L. Stryer (2009). Biochemistry. W.H.Freeman & Company, NewYork.
4. Ambika Shanmugam (1998). Biochemistry for medical students. West CIT Nagar, Chennai.

PAPER - XIV

MICROBIOLOGY AND IMMUNOLOGY

Semester: VI ***Hours / Week: 6***

Subject code: ***Credits: 6***

Objectives:

This paper deals with the biology of micro organisms and their impact on human welfare and comprehensive coverage of essential concepts and current understanding of cellular and molecular events underlying immunity.

MICROBIOLOGY

Unit I: Classification and Culture techniques

Outline Classification of microbes - Five kingdom concepts, Bergey's classification, Methods of sterilization, culture media-Assessment of bacterial growth - Pure culture - Serial dilution technique - Pour plate and streak plate culture – maintenance of bacterial culture (slant culture) and gram staining.

Unit II: Bacteria and Viruses

Characteristics of bacteria- structure of bacteria, ultra structure of *E.coli* - Nucleoid-plasmid. Characteristics, structure and shape of viruses - T_4 bacterio phage - Life cycle of λphage- Fungi: Characteristics and economic importance. Yeast: Characteristics and economic importance.

Unit III: Food Microbiology

Food and dairy microbiology- preservation of milk, pasteurization of milk-grading of milk- dairy products – yoghurt and cheese – Spoilage of vegetable, fish and meat- food poisoning and food preservation.

IMMUNOLOGY

Unit IV: Immune system and Immune organs

Types– Immunity - Innate and acquired. Lymphoid organs- Primary and secondary lymphoid organs. Cells of the immune system - Stem cells, lymphocytes, plasma cells, null cells, macrophages, antigen presenting cells and mast cells.

Unit V: Antigens and Antibodies

Antigens- Epitopes, paratopes, chemical nature of antigens and antigenic determinants, Immunoglobulin - classes, properties and functions of immunoglobulin, structure of IgG. Antigen and antibody reaction - complement systems, hypersensitivity and transplantation immunology.

Text Books

1. A. Mani, N. Arumugam and A. M. Selvaraj (2014). Microbiology. Saras publication,Nagercoil.
2. N. Arumugam, A. Mani and Dulsi Fatima (2014). Immunology. Saras Publication, Nagercoil

Reference Books:

1. H. G. Schelgel (1986). General Microbiology. Cambridge University Press, U.K.
2. M. J. Pelzar and R.D. Reid (1982). Microbiology. Mc Graw Hill Book Company, New York.
3. Jonathan, Abramoff, David Male, Ivan and Roitt (1994). Immunology. Karger, Barel.
4. W. K. Paul (1980). Fundamental Immunology. Raven Press, New York,

PAPER - XV

ANIMAL PHYSIOLOGY

Subject: VI ***Hours/Week: 5***
Subject Code: ***Credits: 6***

Objectives:

This paper deals with the general principles of physiology, to appreciate the mechanism of physiological systems and to focus on physiological regulatory mechanism.

UNIT I: Nutrition and Digestion:

Types of Nutrition and Mechanism of feeding- Nutritional requirements – Protein, carbohydrates, lipid, vitamins, minerals and water. Structure of digestive system – Physiology of digestion and absorption of carbohydrates, protein and lipid in man.

UNIT II: Respiration and circulation:

Respiration: Definition, types - Aerobic and anaerobic respiration. Respiratory organs- Skin, gill, trachea and lung- Respiratory pigments - Transport of O_2 and CO_2. Circulation: composition and functions of blood, blood clotting, blood volume, types of heart, heart beat - ECG, Cardiac cycle and Blood pressure.

UNIT III: Homeostasis and Osmoregulation :

Excretion, metabolic waste products in vertebrates, Structure and function of mammalian kidney - physiology of urine formation - regulation of kidney function. Ammonotelism, ureotelism, uricotelism and ornithine cycle. Osmoregulation of fresh water fish, marine fish and Migratory fishes.

UNIT IV: Muscular coordination and Receptors:

Types of muscle, chemical composition and properties of skeletal muscles, Ultra structure of muscle and mechanism of muscle contraction – Structure of eye and ear – Physiology of vision and hearing.

UNIT V: Nervous and chemical co-ordination:

Structure of neurons, resting and action potential, conduction and transmission of nerve impulse, neuro-muscular junction, reflex action. Chemical co-ordination –Hormonal secretion in vertebrates - Pituitary, thyroid and adrenal glands.

Text Book:

Mariakuttikan. A and N. Arumugam (2017). Animal Physiology. Saras publication, Nagercoil.

References:

1. K. A. Goel and K. V Sastri (2008). A text book of animal physiology. Rastogi Publications, Meerut
2. P. S. Verma, B. S. Tyagi and V. K. Agarwal (2006). Animal Physiology. S. Chand and Company Ltd, New Delhi.
3. C. L. Prosser and F, A. Brown (1998) - Comparative Animal Physiology. W. B Saunders Company, Philadelphia, London.
4. R. Nagabhushanum, M.S. Kodarkar and R. Sarojini – Text Book of Animal Physiology – Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.

PAPER - XVI

LAB IN BIOCHEMISTRY, MICROBIOLOGY AND IMMUNLOGY & ANIMAL PHYSIOLOGY

Semester : VI ***Hours / Week: 8***
Subject Code : ***Credit : 4***

Biochemistry

1. Measurements of pH various samples with the help of pH meter
2. Beer – Lambert's Law verification using colorimeter
3. Aminoacids separation using Chromatographic method – (Demonstration only)
4. Qualitative tests for Carbohydrate , Protein and Fats
5. Electrophoresis – (Demonstration only)

Spotters:

Centrifuge, Colorimeter, Spectrophotometer, pH meter, Paper Chromatography

Microbiology

1. Sterilization techniques – Dry, Wet, Chemical
2. Preparation of Liquid medium and Solid Medium
3. Serial Dilution technique
4. Culture techniques – pour plate, spread plate and streak plate
5. Observation of Motility of Lactobacillus
6. Staining technique – Gram staining

Spotters:

Autoclave, Colony counter, L-Rod, Laminar air flow chamber

Immunology

1. ABO – Rh blood grouping
2. Haemoagglutination titer plate method
3. Preparation of Agarose Plates and well cutting for electrophoresis
4. Immuno electrophoresis (Demonstration only)
5. Immunodiffusion (Demonstration only)

Spotters:

Nude Mouse , Electrophoretic apparatus, Lymphoid organs of Chick and human

Animal physiology

1. Effect of temperature on the rate of salivary amylase activity in man
2. Effect of pH on the rate of activity of salivary amylase in man
3. Opercular movement in fishes: Influence of temperature and calculation of Q_{10}
4. Haemoglobin estimation (Demonstration only)
5. Quantitative estimation of blood sugar.
6. Blood pressure measurement

Spotters:

Nutritional Deficiency diseases

ECG

Sphygmomanometer

Haemoglobinometer

Haemocytometer

Kymograph

References

1. P. Gunasekaran (1995). Laboratory manual in Microbiology. New Age International (P). Ltd. New Delhi.
2. N. Arumugam, R. P. Meyyan and A. Mariakuttikan (2013). Practical Zoology (Volume III). Saras Publications, Nagarcoil.

SELF STUDY PAPER

FOOD AND NUTRITION

Semester: VI ***Hours/Week:***

Subject code: ***Credit: 3***

Objectives:

This paper makes the student to understand the role of food and nutrition in maintaining good health.

Unit I: Food and Health

Food and health: Food and its relation to health, types of food

Unit II: Food Preparation

Changes occurring during the preparation of food: changes in flavor, colour and appearance with reference to rice, milk, fish and vegetables during preparation.

Unit III: Nutrition

Sources and functions of carbohydrates, proteins and lipids. Vitamins – water soluble and fat soluble vitamins – sources and functions.

Unit IV: Nutrients and Water

Minerals: Role in nutrition – calcium, phosphorus, ion, sodium and magnesium.

Water – fluid of life – functions and dehydration.

Unit V: Malnutrition and deficiency diseases

Balanced diet, Kwashiorkor – Marasmus – Obesity – Anemia – Epidemic Dropsy: Causes, prevention & treatment.

Text book:

1. A.Mariakuttikan and N.Arumugam. Animal physiology (2014). Saras Publications, Nagercoil.

Reference books:

1. Sri Lakshmi (2005). Dietics. New Age International (P) Ltd Publishers, New Delhi.
2. N. Shakuntala Mary and M. Shadaksharaswamy (2000). Foods Facts and Principles. . New Age International (P) Ltd Publishers, New Delhi.
3. S. Shanthi, V. Jemima Florance, V. Borgia and A. Kannagi (2007). Study Materials Prepared for Food and Nutrition.

YADAVA COLLEGE

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PG & RESEARCH DEPARTMENT OF ZOOLOGY

BOARD OF STUDIES MEETING

09 APRIL 2018

M.Sc. Zoology Programme

CBCS (2018- 2019 onwards)

DEPARTMENT OF ZOOLOGY

M.Sc. ZOOLOGY

COURSE CONTENT

Semester	Sub. Code	Title of the Paper	Teaching Hrs / Week	Credits	Evaluation			Examination Hours
					Internal	External	Total	
I		Core I – Biochemistry & Biophysics	**8**	**7**	**25**	**75**	**100**	**3**
		Core II – Microbiology	**8**	**6**	**25**	**75**	**100**	**3**
		Core III – Lab in Biochemistry & Biophysics – I	**4**	**2**	**40**	**60**	**100**	**3**
		Core IV – Lab in Microbiology – II	**4**	**2**	**40**	**60**	**100**	**3**
		Elective – Biological Techniques **(or)** Animal Diversity	**6**	**5**	**25**	**75**	**100**	**3**
		TOTAL	**30**	**22**				
II		Core V – Genetics and Evolution	**8**	**7**	**25**	**75**	**100**	**3**
		Core VI – Animal Physiology and Developmental Biology	**8**	**6**	**25**	**75**	**100**	**3**
		Core VII – Lab in Genetics and Evolution-III	**4**	**2**	**40**	**60**	**100**	**3**
		Core VIII – Lab in Animal Physiology and Developmental Biology – IV	**4**	**2**	**40**	**60**	**100**	**3**
		Elective – Natural Resources and Management **(or)** Entomology	**6**	**5**	**25**	**75**	**100**	**3**
		TOTAL	**30**	**22**				

Semester	Sub. Code	Title of the Paper	Teaching Hrs / Week	Credits	Evaluation			Examination Hours
					Internal	External	Total	
III		Core IX – Molecular Biology and Microbial Genetics	**8**	**7**	**25**	**75**	**100**	**3**
		Core X – Biostatistics & Computer Application and Bioinformatics	**8**	**7**	**25**	**75**	**100**	**3**
		Core XI – Lab in Molecular Biology and Microbial Genetics - V	**4**	**2**	**40**	**60**	**100**	**3**
		Core XII – Lab in Biostatistics & Computer Application and Bioinformatics - VI	**4**	**2**	**40**	**60**	**100**	**3**
		Elective – Wildlife Conservation and management **(or)** Entrepreneurial Zoology	**6**	**5**	**25**	**75**	**100**	**3**
		TOTAL	**30**	**23**				
IV		Core XIII – Immunology	**8**	**7**	**25**	**75**	**100**	**3**
		Core XIV –Biotechnology	**8**	**7**	**25**	**75**	**100**	**3**
		Core XV – Lab in Immunology – VII	**4**	**2**	**40**	**60**	**100**	**3**
		Core XVI – Lab in Biotechnology – VIII	**4**	**2**	**40**	**60**	**100**	**3**
		Research Project	**6**	**5**	**20**	**80**	**100**	**--**
		TOTAL	**30**	**23**				
		Total number of teaching hours: 120hrs Total number of credits : 90						

Paper - I

BIOCHEMISTRY AND BIOPHYSICS

Semester: I ***Hours/Week: 8***

Subject code: ***Credit: 7***

Objectives:

This paper deals with the metabolism of various biomolecules such as carbohydrates, proteins, amino acids and lipids. It also elucidates the physical laws in the formation of biomolecules and production of energy in the living system.

UNIT I: Metabolism of Carbohydrate:

Metabolism of carbohydrates: glycolysis – energy yield in glycolysis – glycogenesis – glycogenolysis – hexose monophosphate shunt – TCA cycle, electron transport system, gluconeogenesis.

UNIT II: Metabolism of Protein:

Catabolism of amino acid: oxidation - deamination – transamination – decarboxylation – transmethylation. Ornithine cycle (urea cycle) – fate of amino acids: Entry through Kreb's cycle – pyruvic acid, α-Ketoglutaric acid, succinyl coA and oxaloacetic acid and fumaric acid.

UNIT III: Metabolism of Lipid:

Metabolism of triglyceride, glycerol and fatty acids – β-Oxidation of fatty acids (Palmitic acid) – energetics of palmitic acid oxidation. Blood lipid – Metabolism of cholesterol. Ketogenesis – ketosis – ketone bodies and Ketolysis (Brief account only).

UNIT IV: pH & Enzyme:

pH and buffers, Henderson - Hasselbalch Equation. Enzyme – classification – properties of enzymes – mechanism of enzyme action – factors affecting enzyme activity. Michaelis - Menten derivation – co-enzymes – iso enzymes.

UNIT V: Biophysics:

Nature of energy and its measurements, chemical energy, concepts of free energy, Laws of thermodynamics – exergonic and endergonic reactions – scheme of bioenergetics – oxidation, reduction potential – ATP bioenergetics – mitochondrial bioenergetics – bioluminescence – introduction and types – physical characteristics of bioluminescence

– biochemistry – mechanism of light production – control of bioluminescence – functions of bioluminescence – effect of UV radiation in biological systems – mutagenesis.

Text Book:

1. L. L. Jain, S. Jain and N. Jain (2006). Fundamentals of Biochemistry. S.Chand & Company Ltd., New Delhi.
2. S. Thiraviaraj (2014). Biophysics. Saras Publication, Nagercoil.

References Books:

1. E. S. West, Todd and Masson (1998). Text book of Biochemistry. Mc Graw Hill. UK.
2. A.L Lehnineger (2010). Principles of Biochemistry. W. H. Freeman and Company, New York.
3. U. Satyanarayana and U. Chakrapani (2010). Biochemistry. Books and Allied (P) Ltd. Kolkata.
4. A. C. Deb (2010). Fundamentals of Biochemistry. New Central Book Agencies, Bihar.
5. C. Champe and A. Harvey (2006). Biochemistry IInd Edition. Lippicott – Raven Publishers, USA.
6. R. Palanichamy, Biological techniques, Paramount publication, palani.

PAPER - II

MICROBIOLOGY

Semester: I ***Hours/Week: 8***

Subject Code: ***Credit: 6***

Objectives:

This paper deals with the biology of microorganisms and their impacts on human welfare. It includes history, systematic growth, culture methods, metabolism, reproduction and applications of microorganism. It also covers application in industrial productions.

UNIT I: Classification and bacterial growth

General characteristics and classification of bacteria, virus, fungi and algae. Whittaker five kingdom concept. Three Domain system -Bergey's manual of classifications, classification of viruses. Growth curve, generation time, factors affecting growth. Culture of Bacteria – asynchronous growth – synchronous growth – continuous culture.

UNIT II: Food Microbiology

Microbiology of food – Microbes associated with food – food spoilage: spoilage of vegetables, spoilage of fish, spoilage of egg, spoilage of meat and bread. Methods of food preservation – food poisoning. Fermented dairy products-yogurt and cheese.

UNIT III: Industrial and environmental microbiology

Fermentation, selection of microbes for fermentation. Production of beer and wine. Production of Organic acids: vinegar, lactic acid and citric acid. Production of antibiotics: Penicillin, tetracycline and chloramphenicol. Production of fuel: Bio gas and Bio-ethanol.

UNIT IV: Medical Microbiology

Air borne diseases – Tuberculosis. Food borne and water borne diseases: cholera, Botulism, typhoid fever. Soil borne diseases – tetanus, anthrax. Sexually transmitted disease – Gonorrhea. Contact disease – Leprosy. Vector borne diseases – A brief account on dengue fever, chikungunya, swine flu, Avian Influenza (AI).

UNIT V: Agricultural Microbiology

Biofertilizer – Rhizobium, Azotobacter, Azospirillum, BGA, VAM fungi, Azolla: Microbial herbicides, Bacterial pesticides, Fungal pesticides, Viral pesticides. Economic importance of *Agaricus bisporus*, *Spirulina sp.*, Lichens sp.

Text Book:

1. R.C. Dubey and D.K. Maheswari (2004). A Text book of Microbiology. S.Chand & Company Ltd, New Delhi.

Reference Books:

1. Presscott, Haley and Klein's, (2008) Microbiology, Mc Gram International 7th Edition.
2. H.G. Schelgel (1986). General Microbiology. Combridge University Press, U.K,
3. Bernard D.Davis, Dulbecco, R.Eisen, H.N, and H.S. Guisberg (1980), Microbiology,3rd Edition, Harper and row Internation Publisher Inc., New York.
4. S, Bergy (2006). Manual of Determinative Bacteriology, 8th Edition, Breed EGS Murky and NR, Smith (ed) Williams and Wilkins, Baltimore.
5. P. Tauro, K.K. Kapoorand and Y.S. Yadav (1981) An introduction to Microbiology, Wiley Ltd., Madras.
6. M.J. Pelzar and Reid, R.D (1982). Microbiology. Mc Graw Hill Book Company. New York.

PRACTICAL I

LAB IN BIOCHEMISTRY AND BIOPHYSICS

Semester: I ***Hours/Week: 4***

Subject Code: ***Credit : 2***

Biochemistry

1. pH: Acid – Base titration
2. Preparation of biological buffers
3. Determination of buffering action of an amino acid using titration
4. Extraction of phosphatase from any animal source
5. Determination of K_m value and V_{max} of a phosphatase
6. Effect of temperature on phosphatase activity
7. Effect of pH on phosphatase activity
8. Quantitative estimation of carbohydrates, proteins and lipids from fresh tissues – standard graphs

Biophysics:

9. Observation of Haemin crystals
10. Paper chromatography (Demonstration only)
11. SDS PAGE and Agarose Gel Electrophoresis. (Demonstration only)

Spotters:

pH meter, Spectrophotometer, Centrifuge, Colorimeter and Flame Photometer

Reference Books:

1. J. Jayaraman, 1981. Laboratory manual of Biochemistry. Wiley Eastern Company, Delhi.
2. N.Arumugam, 2015. Principles and techniques of Biophysics. Saras publication, Nagercoil.

PRACTICAL II

LAB IN MICROBIOLOGY - II

Semester: I ***Hour/Week: 4***

Subject code: ***Credits: 2***

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1. Sterilization Techniques- Cleaning of glassware's and preparation of media.
2. Serial Dilution techniques – Isolation of bacteria from soil and water
3. Culture Techniques – Pour plate, Spread plate, Streak plate and Slant culture (pure culture)
4. Observation of colony morphology by colony counter
5. Hanging drop techniques – observation of motility of *Lactobacillus sp.*
6. Bacteriological examination of raw and pasteurized milk (Methylene blue reduction)
7. Antibiotic sensitivity test (Demonstration only)
8. Gram staining technique
9. Special features of selected microorganisms:
   a) Bacteria- *Escherichia coli*
   b) Actinomycetes – Streptomyces, Mycoplasma and Bacteriophage-T_2.
   c) Algae – *Spirulina, Oscillatoria.* Fungi – *Rhizopus*, *Aspergillus* and Pencillium
   d) Nitrogen fixing bacteria- Rhizobium sp.

Spotters:

Autoclave, Laminar flow hood, Colony counter and Anaerobic jar

References:

1. Vinita Kale and Kishore Bhusari (2005). Practical Microbiology. Himalaya Publishing House, New Delhi.
2. Ritu Mahajan, Titender Sharma and R. K. Mahajan (2006). Practical Manual of Biotechnology, Vayu Education of India, New Delhi.
3. Gunasekaran. P (2010). Laboratory Mannual in Microbiology, New Age international Pvt Ltd.

ELECTIVE - I

BIOLOGICAL TECHNIQUES

Semester: I ***Hours/ Week: 6***

Subject Code: ***Credit: 5***

Objectives:

This paper to make the students to understand the techniques adopted in living systems to understand it's biochemistry and physiology of life.

UNIT I: Microtomy & Microscopy

Fixatives, infiltration, embedding, sectioning, affixing and processing the section, staining, mounting and labelling. Microscopy – Compound microscope – Electron microscope, AFM and phase contrast microscope.

UNIT II: Colorimetery

Measurement of colours – Complementary colours – Beer's Lamberts law – absorption spectrum – Molar extinction coefficient – Spectra of mixtures.

UNIT III: pH Meter and Centrifugation

pH meter-measurement of pH, titration of acid, preparation of buffer – Phosphate TRIS. Centrifugation – Ordinary centrifugation, high speed centrifugation, ultra centrifugation, centrifugation – density gradient centrifugation.

UNIT IV: Instrumentation

Principle and operating system of monopan balance, working principle and applications of Bomb calorimeter, Flame photometer and Spectrophotometer.

UNIT V: Electrophoresis and Autoradiography

Kinds of electrophoresis – SDS Polyacrylamide gel electrophoresis, DNA and RNA – agarose gel electrophoresis. Immuno electrophoresis – Rocket immuno electrophoresis and immuno diffusion.Principle, working mechanism and applications of Scintillation counter and Geiger Muller counter.

Text Books:

1. L. Veerakumari (2006). Bioinstrumentation. MJP Publishers, Chennai.
2. J. Jeyaraman (1981). Laboratory Manual in Biochemistry. Willey Eastern Limited. India.

Reference Books:

1. John G. Webster (2008). Bioinstrumentation. John Wiley & Sons, Inc.
2. Harold Varley (1975). Practical clinical Biochemistry, Arnold Heinemam.
3. Frances M. Weesner (1960) – General zoological Microtechnique. The William & Wilkins Co.,

4. P. R. Yadav and R. Tyagi (2006). Biological Techniques. Discovery Publishing House, New Delhi.

ELECTIVE - I

ANIMAL DIVERSITY

Semester : I ***Hours/Week : 6***

Subject Code : ***Credit : 5***

Objective

This paper is designed to reveal the fundamental aspects of core Zoology. It provides adequate facts which will enrich the knowledge in Zoology. It deals with broad outline classification of Invertebrates and Chordates. It also deals with minor phyla, living fossils, connecting links, missing links, Zoogeography and general topics such as parental care and migration of birds.

UNIT 1: Principles of taxonomy and levels of structural organization

Concepts of species, biological, binomial and trinomial nomenclature. Kinds of classification- five kingdom, types of taxonomy- morphology, numerical, molecular and phylatic lineages. Hierarchal organization of animal complexity- unicellular, colonial and multicellular forms, coelom, symmetry, organs and systems.

UNIT II: Methods of Biosystematics

Classical and modern methods- typological, phonetics, evolutionary, Phylogenetic and cladistics. Molecular taxonomy- Phylocode, tree of life and bar-coding of life, Sero taxonomy, Integrated Taxonomic Information System (ITIS), Biodiversity informatics and website related to taxonomy. Importance and applications of systematics in biology.

UNIT III: Outline classification and minor phyla

Outline classification of Invertebrates (up to class level) and Chordates (up to order level)- general characters , examples. Comparative anatomy of digestive, respiratory, exoskeletal, circulatory, nervous and urinogenital system of Chordates. Minor phyla- Ctenophora, Ectoprocta, Endoprocta and Rotifera.

UNIT IV: Living Fossils, Connecting and Missing link

Geological time scale- living fossil- *Limulus, Latimeria, Callorhinchus* (elephant shark), *Sphenodon* and *Ctenophora.* Connecting links- *Peripatus*, *Neoplina,* Protopterus, *Chimera, Balanoglossus* and *Orinthorhyncus.* Missing link – *Archeopteryx, Ichthyostega* and *Seymouria*

UNIT V: Natural history of Indian subcontinent

Zoo geography, Major habitat types of the subcontinent, Seasonality and Phenology. Wildlife organization- ICZN, WWF, ZSI and BNHS. General topics, parental caring fishes and amphibian, migration of birds.

Text book:

1. Hickman. C.P.J.R, Roberts S.L and Larson A (2001) “Integrated Principle of Zoology” 11th edition. McGraw- Hill Publishers.

Reference Books:

1. Agarwal V.K. (2000) “Invertebrate Zoology” Ist edition, S.Chand and Co Ltd. New Delhi.

2. Ayyar E. (1993) “ Manual of Zoology” Vol-1- Invertebrates, S. Viswanathan (Printers & publishers) Pvt. Ltd, Chennai.

3. Jordan E.L and Verma P.S. (2013) “Invertebrate Zoology” S. Chand & Co Ltd, New Delhi.

4. Kotpal R.L (2003) “A text book of Minor Phyla, 11th eds, Rastogi Publications, Meerut.

5. Kotpal R.L (2014) “Modern Text book of Zoology: Invertebrate” 11th eds, Rastogi Publications, Meerut.

PAPER – V

GENETICS AND EVOLUTION

Semester: II ***Hours/Week: 8***

Subject Code: ***Credit: 7***

Objectives:

This paper is designed to give an understanding of human genetics, sex determination, sex linkage, mutation and also detailed studies on the evolutionary evidences, theories of evolution, horse evolution and human evolution.

GENETICS

Unit I:

Mendelism: monohybrid cross – dihybird cross – back cross – test cross. Gene interaction: complementary – supplementary genes – epistasis – co-dominance (sickle cell anaemia). Multiple alleles: ABO blood groups – Rh factor – erythroblastosis foetalis.

Unit II:

Linkage and crossing over in *Drosophila* – chromosomal mapping – sex determination in man and Drosophila. Sex-linked inheritance: colour blindness and Haemophilia. Non-disjunction – syndromes – human karyotype – gene mutation – types – mutagens.

Unit III:

Population Genetics : Gene pool – gene frequency – Hardy-Weinberg Law – explanation – significance – applications – role in evolution. Applied Genetics: inborn errors of metabolism – inbreeding, out breeding and Heterosis. Eugenics – Euthenics – Euphenics – genetic counseling.

EVOLUTION

Unit IV:

Introduction – Origin of life and Organic evolution – Biochemical origin of life. Evidences for evolution: Morphological, embryological, biochemical and palaeontological. Theories: Lamarckism – Neo-Lamarckism – Darwinism – Neo Darwisim – Variation – types and sources. Models on phylactic gradualism and punctuated equalibrium.

Unit V:

Speciation – types – mechanism – patterns of speciation. Isolating mechanisms: geographical and reproductive isolation. Patterns of evolution – salient features and mechanism. Mimicry and colouration - role in evolution- rates of evolution: Horotely, Tachytely and Bradytely. Evolution of man: Biological, cultural and future evolution.

Text Books:

1. R. P. Meyyan and N. Arumugam (2015). Genetics and Evolution. Saras Publications, Nagercoil.
2. Veerbala Rastogi (2005). Organic evolution. Surjeet Publications, New Delhi.

Reference Books:

1. A. Gardner and T. Davies (2010). Human Genetics IInd Edition. Scion Publishing Ltd., Uk.
2. P. S. Verma and V. K. Agarwal (2010) Genetics. S. Chand & Co., Ltd., New Delhi.
3. M. W. Strickberger (1996). Evolution. Jones and Barlett Publishers, Sudbury, Massachusetts, Baston.
4. Stebbins (1998). Process of organic evolution. Surjeet Publications, New Delhi.
5. Gopalakrishnan, T.S. Itta Sambasivaiah, Kamalakra Rao, A.P. Principles of organic evolution. Himalaya Pub. House (2000), Bombay.
6. T. Dobzhansky (1951). Genetics and the Origin of Species. Oxford and IBH Publishing com. New Delhi.

PAPER - VI

ANIMAL PHYSIOLOGY AND DEVELOPMENTAL BIOLOGY

Semester: II ***Hours/Week: 8***

Subject code: ***Credit: 6***

Objectives:

This paper is to make the learner to understand the functioning of various system of living organism, to make them understand the basic plan of development, development of

various organs and to gain knowledge about role of hormones in development and birth control aspects.

ANIMAL PHYSIOLOGY

UNIT I:

Digestion: Digestion in mouth, duodenum and intestine - Bile composition, functions of gastro intestinal hormones, absorption and assimilation. Role of enzymes in digestion of carbohydrates, protein and lipid.

Blood and Circulation: Blood composition and blood coagulation. Types of heart – structure and working mechanism. Cardiac cycle, blood pressure and ECG.

Respiration: Inspiration, expiration, mechanism of respiration - respiratory pigments, transport of gases and oxygen dissociation curve.

UNIT II:

Muscle: Types of muscle, structure and chemistry of striated muscle- molecular basis of muscle contraction and factors influencing contractility – Receptors: structure and physiology of eye and ear. Excretion: Structure of kidney and nephron, mechanism of urine formation.

UNIT III:

Endocrine System: Pituitary, thyroid, adrenal, pancreas, ovary and testis. Nervous system: Structure of neurons, nerve impulse, conduction, synaptic transmission, neuromuscular junctions.

DEVELOPMENTAL BIOLOGY

UNIT IV:

Development of eye, ear, brain in chick and kidney in man – Organizer concept of Spemann; structure, chemical nature and mechanism of induction - experimental evidences, embryonic induction; competence and totipotency. Nucleo cytoplasmic interaction. Role of hormones in insect and amphibian metamorphosis.

UNIT V:

Sperm bank, artificial insemination, infertility - measures to overcome infertility, birth control, pregnancy test and maintenance, *invitro* fertilization (IVF), embryo transfer. Prenatal diagnosis of diseases – Stem cell bank.

Text Book:

1. Nagabushanam (2005). Animal Physiology. Himalaya Publications, Mumbai.
2. N. Arumugam (2014). Embryology. Saras Publications, Nagercoil.

References:

1. S. C. Rastogi (2008). Essentials of Animal Physiology. New Age International Publishers, Mumbai.
2. W. S. Hoar (2005). General and Comparative Physiology. William Publication. USA.
3. Veer Bala Rastogi and M. S. Jayaraj (2008). Developmental Biology. Kendra Nath Ram Nath, Meerut.
4. T. Subramonium (2006). Developmental Biology. Narosa Publishing Housing. Kolkata.

PRACTICAL- III

LAB IN GENETICS AND EVOLUTION

Semester: II ***Hour/Week: 4***

Subject code: ***Credits: 2***

Genetics:

1. Verification of Mendel's Law of segregation with coin tossing.
2. Verification of Mendel's Law of independent assortment using colour beads
3. Verification of Hardy-Weinberg law using colour beads.

4. Sex linked inheritance in man – colour blindness (using colour chart).
5. Analysis of at least six Mendelian traits of the students.

Spotters: Albino rat, normal and mutant forms of *Drosophila,* Sinistral and Dextral shells. Syndromes: Klinefelter‘s, Turner’s and Down’s syndrome

Evolution:

6. Analysis of variation – Observation of Finger prints of the students
7. Homology - Forelimbs / hindlimbs of vertebrates.
8. Analogy – Wing of a bird and an insect.
9. Serial evolution – Mouth parts of insects.
10. Fossils evidence – a) *Archeaopteryx* b) Casts and Moulds
11. Adaptive radiation – Beaks of birds
12. Museum specimens for adaptive and warning colouration
13. Mimicry- Monarch and viceroy butterfly.
14. Industrial Melanism

References:

1. J. C. B. Abraham (1987). Evolution - A Laboratory Manual – Macmillan, Chennai
2. S. Thiagarajan (2000). Practical Zoology. T. J. Publicatins, Tanjavur.
3. A. J Gardner and D. P. Sustad (1984). Principles of Genetics. VII Edn. John wiley and Sond, New York.

PRACTICAL - IV

LAB IN ANIMAL PHYSIOLOGY AND DEVELOPMENTAL BIOLOGY

Semester: II ***Hours / Week: 4***

Subject code: ***Credit: 2***

Animal Physiology

1. Effect of temperature on human salivary amylase activity
2. Effect of pH on human salivary amylase activity
3. Estimation of O_2 consumption by fish related to temperature
4. Estimation of O_2 consumption by fish related to pH
5. Preparation of haemin crystals
6. Estimation of haemoglobin

7. Estimation of blood sugar
8. Enumeration of red blood cells using haemocytometer (Demonstration only)
9. Analysis of urea and glucose in urine (Demonstration only)
10. Recording of blood pressure using a sphygmomanometer

Spotters:

1. E.C.G
2. Haemocytometer
3. Haemoglobinometer

Developmental Biology:

1. Temporary Mounting of chick blastoderm.

Spotters:

1. Human Sperm
2. Human Ova
3. Human Placenta
4. Contraceptive devices (any three)
5. IVF- flow chart

Reference Books:

1. C. L., Prosser (1984). Comparative Animal Physiology. W.B. Saunders, Philadelphia.
2. V.R Muthu Karupan and R.M. Pitchappan (1979). Animal Development – A lab guide COSIP– ULP publication, madhoor.

ELECTIVE - II

NATURAL RESOURCES AND MANAGEMENT

Subject: II ***Hours/Week: 6***
Subject Code: ***Credit: 5***

Objectives:

This paper creates awareness about the natural resources and role in human welfare, to create awareness about their conservation and management and to create a pollution free environment for the forthcoming generation.

UNIT I: Introduction:

Historic routes of nature protection, global concerns, environmental ethics and philosophy. Energy for life, terrestrial biomass, aquatic ecosystem, human disturbances.

UNIT II: Natural Resources and Management:

Soil, forest and water resources, soil abuse, conservation, wasteland reclamation, deforestation, afforestation and conservation, soil and agro forestry - water cycle – fresh water, marine water and ground water. Water conservation – rain water harvesting and grey water harvesting.

UNIT III: Biodiversity and Management:

Wild life of India, endemism, endangered flora and fauna, Hotspot of biodiversity, biogeography, wild life conservation – *Ex situ* and *In situ* methods. Biosphere reserve.

UNIT IV: Renewable and Non – Renewable Energy Sources:

Conventional sources of energy-solar, wind and biomass and Non conventional sources of energy-fossil fuels. Energy conservation strategies.

UNIT V: Pollution and Management:

Air, water and soil pollution and management. Soil waste problem and management. Environmental value education, role of NGOs on natural resource management. Global warming.

Text Book:

1. N. Arumugam (2014). Concepts of Ecology, Saras Publications, Nagercoil.

Reference Books:

1. Cunningham and Saigo (1999). Enviromental Science McGraw- Hill Publication, New Delhi.
2. R. Gopal et al.,(2005). A text book of Environmental studies, Published by PG Dept. Of Zoology, Yadava college, Madurai – 14.
3. P. S. Verma and V. K. Agarwal (2012). Environmental Biology. S. Chand & Company Ltd, New Delhi.
4. P.D. Sharma (2006). Ecology and Environment. Himalyan Publications. New Delhi.

ELECTIVE - II
ENTOMOLOGY

Semester II ***Hours/Week: 6***

Sub Code: ***Credit : 5***

OBJECTIVE:

This paper gives exposure to students about the application value of knowledge in entomology, to highlight the beneficial aspects of insect population to human welfare and provides knowledge about the harmful insects and their management.

UNIT I: Classification

Classification of insects upto order: Basis of classification- classification of important pests upto order level (any five), key characteristic with South Indian examples. External anatomy of typical insects- Exoskeleton, head, thorax and abdomen. Mouth parts of insects.

UNIT II: Physiology of Insects

Digestive system, Excretory system, Respiratory system, Circulatory system, Nervous system, Sense organs, Reproductive system, Endocrine system and Pheromones.

UNIT III: Medical and Agricultural Entomology

Vectors: Mosquito and House fly- vectors borne diseases and their control.

Agricultural Entomology: Insect pests of crops and their control measures: Paddy, Ground Nut, Coconut, Cotton, Sugarcane, Brinjal, Ladies Finger, pest of stored grains.
Pest control: Propylactic, Mechanical, Chemical and Biological control measures.

UNIT IV: Chemical control and IPM

Insecticidal Formulations, Classification of the insecticides, mode of action of Insecticide, drawback of chemical control. Biological control, Autocidal control, Integrated Pests Management, nano insecticidal control.

UNIT V: Methods of Pests Management

Conventional Methods: prophylactic- curative- Cultural, Mechanical- Physical, Legal and biological methods.
Non Conventional Methods: Plant products- Haemosterilants- Antifeedants- Pheromones- Insect Repellents- Attractants.

Text book:

1. B.V. David and T.N. Ananthakrishnan (2006). General and Applied Entomology. TATA McGraw Hill Publishing Company.

Reference Books:

1. M.S.Mani (2006). General Entomology. JJ Publication. New Delhi.
2. Dunston P. Ambrose (2008). The Insects: Structure, Functions and Biodiversity. Kalyani Publishers. New Delhi.
3. M. S. Nalina Sundari and R. Santhi (2010). Entomology. MJB Publishers, Chennai.
4. Vikas Chaudhary (2008). Entomology and Pest Management. Navyug Publishers. New Delhi.

PAPER - V

MOLECULAR BIOLOGY & MICROBIAL GENETICS

Semester: II ***Hours/week: 8hrs***

Sub. Code: ***Credit: 7***

Objectives:

This paper enriches the readers about the molecular aspects of living system, to make them understand the art of protein synthesis in a cell and to make them understand the basic aspects of microbial reproduction and mapping of their genome.

Unit I: Chemistry of Deoxyribonucleic Acid:

Nucleic acids - DNA – Molecular Structure – functions –Types of replication – Experimental proof for Semi conservative replication – Types of DNA – A, B and Z. Eukaryotic and Prokaryotic DNA - Denaturation and renaturation of DNA.

Unit II: Chemistry of Ribonucleic Acids:

RNA – Molecular structure – Types of RNA – Structure of Prokaryotic and Eukaryotic RNA polymerase – General Transcription – Factors of Eukaryotes – initiation, elongation and termination – Post Transcriptional process - Molecular processing of RNA.

Unit III: Protein Synthesis:

Information Transfer in prokaryote and eukaryote – Genetic code – Types of Gene – transcription – mechanism – Translation – Growth of polypeptide – Post translational processing of polypeptide.

Unit IV: Gene in Action:

Fine structure of Gene – Modern Definition – Cistron, Recon & Muton – function – Regulation of gene expression – Lac-operon. Central dogma and reverse dogma. Galactose operon – Tryptophan operon models. Transformation – Griffth effect– Bacterial conjugation – Hfr cells – gene mapping. Transduction – Experimental proof – Sex duction– application of transduction in gene mapping.

Unit V: Microbial Genetics:

Genetics of Phages – Structure and life cycle of Lambda and M_{13} – Lytic and Lysogenic – genetic mapping of phage T_4.

Text Book:

1. Verma and Agarwal (2006). Molecular Biology. S.Chand & Co., New Delhi.
2. R. Maloy and E. Cronan (2012). Microbial Genetics. Narosa Publishing House.Kolkata.

Reference Books:

1. P.K.Gupta (2006). Cell and Molecular Biology. Rastogi Publications, Meerut.

2. David Freifeldor (2010). Molecular Biology. Narosa Publishing House, New Delhi.

3.George M.Malacinski (2006). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.

PAPER - VIII

BIOSTATISTICS, BIOINFORMATICS AND COMPUTER APPLICATIONS

Semester: III ***Hours/Week: 8***

Subject Code: ***Credits: 7***

Objectives

This paper enable the learners become aware of principle of statistics, understand the various tools of statistics, application of statistics through computer for project work, know the principle of thesis writing and recent trends in bioinformatics.

Unit I:

Data: Primary and secondary data – tabulation, diagrammatic presentation of data. Graphical representation of data. Measures of central tendency. Definition and problems for individual, discrete and continuous series – measures of dispersion – Standard Deviation – problems – coefficient of variation.

Unit II:

Correlation – types – problems. Regression – problems –regression analysis – linear regression – analysis – regression line – calculation – grouped and ungrouped data – multiple regression. Probability – binomial distribution – normal – poission – Skewness and Kurtosis – Chi square test.

Unit III:

Tests of significance: Comparison of means of two samples – Student 't' test – paired – unpaired – test compassion of three or more samples. Analysis of variance – one way and two way- Calculation; ANOVA table . Uses of statistical software packages -SPSS.

Unit IV:

Definition, Scope and applications: types of sequences – DNA, RNA and Protein sequences: biological databases – definition, objectives, Properties, database retrieval tools: Pubmed and Sequence Retrieval System (SRS); DNA, RNA and protein data bases: DDBJ – tools: BLAST, FASTA, application of bioinformatics tools: CLUSTAL W, PROTPARAM, SCANPS, CPG plot, GOR, STRAP, 3D-PSSM, SWISS-MODEL, MMTK, RasMol, PHYSIP, APUP, GeneScan, Genefinder and Webcutter.

Unit V:

Introduction to computer- Evolution of Computers - characteristics of Computer-algorithm and flow chart, Computer Arithmetic and number system- ASCII and EBCDIC codes-operating system, programming language. Computer and communication: Internet-e-mail- Web creation – hosting and medical transcription. Computer application in biostatistics – Basic concepts and application in Bioinformatics

Text Books:

1. N. Gurumani (2005). Biostatistics -An Introduction. MJP Publishers, Chennai
2. N. Sundaralingam and V. Kumaresan (2013). Bioinformatics. Saras Publications, Nagercoil.

Reference Books:

1. P. Ramakrishnan (2010). Biostatistics. Saras Publications, Nagercoil.
2. W.W., Daniel (1987). Biostatistics : A Foundation for Analysis in Health Sciences John Wiley and Sons, New York
3. E. Balagurusamy(1983). Programming in Basics. Tata McGraw Hill, New Delhi.

4. P. K. Jasra and Gurdeep Raj (2004). Biostatistics. Krishna Prakashan (P) Ltd., Meerut.
5. M. Rajadurai. Bioinformatics (A Practical Manual). PBS Book Publishers. Chennai.

PRACTICAL - V

LAB IN MOLECULAR BIOLOGY AND MICROBIAL GENETICS

Semester: II ***Hour/Week: 4***

Subject code: ***Credits: 2***

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1. Isolation of Plasmid DNA from *E. coli*
2. Extraction of RNA from liver of Chick
3. Estimation of DNA concentration by Spectrophotometer (Demonstration only)

Spotters:

a) Mechanism of DNA replication model
b) tRNA model
c) RNA splicing
d) Genetic code
e) Polysomes
f) Griffith experimental model
g) T_4 - Phage
h) Life cycle of lambda phage
i) Bacterial conjugation

j) TATA box
k) PCR
l) Transilluminator
m) Mutagenesis using chemical mutagen
n) Physical mutagenesis (UV- induced)

Reference Books:

1. A. Mani and N. Arumugam (2013). Molecular Biology and Genetic Engineering. Saras Publications, Nagercoil.
2. R. Maloy and E. Cronan (2012). Microbial Genetics. Narosa Publishing House. Kolkata.
3. David Freifeldor (2010). Molecular Biology. Narosa Publishing House, New Delhi

PRACTICAL - VI

LAB IN BIOSTATISTICS, BIOINFORMATICS AND COMPUTER APPLICATIONS

Semester: III ***Hour/Week: 4***
Subject code: ***Credits: 2***

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1. Text preparation through MS- word-paper setting-paragraph formation-font size, left and right margin bold/italyzing/underlining.
2. Data entry and drawing graph using MS-Excel
3. Statistical calculation of mean, median, mode, standard deviation, correlation, regression and‘t’- test using Neem leaves.
4. Proving the laws of Probability using coin tossing.
5. Preparation of 20 PPT slides on any one of the desired topics in biology and present for evaluation.
6. Creation of E-mail –id
7. Collection of Data through E-mail

Spotters:

a. Hardwares

b. Softwares
c. Languages
d. Sigma stat
e. SPSS
f. Genome database –NCBI, EBI & SANGER
g. Sequence analysis - BLAST & FASTA

Reference Books:

1. N. Arumugam and A. Gopi (2014). Biostatistics Computer Application and Bioinformatics. Saras Publications, Nagercoil.
2. N. Sundaralingam and V. Kumaresan (2013). Bioinformatics. Saras Publications, Nagercoil.
3. P. Ramakrishnan (2010). Biostatistics. Saras Publications, Nagercoil.
4. W.W., Daniel (1987). Biostatistics : A Foundation for Analysis in Health Sciences John Wiley and Sons, New York
5. E. Balagurusamy (1983). Programming in Basics. Tata McGraw Hill, New Delhi.
6. P. K. Jasra and Gurdeep Raj (2004). Biostatistics. Krishna Prakashan (P) Ltd., Meerut.

ELECTIVE - II

WILDLIFE MANAGEMENT AND CONSERVATION

Semester : II **Hours/Week : 6**

Subject Code : **Credit : 5**

Objectives

This paper enable the knowledge about the values of wild life & the importance of their management .it also praises oriental information's on the necessity of wildlife consolation Interaction between human wild life & the strategies to reduce it. If further the paper deals with the values, threats & conservation of biodiversity,

UNIT: I Introduction to Wildlife

History of wildlife management in India. Wildlife census. Basic concept and principles of wildlife management; values of wildlife-positive and negative Project Tiger- project Elephant-Project Crocodile.

UNIT: II Evaluation and management of wildlife habitat

Habitat analysis, physical parameters: Topography, Geology, soil and water. Biological parameters: food, cover, forage, brouse an cover estimation. Wildlife protection Act. Standard evaluation procedure: remote sensing and GIS.

UNIT: III wildlife conservation:

Necessity of wildlife conservation-different approaches of wildlife conservation. Conservation ethics and importance of conservation. Causes of depletion: world conservation strategies. Modes of conservation; in-situ and ex-situ conservation.

Unit :IV Human-wildlife interaction

Human- wildlife conflicts; causes and consequences of human-wildlife interaction. Mitigation of conflicts. Case studies- elephant, bear, monkey, tiger and leopard. Strategies to reduce human wildlife interaction-role of government and NGOs in controlling of human-wild life interaction. Socio-economic issues related to human-wild life interaction.

Unit V: Biodiversity

Biodiversity-types-genetic, species, ecosystem diversity. Values and uses of biodiversity. Measurement of biodiversity- species richness and evenness – Simpson's and Shannanon's indices. India as a mega diversity nation. Loss and threats and conservation of biodiversity.

Reference Books:

1. Hosetti., B. B and Venkateshwarlu., M. (2001). Trends in wildlife biodiversity conservation and management, Daya books.

2. Rajesh., G Fundamentals of wildlife management, Justice Home. Alahabath.

3. Sharia., V. B (1982). Wildlife in India, Nataraj Publishers, Dehra Dun.

4. Seshadri., B (1986). India's wildlife reserves, Sterling Publishers Pvt., New Delhi.

5. Robinson, W.I and Eric., G. Bolen., S (1984). Wildlife ecology and Management Mac Millian Publishing Co. Ny. PP 478.

6. Dobson., A. P (1996). Conservation and Biodiversity scientific American Library, New Yark, USA.

ELECTIVE - III

ENTREPRENEURIAL ZOOLOGY

Semester: III ***Hours/Week: 6***

Subject code: ***Credits: 5***

Objectives:

This paper to enrich the knowledge on different types of self- employment opportunities in zoology, to develop a self employed culture among the students and to make the learner a successful entrepreneur.

Unit I: Entrepreneur and Entrepreneurship Development

Entrepreneurship preparation of model project – survey – financial mobilization – leadership – managerial skill – budget preparation – successful operation – quality check – quality improvement – problem solving procedures – statement of profit or loss – self analysis – expertise contact and further improvement (future prospect).

Unit II: Dairy and poultry

Composition of milk, milk products, cheese, ghee, ice cream. Indigenous milk products – Dahi, Khoa, Rabbri, Mallai, Kheer. Milk substitutes - marketing. Rearing and management of chicks, growers, broilers and layers - disease control and marketing of eggs and broilers. Economic importance of dairy and poultry science.

Unit III: Mushroom culture

Preparation of culture and spawn – facilities for cultivating Oyster Mushrooms – white Button Mushrooms - facilities for cultivating paddy straw Mushrooms – preservation of Mushrooms – pests and diseases – economic importance of Mushrooms.

Unit IV: Aquaculture

Characteristics of cultivable fishes – monoculture - polyculture, pond culture – physico chemical characteristics of ponds – construction – preparation of ponds and management. Induced breeding – objective – pituitary extract preparation – selection of breeders – dosage and potency of extract – spawning – stripping, Happa and Bundh Breeding. Prawn culture: Fresh water and marine – farm management – disease control.Marketing: Criteria for market demand – marketing functions.

Unit V: Vermi technology

Introduction – morphology of earthworms - site selection – vermicomposting organisms – preparation of vermibed – management – biomanure harvest technology – vermiwash – applications in the field – limitations in vermitechnology – economic importance.

Text books:

1. N. Arumugam, T. Murugan and J. Johnson Rajeswar (2015). Applied Zoology. Saras Publication, Nagercoil.

Reference books:

1. M. R. Gnanamani (2002). Profitable Poultry Farming. J. Hitone Publications. Mumbai
2. S. Sanathanakumar (1993). Aquaculture. J. J. publications. Meerut.
3. B. N. Yadav (1993). Fish and Fisheries. Daya publishing House, New Delhi.
4. S. A. Ismail (1997). Vermitechnology. Orient Longuson Ltd. Banerjee G. C. Animal Husbandary. Oxford and IBH publishing co.

SELF STUDY PAPER

POULTRY SCIENCE

Semester : III ***Hours / Week:***
Sub. Code : ***Credit : 5***

Objectives:

Poultry science is an economically important and job oriented course, deals with different aspects of poultry such as the external parts of a fowl, nutritive value of broiler meat and egg. Poultry housing and infrastructure, equipment, hatchery farm, grower farm, layer farm, broiler farm, poultry feed and rearing. A short account of poultry diseases and health also dealt.

Unit I: Basic Aspects of Poultry

Commercial poultry : History and important – employment – national productivity – egg production – table bird production – byproducts – integrated farming – entrepreneurial development.

Stock bird description: Classification and breeding Indian and exotic stocks – factors in selection – external parts of a fowl – digestive and reproductive systems – Ross development – egg and meat product description – quality and preservation.

Unit II: Housing

Housing and equipment **:** 1 + 3 housing system – all in, all out and multiple systems – deep litter – nests – brooders – feeders – waterers – daily and weekly practices and routines.

Unit III: Nutrition and Management

Food and Nutrition: Nutritive requirement – feed stuffs – feed formulation – milling – feed grinders and mixers – budget.

Hatchery management**:** Incubation – candling – grower stage – caponetts and capons chick development – sterilization – sexing – culling **-** debeaking.

Unit IV: Farming operation

Layer farming: Feeding program – space requirements – summer management – winter management – stress management – egg marketing.

Broiler Farming: Housing – optimum conditions – management strategies – forced moulting – slaughtering techniques – meat marketing.

Unit V: Poultry Health

Disease and Health : Nutritional and infectious diseases – pathogens – transmission – symptoms – treatment – antibiotics – vaccines.

Text book:

Gnanamani, R (2003). Modern aspects of commercial poultry keeping, Giri pub., Madurai.

Reference books:

1. Chauhan HVS (1993) Poultry diseases, diagnosis and treatment, Wiley Eastern Ltd., New Delhi.
2. Gnanamani R (1993) Profitable poultry keeping, Hitone Pub. Co., Madurai.

PAPER – XI

IMMUNOLOGY

Semester: IV ***Hours/Week: 8***

Subject Code: ***Credits : 7***

Objectives

This paper deals with the basic aspects of immunology. It throws some light on immunity, immune systems, immune cells, immune response, vaccines and immunology related disease like HIV, immunodeficiency diseases, autoimmune diseases etc. Learning immunology helps each and everyone to keep his own defense system in a better working condition and this lead to disease – free life.

Unit I: Introduction, lymphoid organs, immune cells, antigens & immunoglobulin:

History & scope of immunology. Immunity – types. Lymphoid organs – primary and secondary. Cells of the immune system. Antigens - Immunoglobulin – structure – properties – functions – Classes. Biosynthesis of antibody – antibody genes – assembly of immunoglobulin - production of monoclonal antibodies – polyclonal antibodies – theories of antibody biosynthesis.

Unit II: Immune response, Hypersensitivity & Complement:

Immune response – factors causing immune response - humoral & cell mediated immune response – mechanism – functions – cell co-operations in humoral and CMI – memory cells – immunological memory. Antigen processing and presentation. Cytokines - Hypersensitivity – Complement.

Unit III: Major Histocompatibility Complex, Transplantation & Tumour immunology:

MHC- functions – classes – structure – cross presentation; HLA – genetics of HLA –H-2 complex of mouse. Transplantation immunology – types of graft – graft acceptance – graft rejection; HVG – allograft rejection – mechanism of allograft rejection; GVH - mechanism. Tumour immunology – types – properties – tumour antigens – immune response to tumour – immune surveillance – factors involved in tumour immunity – immunotherapy.

Unit IV: Autoimmune diseases, Immuno deficiency disease and Immunoprophylaxis:

Autoimmune diseases -classification. Immunodeficiency diseases – primary & secondary immune deficiency diseases. Immunoprophylaxis – immunization – types; vaccines – types. Immunization schedule for children.

Unit V: Immunotechniques:

Immunoreactions- Precipitation, Agglutination, Flocculation, Opsonisation and Neutralization. Double immunodiffusion - Radial immunodiffusion – Rocket immuno electrophoresis – RIA – Immunoflorescence – ELISA – VDRL – ABO-Rh blood typing – Widel test – Well Felix test – Coomb's test – HLA typing (Serology).

Text Books:

1. Dulsy Fatima and Arumugam, N., 2013. Immunology, Saras Publication, Nagarcoil,
2. Rastogi, S.C., 2005. Elements of Immunology, CBS Publishers & distributors, New Delhi.

Reference Books:

1. Chakravarthy, A.K., 1996. Immunology, Tata Mc Graw Hill Publishing co., Ltd., New Delhi.
2. Stites, D.P. and Abbas, I., 1991. Basic and Clinical Immunology, Prentice Hall International Inc.
3. Ivan Roitt, 1994. Essential Immunology, 8th edition, Blackwell science Ltd., Oxford.
4. Nandhini. S., 1994. Immunology: Introductory Text Book, New Age Int. (P) Ltd. Publications, New Delhi.

PAPER - XII

BIOTECHNOLOGY

Semester: IV ***Hours/Week: 8***

Subject Code: ***Credits : 7***

Objectives

This paper to understand the gene manipulation and its application in solving pressing problems concerning human activities including agriculture, medical treatment, industry and environment.

UNIT-I: RECOMBINANT DNA TECHNOLOGY

Gene cloning - the basic steps - various types of restriction enzymes –modification system. Cloning vectors: pBR322, Cosmid, Ti plasmid, SV_{40}, artificial chromosomes – YAC and BAC; linkers and adaptors-construction of cDNA and genomic libraries- Gene transfer methods in bacteria, plant and animal cells;

UNIT- II: TECHNIQUES IN BIOTECHNOLOGY

Restriction mapping of DNA fragments-Polymerase Chain Reaction (PCR)-principle, types and applications; Nucleic acid blotting techniques – Southern, Northern and Western blotting ; DNA sequencing- principle and methods; Finger printing – RFLP and RAPD

UNIT -III: ANIMAL AND PLANT BIOTECHNOLOGY

Animal cell culture –Bioreactor- natural and defined media- development and maintenance of cell lines – cell hybridization. Stem cell isolation and culture. Transgenic methods- microinjection and electroporation. Human genom project - Human gene therapy. Plant tissue culture - callus culture - protoplast fusion technique –germplasm storage.

UNIT-IV: MICROBIAL BIOTECHNOLOGY

Fermentation - Fermentor- microbial products - primary and secondary metabolites – penicillin, protease; Downstream processing - enzyme immobilization - single cell protein (SCP). Biopolymers-bioinsecticides and biofertilizers – types and applications

UNTI-V: ENVIONMENTAL BIOTECHNOLOGY

Bioremediation of hydrocarbons - industrial wastes - heavy metals –biodegradation of xenobiotics - bioleaching - biomining - biofuels. Genetically modified organism

(GMO'S) - GM food. Intellectual Property Rights, biosafety and bioethics – biodegradation of pesticides and oil- Vermitechnology.

Text books:

1. R.C. Dubey (2009). A text book of biotechnology.S.Chand &company, New Delhi
2. B.D. Singh (1998). Biotechnology , Kalyani Publishers, Ludhiana

Reference Books:

1. R.W.Oldand and S.B. Primrose (1985). Principles of Gene Manipulations. An Introduction to Genetic Engineering. Oxford Blackwell Publishers, London
2. T.A Brown (1995). Gene Cloning- An Introduction, Stanley Thomas Publishers, UK
3. S.S. Purohitand and Mathur, S.K (1999). Biotechnology Fundamentals and Application. Agro Botanica, New Delhi.
4. P.K. Gupta (2004). Biotechnology and Genomics. Rastogi Publications, Meerut.

PRACTICAL VII

LAB IN IMMUNOLOGY

Semester: IV ***Hours/Week: 4***

Subject Code: ***Credits: 2***

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1. Histology of Primary and Secondary Lymphoid organs in man – Thymus, Spleen, Bone marrow and Lymph node.
2. Histology of Bursa Fabricius
3. Isolation and enumeration of spleenocytes of goat.
4. ABO and Rh blood group in Man
5. Haemoagglutination assay
6. Lymphoid organs in chick
7. Immunodiffusion Technique - Ouchterlony technique SRID and DID.
8. **Spotters**

    Nude mouse

    Immunoglobulin – IgG, IgM and IgE

    Antigen

    Immune response curve

    Flow chart of ELISA and Monoclonal antibodies

    Immunoelectrophoresis

Reference Books:

1. S. Jutine Garvey and H. Dieter (2006). Methods in Immunology. Cummings Publishing co. USA.
2. L. Hudson and Hay F. C (1989). Practical Immunology III Edn. Blackwell scientific publication oxford, London.
3. R. L. Myers (1989). Immunology a laboratory manual. WMC. Brown Publishers Debuque Iowa, USA
4. G. P. Talwar (2009). A hand Book of Practical Immunology. Vikas Publications. House New Delhi.

PRACTICAL VIII

LAB IN BIOTECHNOLOGY

Semester: IV ***Hours/Week: 4***

Subject Code: ***Credits: 2***

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1. Isolation of Genomic DNA from bacterial cells
2. Isolation of Genomic DNA from cells (Goat liver)
3. Electrophoresis-SDS PAGE (Demonstration only)
4. Vermicompost-Estimations of N,P,K and C
5. Southern blotting, Northern blotting and Western blotting ((Demonstration only))

Spotters

a. Ethanol fermentation system
b. Biogas plant
c. Bio chips
d. Biosensor
e. Bioreactor
f. pBR322
g. SV_{40}
h. Ti Plasmid
i. Restriction enzymes
j. Transilluminator
k. Western blotting technique
l. RAPD
m. Field visit to vermiary

Reference Books:

1. S. Rajan and R. Selvi Christy (2011). Experimental Procedures in Life Sciences. PRS Associates, Chennai.
2. A. Dutta (2012). Experimental Biology. Narosa Publications, Chennai.

SELF STUDY PAPER

AQUACULTURE

Semester : IV
Sub. Code : Credit :5

Objectives:

In this course the students will be taught to know about the culture techniques of freshwater and marine fishes and related economically important organism like oysters, prawns, seaweed. Economic importance of aquaculture, fish disease, economic loss, prevention and identification of fish diseases will also be taught.

Unit I: Culture fisheries

Introduction: Global and Indian protein crisis – resource potential (capture & culture fisheries) – nutritive value of fish – desirable characters of culturable organisms.

Identification of cultivable organisms: Fin fish, shellfish – crustaceans & mollusks, sea weeds, classification, habitat & habit.

Unit II: Water quality & Nutrition

Physical and chemical factors of water, major nutrition – carbohydrates, proteins & lipids; minor nutrition – vitamins & minerals, feed ingredients & formulations, diet processing.

Unit III: Edible and ornamental fish culture

Edible and fish culture: Culture types, site selection, construction & components of farms, nursery, rearing & stocking induced breeding, harvesting.

Ornamental fish culture**:** Breeding of gold fish, fighter & angel; marketing, special feed supplements.

Unit IV: Oyster, Seaweed and Prawn Culture:

Pearl culture – spat collection – hanging tray culture – mother of pearl insertion, culture and harvesting. Sea weed culture – rope and raft methods, agar extraction process.

Prawn culture: Culture types, life cycle, nursery, hatchery and prawn culture and factors influencing prawn culture farms.

Unit V: Diseases

Fish and prawn diseases, economic importance – fish, and prawn, oysters, seaweeds.

Text Book:

Bardach JE *et al*. (1972). Aquaculture: The farming and husbandry of freshwater and marine organisms. Wiley (Interscience) Wiley New York.

Reference Books:

1. B. L. Srivastava (2000). A Text Book of Fishery Science and Indian Fisheries. Kitab Mahal Publications, Allahabad. India.
2. R. K. Rath (1993). Freshwater Aquaculture. Scientific Publications, Jodhpur.
3. Pandey, Kamaleshwar and J. P Shukla (2005). Fish and Fisheries. Rastogi Publications, Meerut.

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Govindarajan Campus, Thiruppalai, Madurai – 625014.

PG & RESEARCH DEPARTMENT OF ZOOLOGY

BOARD OF STUDIES MEETING

09 APRIL 2018

M.Phil, Zoology Programme

CBCS (2018-2019 onwards)

DEPARTMENT OF ZOOLOGY

M.Phil. ZOOLOGY
COURSE CONTENT

Semester	Sub. Code	Title of the Paper	Teaching Hrs / Week	Evaluation				Examination Hours
				Internal	External	Viva	Total	
I		Paper I – Research Methodology	6	100	100	--	200	3
		Paper II – Recent Trends in Zoology	6	100	100	--	200	3
II		Paper III – Entomology	6	100	100	--	200	3
		Paper IV – Project	6	50	100	50	200	--

PAPER I

RESEARCH METHODOLOGY

Semester: I ***Hours/Week: 6***

Subject Code: ***Credits: 5***

Objectives:

This paper aims at helping the students to have a in depth understanding to the biotechniques to apply in their future research.

Unit I:

Electrophoresis: Principles and application. Polyacrylamide Gel Electrophoresis (PAGE) for protein separation, Agarose Gel Electrophoresis (Nucleic acids), Electrofocussing.

Calorimetry and Manometry: Principles and application. Direct and indirect calorimetry –Bomb calorimetry and wet combustion method. Manometry – principles and applications, derivation of flask constant, oxygen electro, Warburg's apparatus.

Estimation of Biomolecules in Tissues: Isolation, purification and assay of carbohydrates, proteins and amino acids. Nitrogen (Kjeldhal) and lipids.

Unit II: Genetic Engineering and related techniques

Principles and techniques of nucleic acid hybridization, sequencing of proteins and nucleic acids, southern, northern and Western blotting techniques. Dot and slot blots, polymerase chain reaction (PCR). DNA foot printing, screening of CDNA libraries, ultracentrifugation, plant and animal tissue culture

Unit III: Isotopic (Tracer) techniques Biophysical methods

Principles and application, Radiation dosimetry, Radioactive isotopes, half life of isotopes, autoradiography, Cerenkov radiation, G. M. and Scintillation counters – liquid scintillation. Spectrometry. X-ray diffraction, plasma emission spectrocophy, ORD/CD spectroscopy. Immunological technique**:** Immunoduffusion techniques, ELISA and monoclonal antibodies.

Unit IV: Literature collection, research papers and thesis writing

Define the research project, research design, interpretation, report writing. Literature collection – list of abstracts, reviews, journal ect. Utilization of reference cards, intern al abbreviation and proof correction. Computer Architecture, software – types; hardware, networking – internet: literature survey through internet, introduction of bioinformatics.

Unit IV: Statistical Methods

Scale of measurement, measures of central tendency and dispersion; tests of statistical significance; simple correlation and regression, analysis of variance, chi-square test, t-test.

Reference

1. L. Veerakumari (2006). Bioinstrumentation. MJP Publishers, Chennai.

2. J. Jeyaraman (1981). Laboratory Manual in Biochemistry. Willey Eastern Limited. India.

3. John G. Webster (2008). Bioinstrumentation. John Wiley & Sons, Inc.

4. Harold Varley (1975). Practical Clinical Biochemistry, Arnold Heinemam.

5. Frances M. Weesner (1960) – General zoological Microtechnique. The William & Wilkins Co.,

6. P. R. Yadav and R. Tyagi (2006). Biological Techniques. Discovery Publishing House, New Delhi.

7. P. Ramakrishnan (2010). Biostatistics. Saras Publications, Nagercoil.

8. W.W., Daniel (1987). Biostatistics : A Foundation for Analysis in Health Sciences John Wiley and Sons, New York

9. E. Balagurusamy(1983). Programming in Basics. Tata McGraw Hill, New Delhi.

10. P. K. Jasra and Gurdeep Raj (2004). Biostatistics. Krishna Prakashan (P) Ltd., Meerut.

11. N. Gurumani (2005). An Introduction of Biostatistics. MJP Publishers, Chennai.

12. M. Rajadurai. Bioinformatics (A Practical Manual). PBS Book Publishers. Chennai.

PAPER II

RECENT TRENDS IN ZOOLOGY

Semester : I ***Hours/Week : 6***

Subject Code: ***Credits: 5***

Objectives:

This paper to make the students to understand the gravity of the problem of pollution and need for its' management, to expose them to the knowledge of Genomics, Biotechnology, Immunology for general and Human welfare.

Unit I : Pollution and Remedial measures

Environmental Pollution (air, water and soil) – Causes and remedies – Environmental Impact Assessment – Environmental laws – Risk assessment.

Environmental Education, Planning and Management – Bioremediation.

Renewable and Non – renewable sources of energy, Conventional and Non-conventional – Solar energy – Biogas production – Nuclear energy – Indian nuclear power plants.

Remote Sensing and GIS – Basic Concepts.

Unit II: Genomics and Human Welfare

DNA sequencing and Human genome project, stem cells, Detection of genetic disease using DNA recombinant technology, screening and counselling – Human gene therapy.\

Cloning techniques and its application in biology – Ethical issues, Reproductive techniques related to human in vitro fertilization.

Application of Nanotechnology in Biology.

Unit III: Biotechnology and General Welfare

Biofertilizers – Composting – Biopesticides – SCP- Production and sources,

Methods involved in the production of transgenic animals and their uses. Production of recombinant insulin and growth hormone.

Unit IV: Immunology and Human Welfare

Organization and expression of immunoglobulin gene,

Vaccine – Whole organism vaccines, subunit vaccines, recombinant vaccines, DNA vaccines, synthetic peptide vaccine, multivalent subunit vaccine – development of AIDS and malaria vaccines.

HI, A, tissue typing and monoclonal antibody.

Unit V: Aquaculture

Aquaculture: Environmental and Social issues in Coastal Aquaculture – Environmental Management of Shrimp farms – Induced breeding in fishes – Uses of pituitary, HCG, LRGH, Synthetic hormones – administration – injection – feed – implants – Hybridization – Development of polyploids Chromosome manipulation Gynogenesis and Androgenesis – Environmental and Nutritional Probioties in the management of diseases, Cryo preservation of gametes and embryos.

Reference Books:

1. A .K. Abbaslichtman and J.S Pober (1998). Cellular and Molecular Immunology, III Edition W.B.Saunders Company, U.S.A.

2. J.S. Branden and J. Tooze (1999). Introduction to protein structure II Edition, Garland Publishing, Inc., New York

3. S.T. Desmondnicholl (1994). An Introduction to Genetic Engineering, Cambridge University Press, New York,

4. Jonathan Graves and Dungan Reavey (1996). Global Environmental Change. Plant, Animal and Communities, Long man.

5. HAWKINS. J.D., (1996) Gene Structure and expression Iii Edition Cambridge University Press, New York,

6. T. I. Hanshishodia (1998). Biodiversity Conservation and Sustainable development Pointer Publisher, Jaipur.

7. B. King (1986). Cell Biology, London. Allen and Unwin Boston, London.

8. H. D. kumar (1998). Modern concepts of Biotechnology, Vikas Publishing House Pvt. Ltd., New Delhi.

9. D. kumar and S. Kumar. (1998). Modern Concepts in Microbiology. Vikas Publishing House Pvt, Ltd., New Delhi.

10. M. Maeda (1999). Microbial Process in Aquaculture. Society for the Biological creation and Enhancement for the aquatic environment, Japan.

11. J. L. MARX (1999). A revolution in Biotechnology. Cambridge University Press, New York.

PAPER III

ENTOMOLOGY

Semester: II Hours/Week: 6

This paper provides a basic knowledge about role of insects in Human Welfare, to provide a sound knowledge

Subject Code: ***Credits: 5***

Objectives: about pest and their management and to provide them knowledge about Apiculture

Unit I: Classification of Insects

Classification of insects up to orders with examples.

Unit II: Economic Entomology

Insect pests – Classification of pests – pest of cotton: *Dysdercus cingulatus* – pest of sugarcane: *Pyrilla perpusilla* – of paddy: *Spodoptera mauritia* – pest of oil sced crops: *Achae janatha* pests of vegetables; *Spolotera littoralis* – pests of stored grain: *Tribolium castaenum* –pests of fruit crops; *Phyllocnistis, citrella* – pests of pulses; *Thrips hawaiiensis*; Pest of coconut – *Oryctes rhinoceros*.

Unit III: Primary control measures

Mechanical measures; hand picking – hand netting – artificial barriers, physical measures; artificial cooling – super heating – radiation, culture methods: clean cultivation- tilling of soil – crop rotation – synchronization of sowing and harvesting – resistant varieties – use of manures and fertilizers. Chemical control: Insecticidal formulation – nomenclature of insecticide – mode of action of insecticides. Classification of the insecticides – inorganic insecticide – organic insecticide – drawbacks of chemical control.

Unit IV: Industrial Entomology

Silkworms – rearing of silkworms and silk production – silk reeling – honey bee – beehive – honey: - chemical composition – economic importance – lac insect – biology – lac insect culture – rearing method – shellac production.

Unit V: Modern Trend in Pest Control

Integrated pest management – biological control and autocidal control.

Text Books:

1. Vasantharaj David,B, & Jayaraj Elements of Economic Entomology, Popular Book Depot., Chennai,
2. Entomology – L.K.Jha.

Reference Books:

1. D.B.Tembhare, Modern Entomology, Himalaya publishing House, Mumbai.
2. Chappman, R.F, The Insects, Cambridge University Press, U.K.
3. Wiggles worth, Insect Physiology.

ELECTIVE - I

ANIMAL DIVERSITY

Semester : I ***Hours/Week : 6***

Subject Code : ***Credit : 5***

Objective

This paper is designed to reveal the fundamental aspects of core Zoology. It provides adequate facts which will enrich the knowledge in Zoology. It deals with broad outline classification of Invertebrates and Chordates. It also deals with minor phyla, living fossils, connecting links, missing links, Zoogeography and general topics such as parental care and migration of birds.

UNIT 1: Principles of taxonomy and levels of structural organization

Concepts of species, biological, binomial and trinomial nomenclature. Kinds of classification- five kingdom, types of taxonomy- morphology, numerical, molecular and phylatic lineages. Hierarchal organization of animal complexity- unicellular, colonial and multicellular forms, coelom, symmetry, organs and systems.

UNIT II: Methods of Biosystematics

Classical and modern methods- typological, phonetics, evolutionary, Phylogenetic and cladistics. Molecular taxonomy- Phylocode, tree of life and bar-coding of life, Sero taxonomy, Integrated Taxonomic Information System (ITIS), Biodiversity informatics and website related to taxonomy. Importance and applications of systematics in biology.

UNIT III: Outline classification and minor phyla

Outline classification of Invertebrates (up to class level) and Chordates (up to order level)- general characters , examples. Comparative anatomy of digestive, respiratory, exoskeletal, circulatory, nervous and urinogenital system of Chordates. Minor phyla- Ctenophora, Ectoprocta, Endoprocta and Rotifera.

UNIT IV: Living Fossils, Connecting and Missing link

Geological time scale- living fossil- *Limulus, Latimeria, Callorhinchus* (elephant shark), *Sphenodon* and *Ctenophora.* Connecting links- *Peripatus, Neoplina,* Protopterus, *Chimera, Balanoglossus* and *Orinthorhyncus.* Missing link – *Archeopteryx, Ichthyostega* and *Seymouria*

UNIT V: Natural history of Indian subcontinent

Zoo geography, Major habitat types of the subcontinent, Seasonality and Phenology. Wildlife organization- ICZN, WWF, ZSI and BNHS. General topics, parental caring fishes and amphibian, migration of birds.

Text book:

1. Hickman. C.P.J.R, Roberts S.L and Larson A (2001) "Integrated Principle of Zoology" 11th edition. McGraw- Hill Publishers.

Reference Books:

1. Agarwal V.K. (2000) "Invertebrate Zoology" Ist edition, S.Chand and Co Ltd. New Delhi.

2. Ayyar E. (1993) " Manual of Zoology" Vol-1- Invertebrates, S. Viswanathan (Printers & publishers) Pvt. Ltd, Chennai.

3. Jordan E.L and Verma P.S. (2013) "Invertebrate Zoology" S. Chand & Co Ltd, New Delhi.

4. Kotpal R.L (2003) "A text book of Minor Phyla, 11th eds, Rastogi Publications, Meerut.

5. Kotpal R.L (2014) "Modern Text book of Zoology: Invertebrate" 11th eds, Rastogi Publications, Meerut.

ELECTIVE - II

WILDLIFE MANAGEMENT AND CONSERVATION

Semester : I **Hours/Week : 2**

Subject Code : **Credit : 1**

Objective

UNIT: I Wildlife Management

Basic concepts and principles- wildlife management before and after implementation of wildlife (Protection) Act, 1972- IUCN- CTTES- NBA- IBA- Project Tiger- project Elephant- project Crocodile.

Interface between forest and wildlife management in India. Legal instruments for managing wildlife in India. Principles and practices of wildlife management. Course and fine filter approaches for wildlife management. Management of special habitat: riparian zones, grasslands etc.,

UNIT: II Evaluation of wildlife habitat

Define habitat- forest habitat types- basic survey techniques of habitats – vegetative analysis- point centered quadrate, Quadrate, Strip transet- habitat manipulation: food, water, shade, impact and removal of invasive alliance species.

Analysis of wildlife management problems in plantations and exploited forests: Indian and global scenario. Species conservation project; tiger, lion, rhino, crocodile etc., Role of biology in management.

UNIT: III Human conflicts

Basic concept, recent for conflicts, identification of damages caused by wild animals and control measures. Case studies – Elephant, Gaur, Wild boar, Monkey, Tiger and Leopard. Translocation of wild animals- principles, methods and applications.

Management plan for protected areas; forest working plans and wildlife management plans. Need for wildlife management plans. Principles of planning, objectives, resource surveys, analysis of surrounding region, management zones, theme plans, communication, staff and visitor amenities, monitoring. Financing protected areas.

Unit :IV Introduction:

Introductin to conservation biology, the origin of conservation biology, ethical and economical values of conservation biology, definition of biodiversity, types of biodiversity, threats to biodiversity.

Conservation in breeding and wildlife utillsation: Captive breeding and propagation: founder population, rehabilitation, education, utilization, gene banks, ex situ and in situ linkages, conservation breeding management plans, role of scientific institution and NGOs in conservation breeding programme.

Principles: understanding biological requirements of species: design of facilities, food, hygine, disease control, and breeding. Propagation of threatened plants. Case studies on conservation breeding programme of endangered wild animals.

Unit V: Scope of conservation Biology

Scopes and importance of conservation methods-*in-situ* and *ex-situ* conservation approaches of Indian animals. Captive breeding (lion-tailed macaque, white tiger and vultures) and reintroduction (tiger, rhinoceros, gaur).

Role of government and non government organization in conservation-Government – Wildlife Institute of India, Ministry of Environment and Forests (MoEF), National Biodiversity Authority (NBA), Zoological Survey of India (SIS), Botanical Survey of India (BIS), Salim Ali Center for Ornithology and Natural History (SACON), Center for Ecological Sciences (CES). NGOs- Bombay Natural History society (BNHS), World Wide Fund for Natures (WWF).

Wildlife utilization: non consumptive and consumptive utilization, their economic benefit. Game ranching and controlled off- take from wild population, rationale, management design, harvesting by management or hunting licenses, marketing procedure. Use of wildlife products- skin, meat, musk etc., wildlife tourism – objectives, plannings and economics.

Unit 1:

ELECTIVE - II

WILDLIFE MANAGEMENT AND CONSERVATION

Semester : II **Hours/Week : 6**

Subject Code : **Credit : 5**

UNIT: I Introduction to Wildlife

History of wildlife management in India. Wildlife census. Basic concept and principles of wildlife management; values of wildlife-positive and negative Project Tiger- project Elephant- Project Crocodile.

UNIT: II Evaluation and management of wildlife habitat

Habitat analysis, physical parameters: Topography, Geology, soil and water. Biological parameters: food, cover, forage, brouse an cover estimation. Wildlife protection Act. Standard evaluation procedure: remote sensing and GIS.

UNIT: III wildlife conservation:

Necessity of wildlife conservation-different approaches of wildlife conservation. Conservation ethics and importance of conservation. Causes of depletion: world conservation strategies. Modes of conservation; in-situ and ex-situ conservation.

Unit :IV Human-wildlife interaction

Human- wildlife conflicts; causes and consequences of human-wildlife interaction. Mitigation of conflicts. Case studies- elephant, bear, monkey, tiger and leopard. Strategies to reduce human wildlife interaction-role of government and NGOs in controlling of human-wild life interaction. Socio-economic issues related to human-wild life interaction.

Unit V: Biodiversity

Biodiversity-types-genetic, species, ecosystem diversity. Values and uses of biodiversity. Measurement of biodiversity- species richness and evenness – Simpson's and Shannanon's indices. India as a mega diversity nation. Loss and threats and conservation of biodiversity.

Reference Books:

1. Hosetti., B. B and Venkateshwarlu., M. (2001). Trends in wildlife biodiversity conservation and management, Daya books.

2. Rajesh., G Fundamentals of wildlife management, Justice Home. Alahabath.

3. Sharia., V. B (1982). Wildlife in India, Nataraj Publishers, Dehra Dun.

4. Seshadri., B (1986). India's wildlife reserves, Sterling Publishers Pvt., New Delhi.

5. Robinson, W.I and Eric., G. Bolen., S (1984). Wildlife ecology and Management Mac Millian Publishing Co. Ny. PP 478.

6. Dobson., A. P (1996). Conservation and Biodiversity scientific American Library, New Yark, USA.

CERTIFICATE COURSE IN APICULTURE

Semester: IV ***Hours/Week: 2***

Subject Code: ***Credits: 2***

Objective:

This paper gives exposure to students about the application value of apiculture and to highlight the beneficial aspects of honey bee to human welfare and also to provide knowledge about the harmful enemies and diseases that attack honeybee.

Unit I:

Introduction to Apiculture and Bee Keeping. – Types of Honey bees: - ***Apis dorsata – Apis indica – Apis florea – Apis mellifera*** – General Biology – Body structure – Mouth parts – Secretary glands – sting apparatus.

Unit II:

Social organization and division of labour – Queen – worker – Drone – Life cycle. Swarming Nauptial flight – Honey bee dances: - Language dance – round dance – wag tail dance.

Unit III:

Hive or Comb – Selection of bees for apiculture – methods of bee keeping – Indigenous method and Modern method – Tools and Equipments connected with bee keeping.

Unit IV:

Products of bee keeping: - Honey- Honey extraction – Ripeing of honey – Chemical composition of honey – Economic importance of honey:-Food value, Medicinal value and other uses – By-products of honey – Bees Wax – Bee venom.

Unit V:

Pest, Paracites and Diseases of Honey bees:- Wax moth, Wax beetle, Black ants, Birds and other enemies. Nosema, Acarine, Septicemia, Fungal and other important brood diseases.

Text Book:

N. Arumugam and Jeyasurya (2013). Economic zoology. Saras Publication, Nagercoil.

Reference books:

1. Vasantharaj David and T. Kumaraswami, (2006). Elements of Economic Entomology -
2. K.R. Ravindran, (2004). A Text Book of Economic Zoology – Dominant Publishers, New Delhi.

DIPLOMA COURSE IN VERMITECHNOLOGY

Semester: IV ***Hours/Week: 2***

Subject Code: ***Credits: 2***

Objective:

This paper gives exposure to students about the application value of vermicompost and to highlight the beneficial aspects of vermicompost bee to human welfare.

Unit I:

Earthworms: Classification – morphological and anatomical characteristics – reproduction – biology of composting earthworms *Eudrilus eugeniae* and *Lampito mauritii*

Unit II:

Ecological groups of earthworms – epigeic, endogeic, anegeic, saprophagus and geophagus worms, humus form, humus feeders – earthworm casts – an outline of earthworms importance in agriculture, fishing, therapeutics and pollution.

Unit III:

Soil physical, chemical and biological features – soil types – soil formation – soil organic matter – organic matter decomposition – humus formation.

Unit IV:

Organic wastes sources – vermicomposting definition – types – factors affecting vermicomposting: pH, moisture, temperature, nutritional value of feed and microbes and earthworms.

Unit V:

Application of vermicomposting in agricultural and horticultural practices – economic of vermiculture – NABARD – National Bank supports for vermiculture

Text Book:

1. Gupta, B. K (2008). Vermicomposting for Sustainable Agriculture. Agrobios.
2. N. Arumugam and Jeyasurya (2013). Vermitechnology. Saras Publication, Nagercoil.