PONDICHERRY UNIVERSITY
(A CENTRAL UNIVERSITY)

B.Sc. ZOOLOGY
(Choice Based Credit System)

Regulations & Syllabus

2017-18 onwards
THE UNDERGRADUATE COURSE IN ZOOLOGY

AIM AND SCOPE OF THE COURSE:

To acquire knowledge across different areas of animal science and understand the importance of animals in the biosphere.

Provides an opportunity to familiarize with the functional anatomy and mode of reproduction in different animal groups.

The topics included in different units of respective paper would enable the students to develop technical skills in Zoological and allied branches.

Skill based subjects like Vermitechnology, Clinical Laboratory Technology, Apiculture and Aquatic Biology included in order to promote their skill and provide employable opportunities in the field of higher studies and research in Government and Private organizations.

There is also scope for self-employment for the students.

Practicals included in the syllabus will improve the skills of students in microscopy, observation, drawing and laboratory techniques.

ELIGIBILITY FOR ADMISSION:

Candidate for admission to the first year of the degree of Bachelor of Science in Zoology Course shall be required to have passed the Higher Secondary Examination(10+2) (Academic – Pure science and Biology) conducted by ICSE/CBSE/any state Govt. Board or equivalent recognized by Pondicherry University.

DURATION OF THE COURSE:

The Course for the degree of Bachelor of Science in Zoology shall consist of three academic years divided into six semesters.

Each semester consists of 90 working days.

PASSING MINIMUM:

The candidate shall be declared to have passed the examination if he/she secures not less than 40 percent of Mark.
DISTRIBUTION OF MARKS:

**THEORY**

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**Continuous Internal Assessment Structure:**

- Test: 15 marks (best of 3)
- Assignment: 5 marks
- Attendance: 5 marks

Passing minimum for Continuous Internal Assessment: 10 marks (40%)
Passing minimum for University Examination: 30 marks (40%)

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**PRACTICALS**

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**Continuous Internal Assessment Structure:**

- Test: 5 marks (best of 3)
- Regularity in Record Submission: 5 marks
- Practical Attendance: 5 marks

Passing minimum for Continuous Internal Assessment: 6 marks (40%)
Passing minimum for University Examination: 14 marks (40%)
# SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc. PROGRAMME

To be implemented from 2017 -18 onwards

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DETAILS OF THE SUBJECTS FOR B.Sc. ZOOLOGY COURSE

I. DSC – DISCIPLINE SPECIFIC CORE (DSC-1A, DSC-1B, DSC-1C & DSC-1D)

(for Zoology Main Students)

Compulsory Subjects (Four papers)

1. Biodiversity of Invertebrates - (DSC-1A)
2. Biodiversity of Chordates and Vertebrates - (DSC-1B)
3. Animal Physiology -- (DSC-1C)
4. Developmental Biology -- (DSC-1D)

DSC - DISCIPLINE SPECIFIC CORE (DSC-2A & DSC-2B)

(for Botany and Chemistry Main Students)

(Two Papers)

1. Basic Zoology - (DSC-2A)
2. Animals and Human Welfare - (DSC-2B)

DSC - DISCIPLINE SPECIFIC CORE (DSC-2C & DSC-2D)

(for Non – Zoology Students)

(Two Papers)

1. Microbiology -- (DSC-2C)
2. Vector Biology—(DSC-2D)

II. SEC - SKILL ENHANCEMENT COURSES (SEC-1, SEC-2, SEC-3 & SEC-4)

(for Zoology Main Students)

(Four papers)

1. Vermitechnology – (SEC-1)
2. Clinical Laboratory Technology – (SEC-2)
3. Apiculture --- (SEC-3)
4. Aquatic biology and Culture Techniques ---- (SEC-4)
III. DSE - DISCIPLINE SPECIFIC ELECTIVES

**DSE - Fifth Semester (DSE-1)**
For Zoology Main Students (any one paper)
1. Immunology
2. Ornamental Fish Culture and Aquarium Technology

**DSE - Sixth Semester (DSE-1)**
For Zoology Main Students (any one paper)
1. Endocrinology and Reproductive Biology
2. Poultry and Dairy Science

**DSE - Fifth Semester (DSE-2 & DSE-3)**
For Zoology and other Science Students (any two paper)
1. Biochemistry and Intermediary Metabolism
2. Cell and Molecular Biology
3. Bioinstrumentation

**DSE - Sixth Semester (DSE-2 & DSE-3)**
For Zoology and other Science Students (any two paper)
1. Genetics and Biotechnology
2. Evolution and Conservation Biology
3. Biostatistics and Bioinformatics

IV. GE - GENERIC ELECTIVE (GE-1 & GE-2)
For Non Zoology Students
1. Public Health and Hygiene - (GE 1)
2. Value Added Products of Animals - (GE 2)

V. MIL - MODERN INDIAN LANGUAGES -- (MIL-1,MIL-2,MIL-3 & MIL-4)
Bengali/Hindi/Malayalam/Sanskrit/Tamil/Telugu

VI. ENGLISH -- (ENGLISH-1,ENGLISH-2,ENGLISH-3 & ENGLISH-4)

VII. AECC - ABILITY ENHANCEMENT COURSES (AECC-1 & AECC-2) (Compulsory)
1. Public Administration – (AECC-1)
2. Environmental Studies –(AECC-2)
## The Course of Study and the Scheme of Examinations

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- Any Three subject
FIRST SEMESTER

Core Paper : BIODIVERSITY OF INVERTEBRATES

Paper Code : UZOC 111

Objectives: 1. To understand Biodiversity, Habitat, Adaptation organization and taxonomic status of invertebrates.
2. Explaining the basic aspects of classification, structural and functional details of Invertebrates.

Unit I:


PROTOZOA: General characters and classification up to classes with suitable examples of Indian context. Type study – Paramecium

PORIFERA: General characters and classification up to classes with suitable examples of Indian context. Type study – Leucosolenia

Unit II:

COELENTERATA: General characters and classification up to classes with suitable examples of Indian context. Type study – Obelia,

CTENOPHORA: Classification, Salient features with suitable examples of Indian context.

Unit III:

PLATYHELMINTHES: General characters and classification up to classes with suitable examples of Indian context. Type Study: Taenia solium

ASCHELMINTHES: General characters and classification up to classes with suitable examples of Indian context. Type study: Ascaris lumbricoides

Unit IV:

ANNELIDA: General characters and classification up to classes with suitable examples of Indian context. Type study; Nereis

ARTHROPODA: General characters and classification up to classes with suitable examples of Indian context. Type study; Penaeus monodon
Unit V:
**MOLLUSCA** : General characters and classification up to classes with suitable examples of Indian context. Type study; *Unio*

**ECHINODERMATA** : General characters and classification up to classes with suitable examples of Indian context. Type study; *Asterias*.

**Suggested Readings**


FIRST SEMESTER
Core Paper Practical - 1 : BIODIVERSITY OF INVERTEBRATES
Paper Code : UZOP 114

I. DISSECTION
A. Prawn:
1. Digestive system
2. Nervous system

B. Cockroach
3. Digestive system
4. Nervous system
5. Male Reproductive system
6. Female Reproductive system

II. MOUNTING
7. Earth worm- Body setae and Penial setae
8. Mouth parts of Mosquito
9. Sting apparatus of Honey bee
10. Prawn appendages:

III – SPOTTERS ( any 30 spotters)
A- Classify giving reasons up to order:
1. Paramecium
2. Scypha
3. Aurelia
4. Fasciola
5. Ascaris
6. Neanthes
7. Penaeus
8. Lamellidens
9. Asterias

B- Draw labeled sketches:
10. L.S. Sponge
11. Obelia medusa
12. Physalia
13. Ephyra larva
14. Redia larva
15. Cercaria larva
16. Mysis larva
17. Alima larva
18. Bipinnaria larva

C- Comment on Biological significance:
19. Entamoeba
20. Paramecium – Conjugation
21. Plasmodium
22. Obelia colony
23. Velella
24. Fasciola – Miracidium
25. Taenia – Mature proglottid
26. Ascaris
27. Heteronereis
28. Trochophore larva
29. Chaetopterus
30. Peripatus
31. Hirudinaria
32. Limulus
33. Nauplius larva
34. Zoea larva
35. Chiton
36. Sepia
37. Octopus
38. Sacculina on crab
39. Sea anemone on Hermit crab

D – Relate structure and function:
40. Sponge – Spicules
41. Sponge – Gemmule
42. Taenia – Scolex
43. Neanthes – Parapodium
44. Earth worm – Penial setae
45. Penaeus – Petasma
46. Honey bee – Sting apparatus
47. Scorpion – Book – lung
48. Starfish – Pedicellaria
49. Starfish - Tube foot.
SECOND SEMESTER
Core Paper : BIO DIVERSITY OF CHORDATES AND VERTEBRATES

Paper Code: UZOC 121

Objectives : To discuss habitat, adaptations and organization of chordates.

UNIT – I
Salient Features of Phylum Chordata.

PROCHORDATA:
Characteristics and classification of Prochordata upto order level with examples
Type study: Ascidia
General topic: Origin of Chordata.

UNIT – II
PISCES
General characters and classification up to orders with examples
Type study: Shark (without endoskeleton)
General Topic: Accessory respiratory organs in fishes,

AMPHIBIA
General characters and classification up to orders with examples
Type study: Frog (without endoskeleton)
General Topic: Parental care in Amphibians

UNIT – III
REPTILIA
General characters and classification up to orders with examples
Type study – Calotes. (without endoskeleton)
General Topic: Identification of poisonous and non-poisonous snakes..

UNIT – IV
AVES
General characters and classification up to orders with examples
Type study – Pigeon (without endoskeleton)
General Topic Flight adaptations in Birds.
UNIT – V
MAMMALIA

General characters and classification up to orders with examples

Type study – Rabbit (without endoskeleton)

General Topic: Aquatic Mammals.

Suggested Readings
SECOND SEMESTER
Core Paper  Practical : BIO DIVERSITY OF CHORDATES AND VERTEBRATES
Paper Code: UZOP 124

I. DISSECTION
Fish: Digestive, Nervous system, Male and female Reproductive system

II. MOUNTING
1. Scoliodon: Placoid scales.
2. Mugil: Ctenoid scales.

III – SPOTTERS (any 30 spotters)
A- Classify giving reasons up to order:
   1. Balanoglossus
   2. Herdmania (=Ascidian)
   3. Branchiostoma (= Amphioxus)
   4. Petromyzon
   5. Scoliodon sorrakowah
   6. Mugil oeur
   7. Rana hexadactyla
   8. Calotes versicolor
   9. Columba livia
  10. Oryctolagus cuniculus
B - Draw labeled sketches:
  12. Doliolum
  13. Salpa
  14. Arboreesant organ of cat fish
  15. Accessory respiratory organ of Anabas
  16. Flight muscle of Birds
  17. Poisonous apparatus of Snake
  18. Narcine
  19. Naja naja
  20. Typhlops
C- Comment on Biological significance:
  21. Tornaria larva
  22. Ascidian Tadpole larva
  23. Anabas scandens
  24. Hippocampus
  25. Echeneis
  26. Rhacophorus
  27. Ichthyophis
  28. Amblystoma
  29. Axolotle larva
30. *Chamaeleon*
31. *Vipera russelli* (= Russel’s viper)
32. *Draco volans*
33. Bat
34. Fish - air bladder
35. Fang of Snake
36. Placoid- Scale of Shark.
37. Filter feeding structure of Whale- Balen plates
38. Quill Feather of pigeon
39. Aquatic mammals- limbs
40. Contour feather
THIRD SEMESTER

Core Paper : ANIMAL PHYSIOLOGY

Paper Code : UZOC 231

Objectives : Explaining various aspects of physiological activities of animals with special reference to mammals.

UNIT – I
Nutrition :
Types of nutrition, Food and feeding mechanisms, Digestive enzymes and their role in digestion,

UNIT – II
Respiration :
Respiratory organs, Respiratory pigments and functions. Transport of gases [Co2 and O2] - Chloride Shift, Haldane and Bohr’s effect

Circulation:
Composition, properties and functions of Blood, Mechanism of blood clotting, Structure of human heart- Cardiac cycle, Origin of heart beat, Pace maker, Regulation of heart beat, ECG, Blood Pressure, Arrhythmias

UNIT – III
Excretion :
Kidney, Nephron - structure and mechanism of urine formation in mammals,.. Osmionoregulation and thermoregulation

UNIT – IV
Muscle Physiology:
Types of muscles, Structure and chemical composition of skeletal muscle, Mechanism of muscle contraction

Nerve Physiology:
UNIT - V
Receptors:
Photoreceptor – Structure of a mammalian eye, Retina – visual pigments, Physiology of vision.
Phonoreceptor – Structure of mammalian ear, Mechanism of hearing, Physiology of equilibrium, Chemoreceptors

Suggested Readings
2. Parameswaran, Anantakrishnan and Ananta Subramanyam, 1975. Outlines of Animal Physiology,
New Delhi. 110 001.
THIRD SEMESTER

Core Paper Practical : Animal Physiology

Paper Code : UZOP 234

1. Qualitative detection of human salivary amylase in relation to either pH or temperature.
3. Detection of nitrogenous waste products (Ammonia, urea and uric acid) in fish tank water, frog tank water, bird excreta and mammalian urine/ Kidney.
4. Estimation of Haemoglobin from Human Blood
5. Determination of blood clotting time
6. Calculation of Body Mass Index (BMI)
7. Estimation of Erythrocyte Sedimentation Rate(ESR)
8. Measurement of Blood Pressure (BP)
9. Pulmonary function test by Spirometer

Spotters
1. B.P.apparatus
2. Stethoscope.
3. ECG apparatus
4. Types of Muscle cell
5. Pace Maker
6. Nerve Cell
7. Nephron
8. Spirometer
Objectives: To emphasize the importance of integrating new knowledge on Microorganisms.

UNIT-I
Scope of Microbiology
Diversity of Microbes, Broad classification of bacteria, fungi, yeast and virus.
Structure and functions of bacteria and virus, Bacterial Culture – Media & types.

UNIT-II
Microbes of the Environment
Air, Water and Soil and its role in ecosystem, Role of Microbes in Ecosystem
Bioremediation of industrial wastes, sewage treatment plants,

UNIT-III
Agricultural Microbiology
Microorganisms as biofertilizers, production and application of. Microbial biopesticides;
Mechanism of N2 fixation.

UNIT –IV
Food Microbiology:
Microbes of milk and food, Pasteurization and food spoilage. Fermentation techniques and Production of alcohol. Uses of microbes in food Industry - Bread, Vinegar,

UNIT- V
Microbial Control
Concept of Sterilization pasteurization, tyndalization; fumication, ultrasonication, and filtration.
Suggested Readings

   Orient Longman Ltd., Madras.
1. Identification of microorganisms from the habitats [simple staining, differential staining,]
2. Morphological Observation of bacterial cell.
4. Motility study of Lactobacillus – Hanging drop method

Spotters:- (any ten)
Mycoplasmas, Rickettsiae, Chlamydiae, Staphylococcus aureus, Streptococcus pneumoniae, Salmonella, HIV, Hepatitis virus and Rabies virus.
Fermentor, Bioreactors, Biofilters
THIRD SEMESTER

Skill Enhancement Paper : VERMITECHNOLOGY

Paper Code : UZOS 233

Objectives : To impart training on Earthworm culture technology
To create knowledge on Self - Employment opportunity

UNIT – I

Introduction:
Definition and concept of vermiculture. Soil: major types (red soil, black soil, alluvial soil).
Influence of soil organisms in vermitechnology- Litter degradation and decomposition.
Problems in vermiculture and remedial solutions.

UNIT – II

Types of earthworms:
Endemic and exotic species of earthworms. Ecological classification of earthworms- epigeic,
anecic and endogeic forms. Physical, chemical and biological changes caused by earthworms in
soil drilospheres and vermicasts.

UNIT – III

Vermicomposting:
Vermicomposting materials, Vermicomposting methods Small scale and large scale Factors
affecting vermicomposting - pH, moisture, temperature, Vermiculture unit - materials required
and maintenance

UNIT – IV

Vermicompost
Harvesting of vermicompost - quality, properties and advantages over chemical fertilizers,
packaging and marketing- cost benefit analysis. Vermiwash and its applications.

UNIT – V

Natural enemies of earthworms
Pests, parasites and pathogens affecting earthworms. Uses of earthworms in food and medicine
- ayurvedic and unani. Recycling of food wastes in vermitechnology.
Suggested Readings

5. Talashikar, S.C. 2008: Earthworms in Agriculture – Agrobios - India
FOURTH SEMESTER

Core Paper : DEVELOPMENTAL BIOLOGY

Paper Code UZOC 241

Objectives:
To understand ontogenesis, the development of animals including parthenogenesis and to study embryonic adaptations, human reproduction and reproductive technology in man.

UNIT – I
Introduction
Theories of developmental biology; Gametogenesis – Spermatogenesis and Oogenesis Types of eggs and egg membranes ; Fertilization – External and internal fertilization, sperm – egg interaction, physiological changes in the organization of egg cytoplasm, theories of fertilization. Parthenogenesis ,types -. Natural and artificial parthenogenesis.

UNIT – II
Cleavage
Types , Patterns and factors affecting cleavage; Types of blastula  Blastulation and Gastrulation in frog and chick, Fate maps in frog and Morphogenetic movements.

UNIT – III
Tubulation
Neurulation and organogenesis : Development of brain, eye , heart in frog ; Extra-embryonic membranes. Placentation in mammals.

UNIT-IV

UNIT V
Suggested Readings

FOURTH SEMESTER

Core Paper Practical : DEVELOPMENTAL BIOLOGY

Paper Code UZOP 244

1. Blastoderm mounting in Chick (demonstration only)
2. Study of the following prepared slides / models
3. Section of testis and Ovary [ Mammalian]
4. Slides of Mammalian sperm and ovum.
6. Study of cleavage stages 2 Cell, 4Cell, 8Cell
8. Slides of different stages of chick embryo – 18 hours [primitive streak stage], 24 hours, 48 hours 72 hours and 96 hours.
FOURTH SEMESTER

Core Paper : VECTOR BIOLOGY

Paper Code UZOC 242

Objectives:
To understand insect vectors of economic importance
To study vector born diseases and their control

Unit-1
Introduction - Scope of vector biology; Classification of insects vectors; Morphological features of Insect vectors, Mouth parts, feeding habits; Types of Vectors (mechanical and biological ), Adaptations of vectors, Reservoirs, Host Specificity

Unit-2
Dipteran insect vectors – Mosquitoes, Sand fly, Houseflies; transmission cycles ,Study of Dipteran-borne diseases – Malaria, Dengue, Filariasis; Leishmaniasis, Phlebotomus fever; cholera and dysentery

Unit-3
Siphonapteran insect vectors – Flea, transmission cycles; Study of Flea-borne diseases – Plague, Endemic Typhus.
Siphunculatan insect vectors-Human louse, transmission cycles; Study of louse-borne diseases – Relapsing fever, Trench fever.

Unit-4
Hempiteran insect vectors – Bugs, transmission cycles; Bug-borne diseases; Chagas disease, Q fever.

Unit - 5
Control of vector and vector borne diseases; Vector control- Chemical, Biological, Genetic and Environmental. Insecticide resistance in vectors. Drug resistance in pathogens. Importance of education, awareness and Community participation.
Suggested Readings


FOURTH SEMESTER

Core Paper  Practical  : VECTOR BIOLOGY

Paper Code  UZOP 245

1. Study of different kinds of mouth parts of insects

2. Study of following insect vectors through permanent slides/ photographs:
   Aedes, Culex, Anopheles, Pediculus humanus capitis, Pediculus humanus corporis, Phthirus pubis, Xenopsylla cheopis, Cimex lectularius, Phlebotomus argentipes, Musca domestica, through permanent slides/ photographs

3. Study of different diseases transmitted by above insect vectors
FORTH SEMESTER

Skill Enhancement Paper : CLINICAL LABORATORY TECHNOLOGY

Paper Code : UZOS 243

Objectives : To impart awareness on Clinical Lab Technology
To create knowledge on Self-Employment Opportunity

Unit-I

Scope of Clinical Laboratory Technology

Basic tools used clinical laboratory
Code and conduct for medical laboratory personnel, Safety measures in laboratory. Cleaning and sterilization-dry heat, moist heat, cold and UV radiations. Disposal of biomedical wastes..

Unit-II

Blood collection procedures

Capillary method, venous blood, estimation of haemoglobin. WBC total count- differential count; RBC-total count, platelet count. packed cell volume (PCV), Erythrocyte Sedimentation Rate (ESR), Blood grouping, Blood transfusion and blood banking.

Unit-III

Biochemical Analysis

Blood sugar and cholesterol estimation, Urine - Physical characterstics and Composition and examinations. Analysis of sputum and faecal matter for Infection.

Unit-IV

Screening of Parasites:


Unit-V

Diagnostic methods

X-Ray, EGC, EEG, CT, MRI, PET, Echo recording, Histopathological techniques - neoplastic tissue.
Suggested Readings

FIFTH SEMESTER

Skill Enhancement Paper : APICULTURE

Paper Code : UZOS 351

Objectives: Entrepreneur motivation for practicing apiculture as cottage industry.

UNIT I
Scope and history of Apiculture - systematic position of honeybee, Species of Honey bees , Biology and life history of Honey bee.

UNIT II
Bee colony – social organization, bee communication,swarming,pheromone. Bee hive – structure and types of bee hives, Newtons beehives. Instruments used in Apiary.

UNIT III
Site selection of apiculture, flora of apiculture – nectar,non nector and pollen plants, modern method of apiculture, Care and management of apiary.

UNIT IV

UNIT V
Economic Importance of Apiary products, Bee Keeping Industry status in India, Recent Efforts, Apiculture as self – employment venture.

Suggested Readings
1. Cherian R, & K.R. Ramanathan, 1992 – Bee keeping in India,
2. Mishra, R.C., 1985 – Honey bees and their Management in India, ICAR.
5. Rare, S. 1998-Introduction. to bee keeping, Vikas publishing house.
FIFTH SEMESTER

Specific Elective Paper : IMMUNOLOGY

Paper Code UZOE 352

Objectives : To study the process which help to maintain the organisms internal environment, when challenged with foreign substances. To understand the advances in Immunology

Unit: I
Introduction-Scope of immunology- Historical perspectives - Immunohaematology- blood groups, blood transfusion, Rh-incompatibilities; Types of immunity- innate and acquired immunity.

Unit: II
Anatomy of lympho- reticular system- primary and secondary lymphoid organs; Cells of the immune system, T and B cells receptors- activation and function.

Unit: III
Antigens- Types, properties, antigenic determinants, haptens, adjuvants. Immunoglobins- types, structure and properties, Monoclonal and polyclonal antibodies; Antigen-antibody interactions. Vaccines- types, toxoids,antitoxins.

Unit: IV
Immune responses- Primary and secondary immune response- Cell mediated and humoral immune responses, Immune responses against tumors, Immunologic tolerance and disorders, autoimmune diseases.

Unit: V
Complement system- Classical and alternate pathway, MHC-classes, haplotype, MHC and peptide interactions. Hypersensitivity reactions – types and diseases. Types of grafts, graft Vs host reactions.
Suggested Readings

FIFTH SEMESTER
Specific Elective Paper Practical : IMMUNOLOGY
Paper Code UZOP 358

1. Human Blood grouping [ABO and Rh]
2. Study of prepared slides of primary and secondary lymphoid organs.
   Thymus
   Spleen
   Bone marrow
   Lymph node.
   Peyers patches
   Bursa fabricus
   T – cell
   B- cell
   MALT
   GALT
FIFTH SEMESTER

Specific Elective Paper : ORNAMENTAL FISH CULTURE AND AQUARIUM TECHNOLOGY.

Paper Code UZOE 353

Objectives:
To impart training on Aquarium fish keeping technology
To create knowledge on self employment opportunity

UNIT – I
Importance and scope of ornamental fish culture – Economic potential, commercial and aesthetic value of ornamental fish culture, trends in ornamental fish farming in the world and in India. Taxonomy of important freshwater and marine ornamental fish of indigenous and exotic species.

UNIT – II

UNIT – III

UNIT – IV
Disease management: Common bacterial, viral, fungal, protozoan and crustacean infections - treatment and control.

UNIT – V
Aquarium design, Construction and preparation: size, shape, substrate, ornamental aquatic plants. Construction and functions of Bio-filters; aerators – accessories for fish tanks – hood and
light, nets, suction tube and maintenance of water quality: controlling ammonia build up, pH, feeding regimes.

**Suggested Readings.**

FIFTH SEMESTER

Specific Elective Paper Practical : ORNAMENTAL FISH CULTURE AND AQUARIUM TECHNOLOGY

Paper Code UZOP 358

1. Identification of Common freshwater aquarium fishes
2. Identification of Common marine ornamental fishes
3. Identification of plants and décor materials for aquarium
4. Identification, symptoms and treatment of diseases of aquarium fishes
5. Field visit: Visit to ornamental/aqua farms (Tour report submission)
FIFTH SEMESTER

Specific Elective Paper : CELL AND MOLECULAR BIOLOGY

Paper Code UZOE 354

Objectives:
To learn the structure and functions of various cellular components.
To understand the molecular basis of cell structure DNA structure and functions.

Unit – I
History of cell biology – Cell theory – Cell as the basic unit of living organism,
Difference between Prokaryotic and Eukaryotic cell, Ultra structure of an Animal Cell,
Plasma membrane – Ultra structure, chemical composition, models ( Bilayer, Unit membrane, fluid mosaic) and functions.

Unit-II.

Unit – III

Unit IV.
Nucleic acids – Molecular structure of DNA and RNA, DNA replication, Transcription, Types of RNA, Protein Synthesis (Eukaryotic), Regulation of Protein Synthesis.

Unit V.
Gene Mutation, Molecular basis of Gene Mutation (Sickle cell anemia, phenylketonuria) – Mutagenic agents - Physical and chemical. DNA Repair, DNA Recombination DNA barcoding- role of mitochondrial DNA in barcoding;
Suggested Readings:

FIFTH SEMESTER

Specific Elective Paper Practical : CELL AND MOLECULAR BIOLOGY

Paper Code UZOP 358

1. Onion root tip – squash preparation and study of mitosis
2. Chironomous larva - squash preparation of giant chromosome.
3. Squash preparation of squamous epithelial cells from buccal smear
4. Measurement of cell dimensions by using stage and ocular micrometer
5. Total count of RBC and WBC using Haemocytometer.
7. Study of prepared slides of histology.
   Columnar Epithelium
   Ciliated epithelium
   Glandular Epithelium
   Cartilage T.S.
   Bone T.S.
   Male germ cell - sperm
   Female germ cell - egg
8. Isolation and Estimation of DNA and RNA (Demonstration only)
9. Protein separation by Gel electrophoresis (PAGE) (Demonstration only)
FIFTH SEMESTER

Specific Elective Paper : BIOCHEMISTRY AND INTERMEDIARY METABOLISM

Paper Code UZOE 355

Objectives:
To define and explain the basic principles of biochemistry and metabolic pathway

UNIT I
Scope of Biochemistry – Dissociation constant of water, Hydrogen ion concentration, Buffers and electrolytes. Acidity, alkalinity and pH determination.

Unit-II

Unit-III

UNIT-IV
Intermediary metabolism-Glycolysis -TCA Cycle- Electron transport chain, Deamination, of aminoacids, B- Oxidation of fatty acids. HMP shunt pathway

UNIT – V

Suggested Readings
1. Qualitative analysis of sugar
2. Qualitative analysis of Glycogen
3. Qualitative analysis of Protein
4. Quantitative analysis of glucose
5. Quantitative analysis of protein
6. Separation of Aminoacid by Paper Chromatography
7. Enzyme Assay – Urease
8. pH meter
9. Models of biomolecules
FIFTH SEMESTER
Specific Elective Paper: BIO-INSTRUMENTATION
Paper Code UZOE 356

Objectives:
To acquire the knowledge of basic principles and applications of tools. To know the techniques for the measurement of physical, physiological, biochemical and biological factors in man and other living organism.

UNIT – I
Microscope - Principles and types of light Microscope, Phase Contrast Microscope, X-ray Microscope, Flourescence Microscope, Confocal microscope, Type of Electron Microscope (SEM and TEM)

UNIT – II
Centrifuge - Types of Centrifuge – Clinical, Refrigerated and High Speed centrifuges. pH meter and its application, Colorimeter, Spectrophotometer - Principle, Structure and Uses.

UNIT – III
Chromatography – Types - Paper, Thin layer, Column Chromatography
Electrophoresis – Types – Paper and PolyAcrylamide Gel Electrophoresis.

UNIT – IV
Blotting techniques – Southern, Northern and Western
DNA and RNA sequencing method (First, second and third generation), PCR and gene amplifier.

UNIT – V
Geiger Muller Counter, Biochemical application of radioisotopes, Radio isotopic technique – Radio Immuno assay, Autoradiography
Suggested Readings


Experiment/Spotter

1. Determination of pH by pH meter
2. Principle and Operation of Centrifuge
3. Principle and Operation of Colorimeter
4. Principle and Operation of Spectrophotometer
5. Principle and Operation of Electrophoresis
FIFTH SEMESTER
Generic Elective Paper : PUBLIC HEALTH AND HYGIENE

Paper Code UZOG 357

Objectives: To impart awareness on public health and Hygiene
To create knowledge on Health Education.

UNIT – I
Concepts of Public Health and Hygiene
Nutrition and health- Malnutrition and Over nutrition, Nutritional Deficiencies, Vitamin deficiencies.

UNIT – II
Environment and Health Hazards:
Need of Water Purification, Adulteration of Food, Undesirable Changes in Air, Radiation effects, e- waste, Solid waste and Excreta disposal

UNIT-III
Communicable diseases and their control measures:
Air Borne Disease : Tuberculosis, Influenza
Food and water Borne Disease : Amoebiasis, Jaundice
Vector Borne Disease : Malaria, Dengue
Contact Disease : Venerial disease and AIDS

UNIT – IV
Non – communicable diseases and their preventive measures:
Hypertension, Coronary Heart Diseases, Diabetes, Obesity and Tumour
Haemophilia and Sickle Cell Anaemia, Occupational health Hazards

UNIT – V
Health Education in India:
Ill Effects of Smoking, Alcoholism and drug abuse
WHO programmes, Government and voluntary Organizations – vaccination and awareness programme. First Aid- Precautions and awareness on Personal hygiene.
Suggested Readings

2. Verma, S. 1998: Medical zoology, Rastogi Publ.- Meerut- India
SIXTH SEMESTER

Skill Enhancement Paper : AQUATIC BIOLOGY AND CULTURE TECHNIQUES  
Paper Code : UZOS 361

Objectives: To study and understand the biology of fishes and make the students to know about the culture techniques of fish.

UNIT – I

Introduction-Scope of aquaculture. Classification and biology of cultivable finfishes – food and feeding, digestive enzymes and their role with food habits; Age and growth- Respiratory structure and functions; Reproduction and reproductive cycles of Catla.

UNIT – II

Marine fisheries of India- Major fisheries of India ( Sardine, Mackeral, tuna), and their characteristics; Indian major and exotic carps and their characteristics. Fishing technology-fishing craft and gear; Types of fish culture: Extensive, intensive,semi-intensive and pokkali culture- cage and pen culture . Monosex and monoculture-polyculture- advantages of polyculture - integrated fish culture.

UNIT – III

Site selection – elementary survey –design and construction of fish and prawn ponds (stocking pond and rearing pond), Maintenance and management of culture ponds. Selection criteria for cultivable species -Culture of Carp, pearl oyster.

UNIT – IV

Fish disease management: Common bacterial, viral, fungal, protozoan and crustacean diseases, their symptoms and treatment. Control of aquatic weeds, predatory and weed fish control. Feeds for cultivable species – natural, supplementary and artificial feeds.

UNIT – V

Marketing the products: Harvesting and transport -marketing the fish to local markets and for export. Quality control and norms of MPEDA for export of fishes- HACCP concept; Fish preservation-canning and freezing method. Products, byproducts and value added products of fishes.
Suggested Readings


5. B.N. Yadav, - Fish and fisheries, Daya Publishing House, Delhi.
SIXTH SEMESTER
Specific Elective Paper : ENDOCRINOLOGY AND REPRODUCTIVE BIOLOGY
Paper Code UZOE 362

Objectives: Explaining the role of hormones on physiological activities of animals with special reference to humans.

UNIT – I
Scope of Endocrinology, Endocrine glands, hormones and hormone action,
Structure, hormone secretion and functions of hypothalamus and pituitary gland
Pineal gland – circadian rhythm.

UNIT – II
Structure of thyroid gland – Biosynthesis of thyroid hormones,
Biological functions of Thyroid hormones, Regulation of Thyroid secretion
Hormones of parathyroid Glands and their biological action

UNIT – III
Adrenal Cortex – Glucocorticoids, Mineralocorticoids and their biological function
Renin Angiotensin System
Adrenal Medulla – Catecholamines – Synthesis and Biological action

UNIT – IV
Pancreatic (Islets of Langerhans) hormones – Insulin, Glucagon – Biosynthesis,
Regulation, Biological action, Gastrointestinal Hormones

UNIT – V
Male reproductive system
Structure of Testes, Biosynthesis of testosterone, Regulation and functions
Female reproduction system
Structure of Ovary, Biosynthesis of estrogen, Feed back regulation and functions
Female Reproductive Cycle – Estrous, Menstrual
Placental hormones – parturition – Lactation.
Suggested Readings

SIXTH SEMESTER

Specific Elective Paper Practical : ENDOCRINOLOGY AND
REPRODUCTIVE BIOLOGY

Paper Code UZOP 368

1. Observation of permanent slides – Pancreas, Testes, Ovary, Adrenal Pituitary

2. Test for Pregnancy

3. Fertility test
SIXTH SEMESTER

Specific Elective Paper : POULTRY AND DAIRY SCIENCE

Paper Code UZOE 363

Objectives:
To impart training on Modern Poultry and Dairy Science Technology
To create knowledge on self employment opportunity.

UNIT – I
External morphology of a fowl, Classification of fowls based on their Use.
Nutritive value of meat and egg, Meat type – Broilers, Egg type- White Leghorn, Dual purpose Varieties, Game and Ornamental purpose Varieties

UNIT-II
Management of Broilers and Egg Layers – Housing and Equipment, Brooding, feeding and health care Poultry diseases- prevention and control ( any five), Vaccination

UNIT-III
Dairy breeds of India : Cattle and Buffaloes, Native and Exotic Breeds
Nutritive value of Milk and meat, Milk synthesis and Secretion, Composition of Milk.
Artificial Insemination Programme, Merits and Demerits of Inbreeding and Outbreeding

UNIT-IV
Farm Management : Housing and Equipments of dairy forms- Feed, Care and Management of adult and newborn calves, Live Stock diseases and Management

UNIT-V
Storage and Marketing of Poultry and Dairy Products, Role of Govt. and Co operative Societies in Production and Marketing. Progressive plans to promote Poultry and Dairy technology as a Self employment Venture.
Suggested Readings
SIXTH SEMESTER

Specific Elective Paper Practical: POULTRY AND DAIRY SCIENCE

Paper Code UZOP 368

1. Identification of feathers
2. Incubation of Eggs: Temperature and humidity control.
3. Identification of eggs
4. Biochemical estimation of nutritive contents in a hen’s egg (demonstration)
5. Visit to poultry markets and study of specific marketing problems.
6. Testing freshness of Egg
7. Screening of fertilization

Spotters/Chart

1. Identification of different varieties of poultry and dairy
2. Equipments
SIXTH SEMESTER

Specific Elective Paper : EVOLUTION AND CONSERVATION BIOLOGY

Paper Code UZOE  364

Objectives :
To explain the scientific concepts of animal evolution through theories and evidences.

Unit –I


Unit –II

Theories of Evolution : Lamarckism, Neo-lamarckism, Darwinism, Neo-Darwinism, Devries concept of Mutation, Modern version of Mutation theory.

Unit –III

Origin of Species, Phylogentic and biological concept of species: Mechanisms of reproductive isolation; Models of speciation

Hardy –Weinberg law of genetic equilibrium. natural selection, mutation, genetic drift and migration.

Unit –IV

Unit – V

Threats to biodiversity: Habitat loss; invasive species, Overexploitation, Climatic changes. Anthropogenic activities: Pollution. Biodiversity management: Ex-situ and In-situ conservation. Protected areas- Wild life wealth of India, Hot spots, Restoration of damaged ecosystem and endangered population

Suggested Readings


SIXTH SEMESTER

Specific Elective Paper Practical : EVOLUTION AND CONSERVATION BIOLOGY

Paper Code UZOP 368

1. Study of Fossils
2. Field Visit to wild life sanctuaries and National parks (Tour report submission)
3. Homologous organs
4. Analogous organs
5. Industrial melanism
6. Adaptive radiation (Darwin finches)
7. Living fossils
8. Connecting link
9. Hardy Weinberg law calculation
SIXTH SEMESTER

Specific Elective Paper : GENETICS AND BIOTECHNOLOGY

Paper Code UZOE 365

Objectives:
To know the principles of genetics and to integrate biology with technology.

UNIT – I
Introduction to genetics, Basis of Mendelian Inheritance and Mendelian Laws, Interaction of Genes – Multiple Alleles – Blood Groups and their Inheritance in Human.

UNIT – II

UNIT – III

UNIT – IV

UNIT – V
Techniques of Genetic Engineering – an overview of R DNA technology, application of R DNA technology in agriculture, medicine and environment.

Suggested Readings
1) Verma P.S. and Agarwal V.K. – Concepts of Genetics
2) Rastogi V.B. A text book of Genetics, Kadarnath, Ramnath, Meerat.
SIXTH SEMESTER

Specific Elective Paper Practical : GENETICS AND BIOTECHNOLOGY

Paper Code UZOP 368

GENETICS
1. Observation of wild and Mutant forms of Drosophila.

3. Study on Normal Karyotype - male and female,

BIOTECHNOLOGY
5. Study of prepared slides, Models or specimen.
Escherichia coli
Bacteriophage
Plasmid
SIXTH SEMESTER

Specific Elective Paper : BIOSTATISTICS AND BIOINFORMATICS
Paper Code UZOE 366

Objective:
To get a basic knowledge of statistical methods and the application of information technology to the management and analysis of biological data.

UNIT –

UNIT I
Biostatistics – Definition and Scope – Collection of Data – Census and sampling methods – Variable - Discrete and Continuous.Presentation of Data – Diagrammatic representation of Bar,pie,histogram, frequency polycon, frequency curve. Concept of statistical population and sample characteristics of frequency distribution

UNIT II
Measures of central tendency-Mean, Mode and Median, Variance, Standard deviation, Standard error and Coefficient of variance. Simple Correlation, Simple Regression, Chi square test, student’s –t- test,

UNIT III
Introduction - Scope of Bioinformatics and bioinformatics resources, Principles of protein structure- Tertiary and Quarternary structure, DNA and RNA Sequencing ; Sequence alignment- pairwise and multiple sequence alignment, local and global alignment, tools of bioinformatics- BLAST,FASTA and CLUSTAL W.

UNIT IV
Biological databases- Gene Bank - NCBI, EMBL and DDBJ- Protein databases (primary,composit and secondary) SWISSPROT, PIR and PROSITE. Structure databases-PDB, CATH, SCOP, Proteomics, Genomics- Human Genome Project., metagenomics, concepts of metabolome and metabolomics.Specialised Genome database(SGD,TIGR and AceDB)
UNIT V

Suggested Readings
SIXTH SEMESTER

Specific Elective Paper Practical : BIOSTATISTICS AND BIOINFORMATICS

Paper Code UZOP 368

BIOSTATISTICS

Frequency distribution of given samples to find out arithmetic mean, median mode range and standard deviation for a biological date (Variation between any two parameters (Height & Weight)

BIOINFORMATICS

Computer components, usage of computer internet and E-mail Download and study at least two samples of Genome sequences (DNA, protein).

SPOTTERS

Parts of Computer, Copies of Genome, Sequences DNA and Proteins.
Unit-I
Products and value added products of bee keeping: Honey – bee wax, bee venom – Honey Production, chemical composition – Economic importance of Honey bee wax. Value added products of honey- Fermented honey (mead), honey paste for dressing wounds, honey jelly, honey caramels, creamed honey, comb honey, honey beer, honey fruit syrup, honey with fruits and nuts and honey gums their manufacture,

Unit –II.
Fishery products, by-products and value added products – Fish protein concentrate, fish oils- fish liver oil and body oil, squalene from shark liver oil, fish gelatin, fish glue, fish maws and isinglass, fish wafers, fish silage, fish skin leather, shark cartilage, fertilizer from fish waste, chitin and chitosan, surumi, roe, ambergris-ready to cook and ready to eat products - Additives and classes of additives.

Unit -III
Meat Products: Canned meat, Frozen meat, Cooked and Refrigerated meat, Dried and preserved meat, Cured meat, Prepared meat products, Production methods for Intermediate moisture and dried meat products, Different kinds of goat meat products -Curried goat, Goat Sausage, Goat Hamburger - Curried goat burrito; Organ products for food and pharmaceuticals.

Unit -IV
Poultry Products: Poultry meat processing operations in detail along with equipment used – Packaging of poultry products, refrigerated storage of poultry meat, by products – eggs, egg products, Whole egg powder, Egg yolk products, their manufacture, packaging and storage.

Unit -V
milks, cultures and their management, yoghurt, Dahi, Lassi and Srikhand. Milk products such as Cream, Butter, Ghee, Khoa, Cheese, condensed, evaporated, dried milk and baby food, Ice cream and Kulfi, butter milk, lactose and casein.

**Suggested Readings**


FIRST SEMESTER

Basic Zoology (for Botany and Chemistry Main)

Paper Code UZOC 112

UNIT I
General classification of Animal kingdom- general charaacterstics of Invertebrata, Chordata and Vertebrata

UNIT II
Protozan parasites of human ( Entamoeba, Trypanasoma), Canal system in sponges, Polymorphism in coelenterates, Helminth parasites of human (Tapeworm, Ascaris), Coelom and its significance.

UNIT III
Respiration in Arthropods. Metamorphosis in Insects. Economic importance of mollusca. water vascular system in Echionodermata, Larval forms in Echinodermata.

UNIT IV
Life cycle and retrogressive metamorphosis in Ascidia. Life cycle of Amphioxus. Life cycle of Balanoglossus and affinities.

UNIT V

Suggested Readings

FIRST SEMESTER
Practical : Basic Zoology (for Botany and Chemistry Main)
           Paper Code UZOP 115

I. Major Practical:

A. Prawn:
1. Digestive system
2. Nervous system

B. Cockroach
3. Digestive system
4. Nervous system

II. Minor Dissection and Mounting:

a) Earth worm - Body setae
b) Honey bee - Mouth parts
c) Mosquito - Mouth parts
d) Prawn - Appendages

III. Spotters:

Amoeba, Paramecium, Entamoeba, Plasmodium, Sycon, Obelia geniculata, Sea anemone on
hermit crab, Aurelia, Fasciola hepatica, Taenia solium, Ascaris – Male & Female, Leech, Fresh
water mussel, star fish, Amphioxus, Shark (Placoid scale), Ichthyophis, Cobra, Pigeon
(feathers) and Rabbit.

IV. Submission of Record
SECOND SEMESTER
Animals and Human welfare (for Botany and Chemistry Main)
Paper code : UZOC 122

Unit – I: Biodiversity and Human Welfare
Threats to Biodiversity - Habitat loss and Man-Wildlife conflict.
National parks, Sanctuaries and Biosphere reserves

Unit – II:
Animal husbandry:
Breeds of cattle- milk breeds- draft breeds- Dairy and Dairy products

Unit – III:
Culture:
Vermiculture, Apiculture, Pisciculture and Poultry

Unit – IV
Communicable and non-communicable diseases
Tuberculosis and Typhoid; Hepatitis (A and B), AIDS, Gonorrhea and Syphilis
Diseases of respiratory system- Asthma, Bronchitis.
Oral Cancer - cause/causative agents, symptoms, diagnostics, precaution /prevention and remedy.

Unit – V
Non – Communicable Diseases
Stress related disorders
Hypertension, Diabetes type II, anxiety, insomnia, migraine, depression (cause, symptoms, precaution and remedy)
Suggested Readings

5. Medical Biochemistry- Ambika Shanmugam.
Practical : Animal and Human Welfare Practical

(For Botany and Chemistry Main)

Paper Code UZOP 125

1. Study of animals in Nature/National park
2. Study of various breeds of cattle.
3. Visit to a Fish culture pond.
5. Identification of parasites related to syllabus
QUESTION PAPER PATTERN FOR THEORY

(MAIN AND ALLIED)

Time : 3 Hours
Max. Marks : 75

Each question paper consists of 3 Section - A, B & C

Section - A
10 x 2 = 20
Answer All questions.
All questions carry equal marks.

Section - B
5 x 5 = 25
Answer any 5 questions.
Either (or) Pattern.

Section - C
3 x 10 = 30
Answer any 3 out 5 questions.
Open Choice Pattern
QUESTION PAPER PATTERN FOR PRACTICALS

(MAIN AND ALLIED)

Time : 3 hours
Max Marks : 35

I . Question 1. Major practical (12 Marks)

II. Question 2. Minor practical (6 Marks)

III. Question 3. Spotters (4 X 3 = 12) (12 Marks)

IV. Record (5 Marks)