


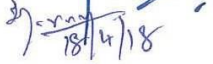
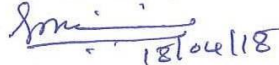

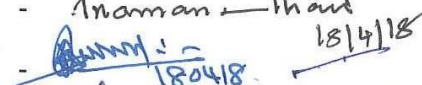
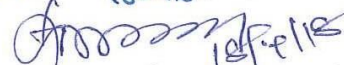







**PG AND RESEARCH DEPARTMENT OF ZOOLOGY
RAJAH SERFOJI GOVERNMENT COLLEGE (Autonomous)
THANJAVUR 613005**

**BOARD OF STUDIES MEETING
18.04.2018**

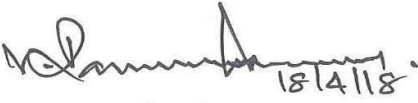




The meeting of Board of Studies (BoS) in Zoology was held on 10.30 am on 18.04.2018 (Wednesday) at the department of Zoology under the chairmanship of Dr.P.Mariappan, Head, Department of Zoology. The following members are present in the meeting

Internal Members

- | | |
|--------------------------|--|
| 1. Dr.K.M.Subbu Rathinam | -  |
| 2. Dr.K.Rameshkumar | -  |
| 3. Dr. M.Sukumaran | -  |
| 4. Dr.S.Babu | -  |
| 5. Dr.S.Sivasuriyan | -  |
| 6. Dr.M.Thangadurai | - ARGENT - |
| 7. Dr.P.Murugaian | -  |
| 8. Mr.S.Ramanathan | - Anaman - hand |
| 9. Dr. P.Raja | -  |
| 10. Dr.M.Sundaramoorthy | -  |
| 11. Dr. S.Ravikumar | -  |
| 12. Dr. R.Ravichelvan | -  |
| 13. Dr.R.Ravichandran | -  |
| 14. Dr.Merlin Emerald .D | -  |
| 15. Dr. M.Soundararajan | -  |

External Members

1. Prof. V.Ramasubramanian
2. Dr. B. Kadalmani
3. Dr. K. Venkatramalingam
4. Dr. S. Mohan Raj
5. Dr. T. Ravimanickam

-  18/4/18
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The Syllabi for B.Sc. Zoology (Major and Allied), M.Sc. Zoology, and M.Phil. Zoology under CBCS system was discussed and correction/changes were made and finalized for the academic year 2018-2019 onwards. The finalized syllabus is approved in the meeting which is appended herewith.



(P.MARIAPPAN)
CHAIRMAN-BoS-ZOOLOGY

HEAD
PG & Research Dept. of Zoology,
Rajah Serfoji Govt. College (Auto),
THANJAVUR - 613 005.

Credit	5	Hours/Week	6	Sub Code	S1PZO1	Semester	I
Medium of Instruction: English							CC1

ANIMAL PHYLOGENY AND BIODIVERSITY

(for students admitted from the academic year 2018-2019 onwards)

Objectives:

The aim of this paper is to study of biodiversity is an attempt to know the species of organism and its importance in the function of ecosystems, to learn about the endangered species, how can they be saved, to know the evolutionary history and relationships between the members of animal kingdom, to identify key features scientists use to classify animals and interpret phylogenetic tree of the metazoan.

Course Outcome:

On successful completion of this course students will be able to:

- ✓ Gain demonstrable and measurable knowledge on the phylogeny, origin and evolution of invertebrates and their significance.
- ✓ Describe the phylogeny of jawless and jawed vertebrate, evolutionary position and their geological time scale.
- ✓ Outline the origin of amphibians, reptiles, primates, adaptive radiation of lemuroids and evolutionary knowledge on Australopithecus.
- ✓ Critique conservation of biodiversity by in situ and ex situ methods, biodiversity laws of India and wildlife protection act.

Unit-I

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

Unit-II

Phylogeny of invertebrates: Mollusca- origin and evolution. Minor phyla: general characters, morphology, anatomy and affinities of rotifers, Phoronida and Chaetognatha. **Ammonites and their significance**

Unit-III

Phylogeny of vertebrates: Jawless vertebrates-characteristic features of lampreys. Ostracoderms. Characteristic features and classification of Cephalaspida, Anapsida, Cyclostomata, Pteropsida and Coelolepis. Evolutionary position of Ostracoderms. Primitive jawed vertebrates-origin of jaws. Acanthodians. Origin of Placoderms. **Geological time scale.**

Unit-IV

Origin of Reptiles: Amphibian and reptilian features of Seymouria. Mammal like reptiles. Aquatic reptiles. Flying reptiles. Rise and fall of dinosaurs. Fossil Birds (**Archaeopteryx**). Origin of Primates. Adaptive radiation of Lemuroids. Tarsius- New world monkeys, Old world monkeys and apes, Australopithecus.

Unit-V

Biodiversity - definition. Types of biodiversity-genetic, species and ecosystem .Values and uses of biodiversity. Biodiversity measurements. Megabiodiversity centers. Fundamental causes- IUCN

categories. Conservation of biodiversity: *in situ* (afforestation, social forestry, agro-forestry biosphere reserves, national parks and sanctuaries), *ex situ* (cryopreservation, gene banks, sperm banks, DNA banks, tissue culture and biotechnological strategies). Biodiversity laws of India. Wild life protection Act.

Reference Books:

Kapoor, V.C.1995.Theory and Practice of Animal Taxonomy. Oxford & IBH Publishing Co. New Delhi.
Solbrig, O.T., Van Emden, H.M. and Van Oordt, P.G.W.J. 1995. Biodiversity and Global Change.CAB international, Wallingford, U.K.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	5	Hours/Week	6	Sub Code	S1PZO2	Semester	I
Medium of Instruction: English							CC2

CELL AND MOLECULAR BIOLOGY

(for students admitted from the academic year 2018-2019)

Objectives:

The main objectives of this paper are: to have basic knowledge in cell and molecular biology and become aware of the complexity and also harmony of the cell, study the structures and purposes of basic components of cells, especially macromolecules, membranes, and organelles, understand how these cellular components are used to generate and utilize energy in cells, the cellular components underlying cell divisions.

Course Outcome:

After completion of this course, the students would be well versed in the following disciplines.

- ✓ Cellular transports systems.
- ✓ Receptors and Cell signaling.
- ✓ Genomic structure of the cells.
- ✓ Synthesis and functions of genes.
- ✓ Types of DNA and RNA.
- ✓ Mechanisms of protein synthesis.
- ✓ Methods of cell culture and cell lines.
- ✓ Valuable products from cell culture.

Unit-I

Ultra structure of eukaryotic cell. Structure and functions of membrane system, Passive & active transport, permeases, sodium potassium pump, Ca²⁺ ATPase pumps. Lysosomal and vacuolar membrane. ATP dependent proton pumps, co transport symport, antiport, transport into prokaryotic cells, endocytosis and exocytosis.

Unit-II

Receptors—characterization, types (cytosolic, nuclear and membrane bound) and quantification. Autocrine, paracrine and endocrine mode of action. Signal amplification – models. Biosynthesis of inositol tri phosphates, cyclic GMP and g proteins. Signal transduction - calcium ion flux and its role in cell signaling. Current models of signal amplification, phosphorylation of protein kinases, regulation of protein kinases, serine –threonine kinases, tumor necrosis factor receptor families.

Unit-III

The law of DNA constancy. DNA-Classes and forms. Structure and organization of chromatin. Chromosomal banding techniques. Chromatid differentiation. Eukaryotic genome organization (coding and non-coding sequences, Satellite DNA).DNA damage and repair, DNA replication – types.

Unit-IV

RNA- Structure and types (m, t & rRNA).Transcription in Prokaryotes and eukaryotes-mechanism. Reverse transcription. Post transcriptional modifications and processing of mRNA. Protein Synthesis-molecular mechanism of protein synthesis. Regulation of gene expression in prokaryotes and eukaryotes.- Genetic Code. Operon concept.

Unit-V

Cell line - generation of cell lines. Maintenance of stock cells. Characterization of cells. Immunochemistry - morphological analysis techniques. Cell culture - explant culture, primary culture, three dimensional culture and role of matrix in cell growth.

Text Books

Darnell J, Lodish H, Baltimore D. 1995. Molecular Cell Biology. W.H. Freeman. Pp 1152.
Kimball. J.W. 1970. Cell Biology. Wesley Publishers. Pp 168.

Reference Books

De Robertis & De Robertis. Cell and Molecular Biology.
G.M. Cooper and R.E. Hausman. 2013. The Cell. A Molecular Approach. Sinauer Associates, Inc. Publishers.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

.Credit	5	Hours/Week	6	Sub Code	S1PZO3	Semester	I
Medium of Instruction: English							CC3

BIOCHEMISTRY AND BIOTECHNIQUES

(for students admitted from the academic year 2018-2019 onwards)

Objectives:

This programme will give learners, sound and broad background knowledge in biochemistry and along with information on bio- instrumentation.

Course Outcome:

Upon successful completion, students will have:

- ✓ Knowledge and skills to understand in detail the structure and physico chemical properties of carbohydrates from monosaccharide to polysaccharides.
- ✓ Learn the significance of structural and storage polysaccharides in nature. Understand in detail about amino acid structures, types of amino acids, classifications, structure of proteins and types of proteins.
- ✓ Describe the lipids are metabolized, cholesterol, prostaglandins etc. Understand the difference between the water soluble and fat soluble vitamins and the knowledge on the clinical consequences of nutritional deficiency.
- ✓ Demonstrate the basic knowledge the principle and applications of centrifuge, electron microscopy, SEM, TEM, STEM and chromatography technique based on the principle involved in the separation of protein.
- ✓ Understand the principles and apply basic techniques of electrophoresis, autoradiography, spectrophotometer, scintillation counter, colorimeter, spectrophotometer and atomic absorption spectrophotometer.
- ✓

Unit-I

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

Unit-II

Proteins: Classification based on Structure, function and solubility. Properties of protein - primary, secondary and tertiary. Amino acids-Structure, classification and properties. Enzymes – Classification and mode of action.

Unit-III

Lipids: Classification, properties - saturated and unsaturated fatty acids – steroids, cholesterol and lecithin. Vitamins. Classification. Properties. Sources. Functions. Deficiency diseases

Unit-IV

Principles and applications of centrifuges. Principles of sedimentation. Centrifuge –Types (Ultra , Analytical, Gradient).Principles and applications of Electron microscopy - SEM, TEM, STEM. Chromatography - Paper, Column, TLC, HPLC and GC.

Unit-V

Electrophoresis- PAGE, AGE. Autoradiography, Geiger Muller -Scintillation counter. Colorimeter - Principle and applications. Beer-Lamberts law. Visible and UV Spectrophotometer. Atomic absorption Spectrophotometer. NMR technique

Text Book

Jain et al. 2016. Fundamentals of Biochemistry. Chand. Co. Pvt Ltd., New Delhi.
SVS Rana 2009. Biotechniques. Theory and Practice. Rastogi Publications, Agra. Pp 329.

Reference Books

Lubert Stryer. 1999. Biochemistry. WH Freeman,
Jeremy M. Berg et al. 2015. Biochemistry. Macmillan Learning, Pp1120.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	6	Sub Code	S1PZOP1	Semester	I
Medium of Instruction: English							CC4

ANIMAL PHYLOGENY AND BIODIVERSITY, MOLECULAR CELL BIOLOGY & BIOCHEMISTRY AND BIOTECHNIQUES- Practical I

(for students admitted from the academic year 2018-2019 and onwards)

Objectives:

To learn animal phylogeny, study biodiversity of organisms, observe various cells and cellular organelles, understand cytological and biochemistry techniques.

Course outcome:

Students completing this course will be able to

- ✓ Have an idea an evolutionary aspects of animals and the know process of fossilization.
- ✓ Able to operate/use basic laboratory equipment
- ✓ Perform cell division study and acquire practical knowledge on cell divisions
- ✓ Carry out data basic haematological anlysis
- ✓ Quantify proximate composition of biological tissues

ANIMAL PHYLOGENY AND BIODIVERSITY

Spotters: Peripatus, Ammonoids, Limulus, Trilobite, Nautilus, Latimaria, Protopterus, Archaeopteryx, Sphenodon, Ant eater.

MOLECULAR CELL BOLOGY

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

BIOCHEMISTRY AND BIOTECHNIQUES

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

MARKS DISTRIBUTION

Animal phylogeny and Biodiversity 10 marks

Biochemistry and Biotechniques	20marks
Cell and Molecular Biology	20 marks
Record	05 marks
Viva-voce	05 marks
Total	60 marks

Credit	4	Hours/Week	6	Sub Code	S1PZOEL1A	Semester	I
Medium of Instruction: English							EC1

SERICULTURE AND APICULTURE

(for students admitted from the academic year 2018-2019)

Objectives:

To make the students understand the history of sericulture and their importance, diseases, symptoms and treatment of mulberry silkworm.

To know the commercial importance of apiculture and their products, status of apiculture in India and its importance.

Course Outcome:

On completion of this course students

- ✓ acquire knowledge about sericulture and their cultural practices.
- ✓ get idea about diseases of silkworm and marketing the silk products
- ✓ learn knowledge about the mulberry silk rearing methods in Tamil Nadu
- ✓ able to understand the different bee species in India and their practices
- ✓ get knowledge about beekeeping techniques and their management's practices.

Unit-I

History of Sericulture - Types of Silkworm – Mulberry (*Bombyx*) and Non-mulberry silkworms (Tasar, Muga and Eri). *Bombyx mori*–Morphology, silk glands and life cycle. Silkworm rearing: equipment used for rearing-rearing racks and trays, disinfectants, bed cleaning, mounting appliances, harvesting and marketing of cocoons.

Unit-II

Moriculture - Mulberry Species – Classification, distribution, cultivation, irrigation and common varieties used in India and recommended varieties for Tamil Nadu. Propagation of Mulberry. Mulberry leaf harvesting methods -leaf picking, shoot leaf harvesting & branch cutting.

Unit-III

Silkworm diseases and their treatment. Silkworm pests, parasites and their management. Silk reeling techniques.

Unit-IV

Apiculture in India-Honey bees-types and morphology different bee types of a colony-Natural bee colonies and their yield. Bee hives – Primitive Hives- Modern hive-Langstroth hive and Newton's hive –setting up an Apiary and management-Appliances used in Apiary

Unit-V

Diseases and pests of honey bees and their management, harvesting and extraction of honey-process. Physicochemical analysis of honey. Byproducts and their uses-medicinal value of honey

Text Books:

H. Aruga and AA Balkema. 1994. Principles of Sericulture. Rotterdam. Pp. 367.

Reference Books:

Manual of Silkworm Rearing: Manual of Mulberry Cultivation by Food and Agricultural Organization (FAO), United States.

Sharma, P. and L. Singh. 1987. Hand Book of Bee keeping, Controller Printing and Stationery.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	6	Sub Code	S1PZOEL1B	Semester	I
Medium of Instruction: English							EC1

WILDLIFE MANAGEMENT

(for students admitted from the academic year 2018-2019 and onwards)

Objectives:

To make the students equipped with principles and applications of various, wildlife management techniques

Course Outcome:

On completion of this course the student will

- ✓ understand and have knowledge on modern concepts in wildlife management,
- ✓ have an insight into relevant conservation policies and legislation and their enforcement mechanism at Global and Local Level,
- ✓ experience in the use of modern scientific methods, techniques and tools that are required for biodiversity assessment and monitoring of conservation goals
- ✓ Develop skills on scientific wildlife management planning, and resolving human wildlife conflict including capture, handling, care and management of wild animals.

Unit-I

Wildlife Management: Basic concepts and principles-Wildlife management before and after implementation of Wild Life (Protection) Act, 1972 –IUCN –CITES –NBA–IBA–Project Tiger –Project Elephant –Project Crocodile

Unit-II

Evaluation of Wildlife habitat: Define habitat–Forest habitat types –basic survey techniques of habitats –Vegetative analyses –Point centered quadrat, Quadrat, strip transect –Habitat manipulation: Food, Water, shade, impact and removal of invasive alien species

Unit-III

Population Estimation: Basic concepts and applications -Direct count (block count, transect methods, Point counts, visual encounter survey, waterhole survey). Indirect count (Call count, track and signs, pellet count, pugmark, camera trap, DNA finger printing and aerial photography)

Unit-IV

Human-animal Conflicts: Basic concepts, reason 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 application.

Unit-V

Zoos, Zoological Parks, Wildlife Sanctuaries, National Parks & Tiger Reserves: Definition–in situ and ex situ conservation, formation, management and administration. Case studies (VOC park zoo, Arignar Anna Zoological Park, Srivilliputtur Wildlife Sanctuary, Vedanthangal bird sanctuary, Mukkuruthi and Guindy National Parks, Mudumalai and Periyar Tiger Reserves-Nilgiri Biosphere Reserve.

Textbook

Text Book of Wildlife Management. S.K.Singh. 2015.International Book Distributing Company. Pp515.

Reference Books:

Wildlife Management and Conservation. Contemporary Principles and Practices. 2013. Paul R. Krausman and James W. Cain III (ed). John Hopkins University Press.Pp 360

Essential readings in Wildlife Management and Conservation. 2013. Paul R. Krausman and Bruce D. Leopold. John Hopkins University Press.Pp 696.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	5	Hours/Week	6	Sub Code	S2PZO4	Semester	II
Medium of Instruction: English							CC5

GENETICS

(for students admitted from the academic year 2018-2019)

Objectives:

The course objectives are: to understand the Mendel's Laws of Equal Segregation and Independent Assortment, to gain knowledge for how genes work together in biological processes and chemical nature of heredity, to study genetic variability and DNA polymorphisms and to understand genetic engineering and the manipulation of DNA

Course Outcome:

On completion of this course the students will

- ✓ Understand the molecular basis of gene interaction.
- ✓ Know the linkage analysis which is genetically used to identify the diseases inherited through genes.
- ✓ Have the knowledge on the mechanism of inheritance and the genetic material and its transfer methods.
- ✓ Able to know the diagnosis of chromosomal disorders

Unit-I

Introduction to genetics. Mendel's laws of inheritance - mono and dihybrid cross. Alleles–Genotype, Phenotype. Back cross .Test cross. Complete and Incomplete dominance. Co dominance .Multiple alleles inheritance (ABO Blood grouping). Gene interaction

Unit-II

Sex chromosomes. Determination of sex. Cytoplasmic inheritance. Linkage–Complete and incomplete linkage. Crossing over-mechanism. Chromosome mapping. Chromosomal abnormalities–Numerical changes: aneuploidy, euploidy, haploidy and polyploidy. Structural changes–deletion, duplication, translocation, inversion.

Unit-III

DNA as the genetic material – Biochemical evidences. Fine Structure of gene – Cistron, Recon and Muton. Gene regulation in Eukaryotes-Britten and Davidson's model. Gene mutations- types (Spontaneous, Base pair substitution, Frame shift and inducible mutation).Mutagens.

Unit-IV

Transformation. Conjugation. Transduction. Plasmids – types (PUC18, pBR322). Movable genes..Genetics of viruses. Life cycle of bacteriophage. Recombination in phage.

Unit-V

Human chromosome and sex determination. Syndromes – types. Eugenics. Euthenics and Euphenic. Pedigree Analysis. Human Genome Project.

Textbook

Gardner et al. 2006. Principles of Genetics 8 Edition. Wiley. Pp 740.

Reference Books

Daniel, L. 2010. Hartl Essential Genetics: A Genomics Perspective: 5th Edition. Jones and Bartlet Publishers, Boston.

Elof Axel Carlson. 1985. Genetics. Tata McGraw Hill Publishing Co.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	5	Hours/Week	6	Sub Code	S2PZO5	Semester	II
Medium of Instruction: English							CC6

DEVELOPMENTAL BIOLOGY

(for students admitted from the academic year 2018-2019)

Objectives:

Developmental biology is an experimental science, which provides understanding of the processes of early embryonic development. To analyze the mechanisms of development by experimental manipulation of developing embryos and to review current methodologies for conducting research in the field of embryology.

Course Outcome:

On completion of this course students

- ✓ understand the relationship between their experiments and concept developmental biology
- ✓ aware of the reproductive health.
- ✓ learn the organogenesis.
- ✓ understand to techniques of cryopreservation and embryo of different species.
- ✓ Know the IVF and cryopreservation techniques.

Unit-I

History and theories of developmental biology. Gametogenesis. Spermatogenesis - Origin of Primordial germ cells, differentiation of spermatozoa. Structure of mammalian sperm. Oogenesis- development of Oocytes. Types of eggs. Biochemical changes during Oogenesis. Egg activation. Acrosomal reaction.

Unit-II

Fertilization process – mechanism. Egg–interaction of sperm and egg .Sequence of events in sperm entry –Egg surface changes. Post–fertilization changes. Changes in the organisation of the egg cytoplasm caused by fertilization.

Unit-III

Cleavage - types and pattern of cleavage. Factors affecting cleavage. Morula. Blastula. Blastulation. Gastrulation - Principles and patterns of gastrulation. Morphogenetic movements in the egg. Fate map.

Unit-IV

Organizer: Spemann’s primary organizer-analysis of nature and mechanism of induction; Organogenesis: Cellular interaction –differentiation and organogenesis. Embryonic adaptation: Extra embryonic membrane structure in Reptiles and Birds. Placenta: Classification, structure and physiology.

Unit-V

Post embryonic developmental events. Metamorphosis (Insects and Amphibians). Regeneration. Asexual reproduction.- forms of asexual reproduction. Cryopreservation of gametes and embryos. In vitro fertilization and Embryo transfer. Assisted Reproduction Technologies (ART)- sperm banking. Fertility control and regulation.

Textbooks

S. Chattopadhyay. 2017. An Introduction to developmental biology. Books Allied (P) Ltd. Kolkatta.Pp 630.

Reference Books

Scott F. Gilbert. 2016. Developmental Biology. Plenum Press, New York.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	6	Sub Code	S2PZO6	Semester	II
Medium of Instruction: English							CC7

ANIMAL PHYSIOLOGY

(for students admitted from the academic year 2018-2019)

Objectives:

Animal Physiology course aims to provide the students about the knowledge on the functions of body systems, structure and function of the major organ systems, to learn the physiology of endocrine glands and its functions.

Course Outcome:

On completion of this course the student will learn

- ✓ the digestive system students and understand the general digestive process in man.
- ✓ know the excretory system, structure of Kidney and its function.
- ✓ Understand the function of circulatory system
- ✓ Study the nervous system and its control over the entire body activities.

Unit-I

Digestion and absorption in man. Respiration - respiratory organs. Respiratory pigments. Mechanism of exchange of gases. Respiratory quotient.

Unit-II

Circulation- circulatory media, typical pattern of circulation. Structure of human heart, Types of circulatory system. Circulatory organs. Heartbeat. Cardiac cycle.

Unit-III

Nervous system - Types of neurons. Propagation of nerve impulse. Synaptic transmission- Reflex action. Excretion - Excretory products in animals. Structure of nephron. Biosynthesis of urea. Mechanism of urine formation. Kidney failure in man .Transplantation - kidney stone. Homeostatic mechanism: Ionic and osmoregulation in fresh water and marine fishes.

Unit-IV

Physiology of mammalian reproduction. Reproductive cycles -estrous cycle, sexual cycle in man, Menstrual cycle. Hormonal control of reproductive cycle. Birth control. Chronobiology. Circadian rhythm.

Unit-V

Endocrine glands in mammals - structure, secretion (Hormones) and function of pituitary, Pineal, Thyroid, Parathyroid pancreas, Adrenal, Testis and Ovary. Neurosecretion in animals. Pheromones. Bioluminense.

Text book

P.B.Reddy. 2015.Text Book of Animal Physiology. Ratna Prasad Multidisciplinary Research & Educational Society. Ibrahimpatnam. AP.Pp 139.

Reference Books

Christopher D. Moyes and Patricia M. Schulte. 2015. **Principles of Animal Physiology (3rd Edition). Pearson Publishers.Pp 699**

Linda S. Coastanzo. 2017. **Physiology. Elseiver.**

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	6	Sub Code	S2PZOP2	Semester	II
Medium of Instruction: English							CC8

GENETICS, DEVELOPMENTAL BIOLOGY AND ANIMAL PHYSIOLOGY

Practical: II

(for students admitted from the academic year 2018-2019)

Objectives:

To learn *Drosophila* culture and human karyotype, study chick blastoderm, observe lymphoid organs of rat, understand the oxygen consumption, salt loss and salt gain in fishes, learn clinical instruments.

- ✓ Demonstrate an understanding of fundamental concept in genetics.
- ✓ To know knowledge on crossing over during meiotic divisions and ask to measure the linkage percentage.
- ✓ Understand the basic concept of developmental biology, how fertilization and cleavage occur.
- ✓ The process and consequence of gastrulation.
- ✓ Concept of organogenesis, growth, regeneration and ageing.
- ✓ Compare the different energy requirements of an animal at rest and during exercise and regulation of the oxygen transport system.

To understand the process of nervous system and sensory perception

GENETICS

Drosophila-culture, mutants, sex identification; Blood groups: ABO and Rh-grouping; Human karyotyping & chromosomal abnormalities; Hardy-Weinberg Law & calculation of gene frequencies for dominant, recessive and co-dominance traits and multiple alleles.

DEVELOPMENTAL BIOLOGY

Preparation of bull-sperm suspension and observation of live and smeared spermatozoa; Mounting of chick blastoderm; Effect of thyroxin or iodine on frog metamorphosis.

ANIMAL PHYSIOLOGY

Estimation of oxygen consumption in fish
 Estimation of haemoglobin in human blood
 Salt loss and salt gain in fish
 Enumeration of RBC and WBC in human blood
 Survey of digestive enzymes in cockroach
 Test for urea and sugar in urine sample
 Quantitative estimation of amylase activity
 Quantitative estimation of ammonia and urea
 Spotters: BP apparatus, Stethoscope and ECG

Marks distribution

Genetics 15 marks

Developmental Biology	20marks
Animal physiology	10 marks
Record	10 marks
viva voce	05marks
Total	60 marks

Credit	4	Hours/Week	6	Sub Code	S2PZOEL2A	Semester	II
Medium of Instruction: English							EC2

AQUACULTURE & VERMICULTURE

(for students admitted from the academic year 2018-2019)

Objectives:

To learn, observe and understand fish biology, cultivable species, understand major diseases of culture fishes, earthworm diversity, methodology of vermicomposting.

On completion of this course students will

- ✓ Acquire knowledge about the species selection for aquaculture, water quality parameters and kinds of aquaculture
- ✓ Able to express the basic ideas of site selection, construction procedures for fish farm, types of ponds, maintaining water quality and different types of feeds
- ✓ Recognize the types of culture, various diseases of fish
- ✓ Understanding the different kinds of worm farming and also the potential of vermicompost as an alternative to chemical fertilizers
- ✓ Gain knowledge about the role of vermiculture in protecting the environment and managing the waste and also the economic importance of vermiculture

Unit-I

Kinds of aquaculture .the selection of species for culture - Physical and chemical characteristics of water bodies. Types of culture-traditional-extensive, semi-intensive, intensive. Cage culture, raceway culture, raft culture, pen culture.

Unit-II

Site selection, preparation of fish farm, Types of ponds - nursery pond, stocking pond and rearing pond. Maintenance and management of water quality. Natural, supplementary and artificial feeds.

Unit-III

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

Unit-IV

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

Unit-V

Methodology of vermicomposting- soil structure- raw material required, environmental, pre-requested, feeding harvesting and storage of vermicompost. Vermin enrichment. Vermi Tea. Composition of vermicompost and vermin wash. Physical, chemical and biological characteristics of vermicast. Earthworm in medicine. Economic importance of vermiculture.

Reference Books

G. Santhanakumar and A.M. Selvaraj. 2002. Concept of aquaculture, Meenam Publication, Nagercoil.

Edwards, C.A. and Loft, J.R., 1977. Biology of Earthworms, 3rd Edition, Chapman Publications.

****Visit to aquaculture farm and processing unit is compulsory****Question Pattern**

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	6	Sub Code	S2PZOEL2B	Semester	II
Medium of Instruction: English							EC2

FISH BIOLOGY AND PHYSIOLOGY

(for students admitted from the academic year 2018-2019)

Objectives:

The main course objective of this paper is to provide the complete knowledge on fish biology and physiology

On completion of this course students will

- ✓ Gain knowledge on agro based small scale industries like fish farming.
- ✓ Understand the rearing techniques of fin and shell fishes.
- ✓ Practice methods for fish culture.
- ✓ Know the economic importance of fishes.
- ✓ Practice fish breeding

UNIT-I

Structure and functions of skin and scales, significance of scales in taxonomy. Chromatophores: Classification, ultra structure and functional significance. Origin of paired fins and modification of caudal fin. Respiratory organs including accessory respiratory organs and respiration in fish

UNIT-II

Swim bladder and its functional significance. Food, feeding habits and nutrition in fish. Digestive system and physiology of digestion in fish. Osmoregulatory organs and osmoregulatory mechanisms in fish

UNIT-III

Brain of fishes and its functional organization in relation to ecological conditions. Lateral line system: Structure, modifications and functional significance. Electric organs and their significance. Bioluminescence in fish and its significance. Chemical communication in fish

UNIT-IV

Neuroendocrine integration and hypothalamo-hypophysial system in fish. Anatomy and physiology of pituitary gland. Anatomy and physiology of thyroid gland. Pineal organ, inter-renal gland and caudal neurosecretory system

UNIT-V

Seasonal cycles of gonads in Indian fish. Hormonal and endocrine control of reproduction in fish. Development of teleost fish. Parental care in fish

References:

- Brown, M.E. 1957. The Physiology of Fishes, Vol.I &II. Academic Press, New York. Pp 538.
- Lagler, K.F. Bardach, J.E., Miller, R.R. and Passino, D.R.M. 1977. Ichthyology. John Wiley & Sons, New York
- Hoar and Randall. 1969. Fish Physiology Vol.1. Academic Press, New York. Pp 466.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	5	Hours/Week	6	Sub Code	S3PZO7	Semester	III
Medium of Instruction: English							CC 9

BIOTECHNOLOGY AND NANOTECHNOLOGY

(for students admitted from the academic year 2018-2019)

Objectives:

The aim of the course is to acquire knowledge and abilities to apply the biotechnological tools necessary in the development of products and services involving biological organisms or components and intended to improve the understanding on recombinant DNA technology, different types of cloning vectors, animal cloning, transgenic animals, gene therapy, animal cell culture methods, stem cells, biotechnological regulations, assisted reproductive technology and nanobiology.

Course outcome: Students completing this course will be able to

- ✓ Recognise gene cloning, gene cloning tools, transgenic animals, animal cloning and biotechnological regulations.
- ✓ Summarise animal cell culture and useful products of this technique.
- ✓ Explain animal cell culture scale-up processes, stem cells and organ culture methods.
- ✓ Appreciate various molecular biological techniques.
- ✓ Give an account of various nanomaterials and their preparations.

Unit-I

Gene cloning- general concept and methods. Restriction enzymes - types. Ligases. Cloning vectors. Linkers and adaptors. Transgenic animals - mice, cattle, sheep, goat, poultry and fish. Animal cloning. Chimera production. Biosafety issues and bioethics in animal biotechnology. Patenting of biotechnological products.

Unit-II

Animal cell culture media – naturals, complex natural media, chemically defined media. Isolation of animal tissue. Disaggregation of tissue - physical and enzymatic methods. Primary and secondary cultures. Cell types – finite cells, continuous cell lines, immortal cell lines, transformed cell lines. Characteristics of cultured cells. Valuable products from cell culture.

Unit-III

Manipulation of cultured cells and tissues - scaling up of animal cell cultures. Stem cells – types, characteristics, applications of stem cells. Organ culture methods. Tissue engineering – artificial skin and artificial cartilage.

Unit-IV

Polymerase Chain Reaction (PCR) and its applications. DNA Sequencing - Sangers's method; DNA finger printing - methodology, applications, zoo blot, garden blot. Molecular markers and their applications. RFLP, RAPDs, VNTRs, SSRs, AFLP. Blotting techniques. Southern blotting. Northern blotting. Western blotting.

Unit-V

Types of nanomaterials - nanorods, nanowires, nanoparticles, nocapsules, nanomembranes, nanomesh, nanofibres, nanocatalysts, carbon nanotubes. Methods of preparation of nanomaterial. Outlines of top

down and bottom up approaches, emulsifiers, homogenizers and MOCVD. Applications of nanobiology, future perspectives and problems.

Reference Books

Singh, B., S.K. Gautam and M.S. Chauhan, 2014. Textbook of animal biotechnology, TERI Publications, New Delhi, pp 620.

Manjulashenoy. 2007. Animal Biotechnology. Laxmi Publications Limited, New Delhi

Portner, R. 2014. Animal Cell Biotechnology. Humana Press, pp 498.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	6	Sub Code	S3PZO8	Semester	III
Medium of Instruction: English							CC10

RESEARCH METHODOLOGY

(for students admitted from the academic year 2018-2019)

Objectives:

The course aims the student to: understand a general definition of research design, to identify the overall process of designing a research study from its inception to its report, identify a research problem stated in a study, know the primary characteristics of quantitative research and qualitative research and define the meaning of a variable, and to be able to identify independent, dependent, and mediating variables.

Upon completion of the course the student shall be able to:

- ✓ Use research data to formulate or evaluate new research questions, using reason and persuasion in a logical argument.
- ✓ Summarize and evaluate a body of research including primary literature, and can compare methods with other disciplines
- ✓ Analyze the biological data that he collects during his research study
- ✓ Understand the need for ethics in conduct of research program
- ✓ Understand the different types or formats of scientific communications
- ✓ Prepare a project proposal for funding and a manuscript for publication

Unit-I

Research – definition and types. Selection of a research problem. Research thesis and research report writing. Sources of information - classical and modern sources (Classical-journal, reviews, monographs, bibliography. Modern sources- internet-digital library-virtual library). Biological databases.

Unit-II

Journals- types-peer and non-peer-reviewed; online journal and **print journals-paid and unpaid journals.** Journal Article Types. Choice of a journal for publication. MS preparation-**Proof reading.** **Quality indices of publications**-Impact Factor (IF); Science Citation Index; H Index; **I10 index.** Overview of Plagiarism.

Unit-III

Biometry-Variables (qualitative and quantitative; continuous and discontinuous).Data (primary and secondary data), Tabulation and Classification of Data. Measures of Central Tendency (mean, mode median). Measures of dispersion (**Range, SD, SE, CV**).

Unit-IV

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

Unit-V

Bivariate relationships-Correlation and Regression-Types, Applications. Introduction to Statistical Packages (SPSS; MS-Excel)

Text Books

N. Gurumani. 2009. Research Methodology: for Biological Sciences. MJP Publishers, New Delhi
G. Vijayalakshmi and C.Sivapragasam. 2008. Research Methods. Tips and Techniques.MJP Publishers, Chennai.

Reference Book

Jerrold H Zar. 2010. Biostatistical Analysis (5th Edition). Pearson Education Inc

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	5	Hours/Week	6	Sub Code	S3PZO9	Semester	III
Medium of Instruction: English							CC11

COMPUTER APPLICATIONS AND BIOINFORMATICS

(for students admitted from the academic year 2018-2019)

Objectives

To understand the basic concepts of Computer applications and bioinformatics to synthesis an area of modern biology in order to analyse and solve biological problems in a more systematic way through computational management .With the aid of computer system and software, the students are also given hands on training in bioinformatics. Also, this paper is to acquire knowledge on the preparation of research manuscripts etc.

A student completing a major in computer applications and bioinformatics shall be able to apply:

- ✓ Grasp the facts about the basic structure of a computer. → Comprehend the aspects of the basic concept of operational software and application software
- ✓ Perceive the details about the database and its retrieval and tools through internet.
- ✓ knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics
- ✓ To characterize the bioinformatics database – primary and secondary databases of protein and nucleotide.
- ✓ existing software effectively to extract information from large databases and to use this information in computer modelling and an understanding of structure-function relationships, information theory, gene expression, and database queries.

Unit-I

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

Unit- II

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

Unit-III

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

Unit-IV

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

Unit-V

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

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

Reference books

S.C. Rastogi & Others. 2003. Bioinformatics- Concepts, Skills, and Applications, CBS Publishing.

S. Ignacimuthu, S.J. 1995. Basic Bioinformatics, Narosa Publishing House.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	5	Hours/Week	6	Sub Code	S3ZOP3	Semester	III
Medium of Instruction: English							CC12

BIOTECHNOLOGY AND NANOTECHNOLOGY, RESEARCH METHODOLOGY & BIostatISTICS, COMPUTER APPLICATIONS & BIOINFORMATICS AND ENTOMOLOGY -Practical: III

(for students admitted from the academic year 2018-2019)

Objective:

To train the students to acquire the knowledge on experiments in biotechnology, literature collection, citation, research report preparation, biostatistical applications, data analysis and graph generation using MS Excel, DNA and protein sequence data analysis using bioinformatics tools and applied entomology.

Course outcome:

Students completing this course will be able to

- ✓ Isolate DNA, separate protein by SDS-PAGE, separate DNA by agarose gel electrophoresis.
- ✓ Perform literature collection, research report preparation, Chi-square and Students 't' test.
- ✓ Carry out data analysis and graph generation using MS Excel
- ✓ Do DNA sequence analysis using bioinformatics tool.
- ✓ Identify, collect and preserve beneficial and harmful insects.

BIOTECHNOLOGY AND NANOTECHNOLOGY

Isolation of DNA from animal tissue, separation of proteins by SDS-PAGE, separation of DNA by agarose gel electrophoresis;

Spotters: PCR, Gel electrophoretic apparatus, pBR322, Ti plasmid.

RESEARCH METHODOLOGY & BIostatISTICS

Research methodology - index card preparation, abstract writing, manuscript writing (demonstration only); Biostatistics - Chi-Square test, Students 't' test.

COMPUTER APPLICATIONS & BIOINFORMATICS

Calculation of mean, median, mode, standard deviation and correlation coefficient, generation of standard deviation graph and regression line using MS Excel; retrieving sequence data from Entrez; retrieving research articles using PubMed; pair wise sequence alignment using BLAST and FASTA;

Spotters – computer input devices & output devices.

ENTOMOLOGY

Methods of collection and preservation of insects; identification of insects - general and major pests; study of life cycle of House fly/ Mosquito/Silkworm; sex identification of insects; study parasitic and predatory insects; insecticides and plant production applications; damages caused by insects of plant;

Spotters – beneficial insects, insect pests.

Marks distribution

Biotechnology & Nanotechnology : 20 marks
 Research Methodology & Biostatistics : 10 marks

Computer applications & Bioinformatics	:	10 marks
Entomology (insect box)	:	10 marks
Record	:	05 marks
Viva – voce	:	05 marks
Total	:	60 marks

Credit	4	Hours/Week	6	Sub Code	S3PZOEL3A	Semester	III
Medium of Instruction: English							EC3

GENERAL AND APPLIED ENTOMOLOGY

(for students admitted from the academic year 2018-2019)

Objectives:

The objectives of this course are: to understand the value and importance of insects, to identify the major orders and families of insects, and to know the insect pests and study the importance of various insect pest management methods.

Outcome

- ✓ By studying Entomology students can know the order of insects and their external characters.
- ✓ Entomology will give a knowledge regarding the beneficial and Harmful insects.
- ✓ Integrated pest management will give an idea towards the control measurements of Harmful insects to the agricultural crops.

Unit-I

General characters of class insecta. Classification of insects up to order with examples.

Insect morphology: Cuticular integument. Head and its appendages. Types of mouth parts – types of antennae and their structure. Thorax structure and its appendages. Wings: their modification and venation. Abdomen: Structure and its appendages both in pterygota and apterygota.

Unit-II

Physiology of insect growth and development. Metamorphosis: types, classification of insects based on metamorphosis – hormonal control of metamorphosis. Polyphenism and diapause. Physiology and biochemistry of insect cuticle and moulting process.

Unit-III

Agricultural entomology: Insect pests of paddy, sugarcane, cotton, ground nut and coconut. Biology, damages caused and control measures of insect pests of paddy, sugarcane, cotton, ground nut and coconut.

Unit-IV

Medical entomology: Life cycle of mosquitoes (*Culex*, *Anopheles* and *Aedes*), House fly, Sand fly and Tsetse fly. Mode of transmission of vector borne diseases through mosquitoes (malaria, encephalitis and dengue), house fly (typhoid, paratyphoid, dysentery and amoebiosis), Sand fly (Kala azar) and Tsetse fly (sleeping sickness).

Unit-V

Insect pest management: Natural, artificial, chemical and biological methods – Insecticides and their classification – Role of pheromones in insect pest management – Advantages and limitations of biological control in integrated pest management -Study of harmful and beneficial insects.

Reference Book:

Shravan M. Haldhar and Hanuman L. Deshwas (2017) Fundamentals of Agricultural Entomology, New Vishal Publications, New Delhi

Vasantharaj David, B. and Ramamurthy, V.V. (2016). Elements of economic entomology, 8th Edition, Brillion Publishing.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	6	Sub Code	S3PZOEL3B	Semester	III
Medium of Instruction: English							EC3

POULTRY FARMING

(for students admitted from the academic year 2018-2019)

Objectives:

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

On completion of this course the student will

- ✓ get basic information on various aspects of poultry farming and its role rural economy
- ✓ understand the incubation and hatching, brooding management
- ✓ Have develop knowledge on the concept, rearing and management of growers and layers.
- ✓ Know importance of different feedstuffs and their proximate composition and nutritive values
- ✓ Know to identify poultry diseases. Prevention (including vaccination schedule) and control of important diseases in poultry.
- ✓ Gaining the knowledge of Marketing the meat and eggs from the poultry farming, and increase the national economy

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

Unit-V

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

Reference Books:

Ahsan, J. and Sinha, S.P. 2003. A Hand book on Economic Zoology.S.Chand& Company Ltd., New Delhi.

Sunil Kumar Das. 1994. Poultry production, CBC Publishers and Distributors, Delhi.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	5	Hours/Week	6	Sub Code	S4PZOP4	Semester	IV
Medium of Instruction: English							CC13

IMMUNOLOGY

(for students admitted from the academic year 2018-2019)

Objectives:

The students will be able to identify the cellular and molecular basis of immune responsiveness, to describe the roles of the immune system in both maintaining health and contributing to disease and to aware the immunological disorders and techniques used in immunology.

Upon completion of this course, the students will be able to:

- ✓ Demonstrate the basic knowledge of immunological processes at a cellular and molecular level, the key mechanisms of innate, adaptive immunity and how they relate.
- ✓ Discuss the properties of antigens, importance of haptens, adjuvants and explain the structure, properties, types and functions of antibodies.
- ✓ Elucidate the types of hypersensitivity reactions, MHC, activation of complements and its biological significances.
- ✓ Outline key events in immunological disorders, transplantation immunology and autoimmune diseases.
- ✓ Understand the principles and apply basic techniques for identifying antigen antibody interactions.

Unit-I

Cells and Organs of the immune system. Types of Immunity-Innate immunity and Adaptive immunity. Humoral and cell mediated immunity. Primary and Secondary immune responses. Primary and Secondary lymphoid organs.

Unit-II

Antigens and Antibodies-Antigens- Characteristics, type, and immunogens. Immunoglobulin-classes, structure, function and types (allotype and idio type).Generation of antibody diversity-Antigen and antibody interactions. Hybridoma technology

Unit-III

Hypersensitivity-Types of hypersensitivity. Major Histocompatibility Complex (MHC) and its significance. Complements and Activation of Complements. Biological Significance of complements..

Unit-IV

Immunological disorders: Immunodeficiency diseases-Congenital and acquired immunodeficiency-Transplantation Immunology-Types of graft-Mechanism of allograft rejection. Autoimmune disorders

Unit-V

Immunotechnology: Immunodiffusion. Immuno-electrophoresis. Vaccines – types – merits and demerits. Immunological techniques: Western Blotting-ELISA-RIA- Immunofluorescence

Text books:

H VajihaBanu. 2012. A Textbook of Immunology. Lambert Academic Publishing.
S.K. Gupta. 1999. Immunology. Narosa Publishing House, New Delhi.

Reference Books

Roitt's Essential Immunology (Essentials). 2017. Peter J. Delves et al.. John Wiley Sons Pvt Ltd., Pp 541.
Abdul .K. Abbas.Andrew .K. Litchmen and Jordan, 1997, Cellular and Molecular Immunology, 3rd Edn. W.B. Saunder Comp

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	6	Sub Code	S4PZOP4	Semester	IV
Medium of Instruction: English							CC14

IMMUNOLOGY, MICROBIOLOGY, ENVIRONMENTAL BIOLOGY & EVOLUTION

Practical IV

(for students admitted from the academic year 2018-2019)

Objective:

To help the students develop skill and acquire the necessary practical knowledge on bacterial culture techniques, observation of microbes, estimation of water quality parameters, plankton identification, observation of variation and study of fossils.

Course outcome:

Students completing this course will be able to

- ✓ Perform culture media preparation, various bacterial culture and staining techniques.
- ✓ Carry out enumeration of bacterial colonies by serial dilution.
- ✓ Identify lymphoid organs in mouse and determine human blood group.
- ✓ Outline the principle of immunodiffusion and immunoelectrophoresis.
- ✓ Estimate water quality parameters and recognise the equipment used for such analysis.
- ✓ Analyse fossils, variation in finger print pattern and describe evidences of evolution.

MICROBIOLOGY

Laboratory rules; cleaning of glassware; methods of sterilization; media preparation – liquid and solid media; fixing and staining bacterial sample – simple and gram staining; enumeration of bacterial colonies by serial dilution technique; culture technique - pour plate, spread plate, **streak plate methods.**

Spotters – autoclave, Petri plate, micropipette, inoculation loop, orbital shaker, Laminar flow, **microbial incubator, colony counter, hot air oven.**

IMMUNOLOGY

Identification of lymphoid organs in a vertebrate; Determination of human blood group by haem-agglutination test and assessment of specificity of antigen antibody reaction; Immunodiffusion and immunoelectrophoresis- demonstration.

ENVIRONMENTAL BIOLOGY

Estimation of water quality parameters - dissolved oxygen, BOD, **carbon dioxide**, salinity, pH, total dissolved solids, carbonate and bicarbonate, calcium, nitrates, phosphates; Identification of freshwater and marine plankton;

Spotters - Secchi Disc, colorimeter, pH meter, thermometer, **BOD incubator.**

EVOLUTION

Study of fossils; Study of finger prints; **Spotters – homologous and heterologous organs, vestigial organs, mimicry, colouration, living fossils.**

Educational tour

Visit to biodiversity rich locations and conservation areas - National parks, sanctuaries, sea shores, museums, aquariums, research institutes.

Marks distribution

Microbiology/Immunology	20 marks
Environmental biology	15 marks
Evolution	10 marks
Educational tour report	05 marks
Record	05 marks
Viva – voce	05 marks
Total	60 marks

Credit	4	Hours/Week	6	Sub Code	S4PZOEL4A	Semester	IV
Medium of Instruction: English							EC4

MICROBIOLOGY

(for students admitted from the academic year 2018-2019)

Objective:

To understand the fundamentals of microbiology, microbial culture methods, sterilization techniques, industrial production of microbial metabolic products, etiology of human pathogens, aeromicrobiology, bacterial examination of water and microbial sewage treatment methods.

Course outcome:

Students completing this course will be able to

- ✓ Explain classification and characteristics of microbes.
- ✓ Describe bacterial culture and sterilization techniques.
- ✓ List out human pathogens.
- ✓ Give an account of aeromicrobiology.
- ✓ Apply the principle of bacterial examination of water & microbial sewage treatment methods.

Unit-I

Classification and characteristics of microbes: Scope of microbiology; classification of organisms – two kingdom concept, three kingdom concept, four kingdom concept, Whittaker's classification; Methods of classifying bacteria - numerical taxonomy, DNA-DNA hybridization, 16S rRNA sequencing; Bergey's manual of systematic bacteriology; salient features and structure of virus, bacteria, mycoplasma, rickettsia, chlamydia, actinomycetes, fungi.

Unit-II

Bacterial culture: bacterial growth curve; types of culture media; decimal dilution procedure; types of culture – batch culture, continuous culture, fed-batch culture; laboratory equipments used in microbial culture- laminar flow, microbial incubator, colony counter, bright field and phase contrast microscope.

Unit-III

Microbial control: physical and chemical methods for the control of microorganisms; antimicrobial agents - mode of action and side effects. Industrial microbiology – mineral leaching, microbial production of ethanol, biogas, citric acid, antibiotics.

Unit-IV

Medical microbiology: causative organism, pathogenicity, clinical symptoms, diagnosis, prevention and treatment of bacterial diseases – tuberculosis and syphilis; viral diseases - polio and AIDS; fungal diseases - Candidiasis and Dermatophytosis; protozoan diseases – amoebic dysentery and malaria.

Unit-V

Aeromicrobiology and aquatic microbiology: aero-microflora of hospitals and houses, aeroallergens; bacterial examination of water–standard plate count, standard multiple tube fermentation

techniques, membrane filter technique, IMViC test; microbial sewage treatment – small scale and large scale treatment.

Text Book

Ananthanarayanan and Paniker's Text Book of Microbiology. 2017. Reba Kanungo. University Press, New Delhi.

Reference Books

Microbiology. 2001. Pelczer, M.J. Reid, R.D. And Chan, E.C.S.Tata McGraw-Hill Education Pvt. Ltd, New Delhi. Pp 926.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	6	Sub Code	S4PZOEL4B	Semester	IV
Medium of Instruction: English							EC4

ENDOCRINOLOGY

(for students admitted from the academic year 2018-2019)

Objectives:

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

Course Outcomes:

After completion of this course, the students would be well versed in the following disciplines.

- ✓ Basics on diversity invertebrate and vertebrate hormones.
- ✓ Biosynthesis of hormones.
- ✓ Mechanism of hormone actions.
- ✓ Diseases associated with level of hormones.
- ✓ Hormone therapy. Industrial preparation of hormones.

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

Unit-V

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

References Books:

Barrinton, E.J.W. 1968. An introduction to general and comparative endocrinology. Academic press, New Delhi.

Bantley, P.J. 1985. Comparative vertebrate endocrinology. S. Chand and Co., New Delhi.

Mac Hadley. 1994. Endocrinology. Prentice Hall of India. New Delhi.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	6	Sub Code	S4PZOEL5A	Semester	IV
Medium of Instruction: English							EC5

ENVIRONMENTAL BIOLOGY AND EVOLUTION

(for students admitted from the academic year 2018-2019)

Course Objectives: This course will facilitate the students to acquire knowledge in fields such as ecosystem, biotic community, different types of pollutions and their impacts. This programme will also teach students the methods of evolution and speciation.

Course Outcomes:

Student completing this course will be able to.

- ✓ Describe the structure of Eco systems, biota, and Nutrient cycles.
- ✓ Summarise the biotic community, Ecological succession and population.
- ✓ Explain the various type of pollution and Environmental Impact Assessment
- ✓ Elucidate the origin of life, evidence of evolution and Darwinism.
- ✓ Summarise the evolution of man, horse, mimicry, colorations and adaptive radiation.

Unit-I

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

Unit-II

Biotic community: concepts–stratification–ecological niches–ecotone and ecological succession–population growth–biotic potential-regulation of population size–population interactions.

Unit-III

Pollution: Sources, effects and control of air, water, noise, thermal, pesticides, heavy metals and radiation pollution – Environmental Impact Assessment (E.I.A) – definition, steps and methods.

Unit-IV

Introduction to evolution: Origin of life - evidences of evolution - morphological, physiological, embryological and paleontological evidences-theories of evolution: Lamarkism, Darwinism, Modern theory of evolution.

Unit-V

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

Textbook

Ecology. Concept and Applications. Manuel C. Molles.

Essentials of Ecology. G. Tyler Miller. Brooks Cole. Pp 336.

Evolution. Barton et al., 2010. NH Barton et al. Cold Spring Laboratory.

Reference Books

Odum, E.P. 1996. Fundamental of Ecology (III Edn), Nataraj Publishers, Dehradun. Pp. 624.

Bhatia, H.S. 1998. A Text book on Environmental Pollution and Control, Galgotia, New Delhi
Clarke, G.L. 1963. Elements of Ecology, Wiley Eastern Limited. New Delhi.

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs

Credit	4	Hours/Week	6	Sub Code	S4PZOEL5B	Semester	IV
Medium of Instruction: English							EC5

ECODEVELOPMENT AND ECOTOURISM

(for students admitted from the academic year 2018)

Objectives:

To make the students equipped with principles and applications of Ecodevelopment Programmes.

Course Outcomes:

- ✓ Acquire the knowledge of principals of ecotourism and its applications.
- ✓ Get idea about the sources of eco development areas and need their protection
- ✓ Understand how to form natural and eco clubs and their managements.
- ✓ Get idea about the self-help groups and private funding agencies and their sources
- ✓ Learn about this introduction of syllabus monitoring the biosphere reserves and devolving the environmental education to all

Unit-I

Definition and Principles of ecodevelopment –Description for identification of areas–Criteria for area identification -identification of resource organizations –Baseline survey

Unit-II

Participatory Rural Appraisal (PRA) exercise –History of the area -Collection of socio-economic details -Preparation of social map-Resource map-problem analysis and prioritization-addressing the problems-SWOT analysis

Unit-III

Formation of Eco-development Committees-Micro plan preparation and its implementation–Finding funding agencies-Fund utilization–Formation of revolving fund –Community development fund –Welfare fund

Unit-IV

Formation of self help groups, Nature clubs and Eco clubs for students, Wildlife protection team – creation of alternative income generation activities –value addition and utilization of NTFP- Involvement in forest protection and gathering intelligence and information –awards and rewards

Unit-V

Study on successful eco development areas –Case studies –Periyar Tiger Reserve and Kalakkad-Mundanturai Tiger Reserves -Monitoring and evaluation of eco-development programmes, data collection, analysis and interpretation, report writing and preparation of eco-development Plan

References

Eco Development-Towards a philosophy of environmental Education -Balasubramanian and Arun, Regional Institute of Higher Education, Singapore, 1984
 Joint Forest Management -The Haryana Experience-Sarin Madhu, Centre for Environmental Education, Ahmedabad, 1996
 Microplanning Manual for Joint Forest Management areas-Bahshih Singh, Varalekshmi, Tata

Energy Research Institute, New Delhi, 1998

Question Pattern

Part A (10 x = 20)	Part B (5x5=25)	Part C (3x10=30)	Max Marks 75
Answer all the questions 2 question from each unit	Answer all the questions. Either or type- 2 question from each unit	Answer any 3 questions out of 5 questions, One question from each unit	Duration 3 hrs