

St. Xavier's College (Autonomous),  
Mumbai



Syllabus of the courses offered by the  
Department of Zoology  
(2015-16)



# St. Xavier's College – Autonomous Mumbai

## Syllabus For I Semester Courses in Zoology (June 2015 onwards)

### **Contents:**

Theory Syllabus for Courses:

S.Zoo.1.01 - Invertebrate Systematics and Biomolecules

S.Zoo.1.02 - Genetics and Evolution

Practical Syllabus for Course: S.Zoo.1.PR

## F.Y.B.Sc. Zoology

S.ZOO.1.01

### INVERTEBRATE SYSTEMATICS AND BIOMOLECULES

#### Learning Objectives:

- To teach student basic classification and characteristics of invertebrates and special adaptations of these phyla
- To understand the structure and functioning of basic biomolecules.

Number of lectures: 45

#### Unit 1

##### **Invertebrate Classification:**

(15 lectures)

- Salient features and adaptations for Phyla and classes.
  - Phylum Protozoa – Reproduction and Skeleton
  - Phylum Porifera- Spicules, canal system
  - Phylum Coelenterata – Polymorphism, Corals and Coral reefs
  - Phylum Platyhelminthes – Parasitic adaptations
  - Phylum Aschelminthes – Life cycle
  - Phylum Annelida – Metamerism and Reproduction
  - Phylum Arthropoda – Metamorphosis, Mouthparts of Insects, Insect larvae
  - Phylum Mollusca – Foot and shells, Torsion
  - Phylum Echinodermata – Water vascular system

#### Unit 2

##### **Biomolecules 1:**

(15 lectures)

- Biological Micro and macromolecules – Monomeric constituents, polymers and significance of carbon.
- Proteins:
  - Amino acids: Types based on carboxylic, amino and aromatic groups
  - Peptide bond
  - Structure of proteins: Primary, secondary, tertiary and quaternary structure
  - Biological role of proteins.
- Carbohydrates:
  - Nomenclature, isomerism and classification
  - Glycosidic bond
  - Types of carbohydrates: Monosaccharides – Glucose, fructose, galactose  
Disaccharides – maltose, sucrose, lactose  
Polysaccharides – Starch, glycogen, cellulose, chitin and heparin
- Biological role of Carbohydrates



## F.Y.B.Sc. Zoology

S.ZOO.1.02

### GENETICS ANDEVOLUTION

#### Learning Objectives:

- To understand the fundamentals of Mendelian genetics and its application
- To understand the basic molecular mechanisms in Mendelian genetics
- To be acquainted with the basics of evolution and the driving forces for the same

Number of lectures: 45

#### Unit 1

##### Mendelian Genetics

(20 lectures)

- History of Mendelian genetics
- Concept of gene and allele in genetics.
- Concept of Dominance, Segregation and Independent Assortment
- Mendelian Monohybrid inheritance.
- Exceptions to Monohybrid inheritance: Lethal genes, Co-dominance and Incomplete dominance.
- Mendelian Dihybrid inheritance.
- Variations of Dihybrid inheritance: Recessive Epistasis, Dominant Epistasis, Inhibitory gene interaction.
- Multiple Alleles: Concept. Human Blood group system and Coat colour in Rabbits: Understanding the emergence of these multiple allelic system
- Cytoplasmic inheritance: Kappa particles in Paramecium, Shell coiling in Snails

#### Unit 2

##### Human Genetics

(10 lectures)

- Mendelian genetics in humans: Autosomal Dominant inheritance: Huntington's Chorea disorder, Autosomal recessive inheritance: Phenylketonuria, X-linked recessive inheritance: Duchenne muscular dystrophy, X-linked Dominant inheritance: X-linked hypophosphatemic rickets.
- Human pedigree analysis based on inheritance patterns.
- Chromosomal Abberations: - Numerical abnormality: Monosomy – Turner Syndrome; Tetrasomy/Trisomy – Down Syndrome.

#### Unit 3

##### Evolution

(15 lectures)

- Why study evolution
- Theories of Evolution:
  - Prebiotic evolution
  - Panspermia
  - Biotic evolution
- Concept of Microevolution and Co-evolution
- Concept of Variation and Genetic drift in population
- Speciation mechanisms: Allopatric and Sympatric speciation
- Isolating mechanisms in nature: Spatial, Ethological, Reproductive
- From water to land: the evolution of legs

**Recommended References:**

1. Genetics – Strickberger. CB publications
2. iGenetics – Russel.
3. Genetics – Gardener
4. Genetics – Winchester. Oxford IBH publication
5. Principles of Genetic - Sinnott, Dunn and Dobzansky. McGraw Hill Publication
6. Basic human genetics - E.J.Mange and A.P.Mange. Rastogi Publication

**Practical Course:**

1. Modification of feet in Birds
2. Modification of beaks in Birds
3. Study of fossil and living fossils: Ammonite, Trilobite, Lingula, Limulus
4. Human Pedigree analysis: X-linked recessive, X-linked dominant, autosomal dominant, autosomal recessive trait
5. Multiple alleles
6. Preparation of Co-acervates and observing its properties

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# St. Xavier's College – Autonomous Mumbai

## Syllabus For II Semester Courses in Zoology (November 2015 onwards)

### **Contents:**

Theory Syllabus for Courses:

S.Zoo.2.01 - Vertebrate Systematics and Ecology

S.Zoo.2.02 - Biotechniques and Comparative Physiology

Practical Syllabus for Course: S.Zoo.2.PR

## F.Y.B.Sc. Zoology

S.ZOO.2.01

### VERTEBRATE SYSTEMATICS AND ECOLOGY

#### Learning Objectives:

- To teach student basic classification and characteristics of vertebrates and special adaptations of these phyla
- To understand how environment affects distribution of animals

Number of lectures: 45

#### Unit 1

##### Lower Chordate classification:

(15 lectures)

- Phylum Hemichordata
- Phylum Chordata
  - Subphylum Urochordata
  - Subphylum Cephalochordata.

#### Unit 2

##### Vertebrate classification:

(15 lectures)

- Subphylum Vertebrata
  - ❖ Superclass: Agnatha
    - Class Cyclostomata
  - ❖ Superclass: Gnathostomata
    - Class Pisces – swimbladder, breeding and parental care
    - Class Amphibia – neoteny and parental care
    - Class Reptilia – adaptive radiation
    - Class Aves - Migration
    - Class Mammalia – Prototheria, Metatheria, Eutheria

#### Unit 3

##### Ecology

(15 lectures)

- Concept of Ecosystem
- Concept of energy flow, food chain and food web
- Concept of biogeochemical cycles (Carbon, oxygen, nitrogen, phosphorus and water cycles)
- Human activities affecting biogeochemical cycles
- Ecological niches and adaptation
- Biodiversity Definition of Biodiversity hotspots, benefits of biodiversity, Conservation of biodiversity, biotic and abiotic theories of species richness
- Abiotic factors and distribution patterns



### **Recommended References:**

1. Vertebrates by Kotpal
2. Chordate Zoology by Dhama and Dhama
3. Vertebrates by Jordan and Verma
4. Ecology: Principles and application by Chapman and Reiss
5. Essentials of Ecology by Tyler and Miller
6. Biodiversity by SVS Rana

### **Practical Course:**

1. Determination of pH of soil
2. Estimation of Dissolved Oxygen in the water sample
3. Estimation of Hardness of water in the water sample
4. Study and identification of Foraminiferan shells
5. Estimation of frequency, density and dominance
6. Vertebrate classification:
  - Hemichordata: Balanoglossus
  - Urochordata: Ascidia, Salpa, Herdmania
  - Cephalochordata: Amphioxus
  - Cyclostomata: Petromyzon, Myxine, Ammocoete larva
  - Pisces: Chondrichthyes – Shark, sting ray, electric ray  
Osteichthyes – Flying fish, Puffer fish and Sea horse
  - Amphibia: Frog, toad, Caecilian, salamander, Siren
  - Reptilia: Chameleon, Calotes/Gecko, turtle, tortoise, snake, crocodile,  
Phrynosoma
  - Aves: Kite, duck, Owl
  - Mammalia: Hedgehog, Bat, Guinea pig
7. Parental Care : Mid wife toad and Surinam toad
8. Neoteny : Axolotl larva
9. Adaptive radiations: sea snake, rattle snake, flying lizard

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## F.Y.B.Sc. Zoology

S.ZOO.2.02

### BIOTECHNIQUES AND COMPARATIVE PHYSIOLOGY

#### Learning Objectives:

- To help students appreciate the complexity of systems and differences in the physiology of animals.
- To understand different techniques used in biology

Number of Lectures: 45

#### Unit 1

##### Biotechniques:

(15 lectures)

- Concept of sterilization: Filtration, Dry heat sterilization, Wet sterilization, Radiation.
- Preparation of solutions: Molar, Normal, Percent solutions, PPM, PPB, Dilutions — serial dilutions
- Separation of Biomolecules:
  - Chromatography: Principle and applications i) Paper ii) Thin Layer iii) Ion exchange
  - Electrophoresis: Paper and gel (Agarose and Polyacrylamide)
- Cell counting techniques: Use of haemocytometer (by using suitable stain)
- Principles of different types of microscopes: a) Simple b) Compound c) Phase contrast d) Electron e) Fluorescence f) Confocal.

#### Unit 2

##### Comparative Physiology 1:

(15 lectures)

- Movement and locomotion:
  - Amoeboid movement
  - Ultrastructure of cilia and ciliary movement
  - Ultrastructure of myofibril and sliding filament theory
  - Action of muscle (Role of muscle in movement)
- Nutrition:
  - Animals without alimentary canal e.g. Amoeba
  - Animals with incomplete alimentary canal e.g. Hydra
  - Animals with complete alimentary canal e.g. Bird
  - Brief account of physiology of digestion in vertebrates and symbiotic digestion in Ruminants.
- Respiration:
  - Types of respiratory surfaces: Trachea, spiracles, gills, lungs of Frog and Human, Air sacs of birds.
- Circulation:
  - Types of circulating fluids: Water, coelomic fluids, lymph and blood.
  - Types of circulation: Protoplasmic streaming
  - Open and closed circulation, single and double circulation.

- Heart in Daphnia, cockroach and chordates
- Structure of cardiac muscle.

### **Unit 3**

#### **Comparative Physiology 2:**

**(15 lectures)**

- Excretion and Osmoregulation
  - Categorization of animals on the basis of principal nitrogenous excretory products
  - Ornithine cycle, formation of urea, deamination and detoxification
- Control and Coordination:
  - Nerve net in hydra and Giant nerve in Earthworm
  - Structure of a neuron
  - Physiology of neuronal function.
- Reproduction:
  - Asexual and Sexual reproduction
  - Gametogenesis, structures of egg and sperm of mammal
  - Fertilization and *in vitro* fertilization
  - Oviparity, viviparity and ovoviviparity

### **Recommended References:**

1. Principles and Techniques of Molecular biology by Wilson and Walker
2. Biochemical Methods by S.Sadasivam and A. Manickam
3. Animal Physiology by Arora
4. Principles of Anatomy and Physiology: G. J. Tortora and S.R. Grabowski, Harper Row Publishers
5. Vertebrate Zoology by Dhama and Dhama
6. Invertebrate Zoology by Dhama and Dhama

### **Practical Course:**

1. Circulatory system: Heartbeat of Daphnia, study of heart of Cockroach, Frog, Fish and Mammal
2. Respiratory system: Gills, Lungs of frog and mammal, spiracles in cockroach
3. Study of Nutritional apparatus
4. Muscle slides-smooth muscle, Striated muscle, Cardiac muscles, ultra structure of cilia
5. Observation of Giant nerve fibre and spinal cord, nervous net in hydra
6. Observation of binary fission and conjugation
7. Mounting of Septal Nephridium of Earthworm
8. Urine analysis and detection of Ammonia
9. Chromatography: TLC and Paper Chromatography
10. Demonstration of cell counter using a Haemocytometer and numerical problems using the haemocytometer
11. Study of agarose and polyacrylamide gels

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# St. Xavier's College – Autonomous Mumbai

## Syllabus For III Semester Courses in Zoology (June 2015 onwards)

### **Contents:**

Theory Syllabus for Courses:

S.Zoo.3.01- Ethology and Parasitology

S.Zoo.3.02 - Biochemistry and Information flow

S.Zoo.3.03 - Advanced Genetics and Bioinformatics

Practical Syllabus for Course: S.Zoo.3.PR

**S.Y.B.Sc. Zoology**

**S.ZOO.3.01**

## **ETHOLOGY AND PARASITOLOGY**

### **Learning Objectives:**

- To help students understand animal strategies and interactions and the importance of behaviour for survival.
- To help students gain an in depth understanding of some disease causing protozoan and helminth parasites

**Number of lectures: 45**

### **Unit 1**

#### **Animal Learning:**

**(08 lectures)**

- Associative and instrumental learning
- Insight learning and Cognition
- Constraints of learning

### **Unit 2**

#### **Ethology:**

**(19 lectures)**

- Ontogeny of behaviour and sensitive periods during development
- Environmental influence on behaviour
- Communication in animals
- Animal interactions
- Adaptive strategies (ESS) in animals
- Foraging strategies

### **Unit 2**

#### **Parasitology:**

**(18 lectures)**

- Parasites (Ectoparasites, Endoparasites, Digenetic, temporary, Permanent, Facultative)
- Hosts (Definitive, Intermediate, paratenic, reservoir)
- Morphology , mode of infection, life cycle, pathogenicity, prophylaxis and treatment of
- Protozoan parasites – *Entamoebahistolytica*, *Leishmaniadonovani*, *Plasmodium vivax*, *typanosomagambiense*, *Giardia intestinalis*.
- Helminth Parasites – *Taeniasolium*, *Ancylostomaduodenale*, *Wuchereriabancrofti*, *Ascarislumbricoides*, *Dracunculusmedinensis*

### **Recommended References:**

1. Animal Behaviour – Mechanism, Ecology, Evolution by Drickamer, Vessey, Jakob
2. Animal Behaviour – Its development, Ecology and Evolution by Robert A Wallace. Goodyear Publishing Company
3. Animal Behaviour by David McFarland. Pitman Publishing ltd
4. Textbook of Animal behaviour by F.B.Mandal. PHI
5. Behaviour by M. Dockery and M Reiss. Cambridge University press.
6. Introduction to Animal Behaviour by Manning and Dawkins. Cambridge Univ. Press
7. Animal Parasitology by JD Smyth. Cambridge University Press
8. Parasitology - Protozoology & Helminthology by K.D. Chatterjee
9. Essentials of Human Parasitology by Judith S Heelan, Frances W Ingersoll. Delmar Thomson Learning
10. Medical Parasitology - A Practical approach by S.H.Gillespie and P.M. Hawkey. Oxford Univ Press
11. Manson's Tropical Diseases – P.H. Manson. Bahr Cassell and Co. Ltd.

### **Practical Course:**

1. Identification of Protozoan parasites – Entamoeba, Leishmania, Trypanosoma, Plasmodium, Giardia
2. Identification of Helminth parasites – Taenia, Ancylostoma, Wuchereria, Ascaris, Dracunculus
3. Parasitic adaptations – Taenia (scolex, proglottid), Trypanosoma, Entamoeba, Ascaris, Giardia
4. Mounting of mouthparts of mosquito/bed bug and house fly
5. Demonstrate wing cleaning in housefly and observation of feeding behaviour
6. Study of animal interactions
  - a. Parasitism (Ecto and Endo)
  - b. Mutualism
  - c. Commensalism
7. To study antennal grooming in cockroach
8. Study of optimal foraging strategies and ideal free distribution using guppy

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**S.Y.B.Sc. Zoology**

**S.ZOO.3.02**

## **BIOCHEMISTRY AND INFORMATION FLOW**

### **Learning Objectives:**

- ❖ To learn concepts used in biochemistry and their applications

**Number of Lectures: 45**

### **Unit 1**

#### **Biochemistry:**

**(15 lectures)**

- Molecular structure of water: tetrahedral geometry, Hydrogen bond and flickering clusters, macromolecular association
- Physical and chemical properties of water: Density, specific heat, heat of vaporization, heat of fusion, surface tension. Hydrogen bonds with solutes. Interaction with non-polar compounds. Water as a reactant.
- Ionization of water,  $K_w$  ion product of water, pH scale.
- Dissociation of weak acids and weak bases, pKa,
- Henderson – Hasselbach equation.
- Titration curves of weak acids
- Buffers in biological systems

### **Unit 2**

#### **Metabolism:**

**(15 lectures)**

- Physiologic regulation
- Carbohydrate metabolism
- Lipid metabolism
- Nitrogen and Amino Acid Metabolism
- Metabolic Integration, Adaptation and Disease

### **Unit 3**

#### **Information Flow:**

**(15 lectures)**

- DNA Replication: Prokaryotes and Eukaryotes
- Transcription in Prokaryotes and Eukaryotes: initiation, elongation, termination of mRNA, RNA polymerases, Differences in transcription in prokaryotes and eukaryotes
- Translation in Prokaryotes and Eukaryotes
  - Genetic code: properties, features and 'Wobble hypothesis'
  - Structure and chemical composition of prokaryotic and eukaryotic ribosome
  - Aminoacylation of t-RNA, Activation of t-RNA, Recognition of t-RNA



Initiation of protein synthesis, chain elongation and terminatio

**Recommended References:**

1. Outlines of Biochemistry E.E. Conn and P. Stumpf Willey Eastern press
2. Textbook of Biochemistry Edward Staunton west, Wilbert Todd et al Oxford and IBH Publishing Co. Pvt. ltd
3. Harper's illustrated Biochemistry Robert Murray Daryl Granner
4. Peter A. Mayes and Victor w Rodwell Mc-Graw Hill Publication
5. Molecular cell Biology. Harvey Lodish David Baltimore Arnold Berk et al Scientific American books
6. Principles of Biochemistry by Albert Lehninger

**Practical Course:**

1. Idetification of parts of instrument (pH meter and Colorimeter) and their functions.
2. pH metry
3. Preparation of Buffers
4. Pka
5. Titration curves
6. Selection of filters for colorimetry
7. Concentration of a particular substance using colorimetry

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## S.Y.B.Sc. Zoology

## S.ZOO.3.03

### ADVANCED GENETICS AND BIOINFORMATICS

#### Learning Objectives:

- This course aims at a comprehensive understanding of genetics and its varied applications whilst shedding light on more fundamental concepts of sex determination and mutations affecting genes.
- In Bioinformatics students are exposed at a basic level to the exciting world of fusion between IT and Biology and the enormous advances and uses of this field.

**Number of Lectures: 45**

#### Unit 1

##### Genetics 1:

(15 lectures)

##### Population Genetics

- Hardy-Weinberg equilibrium
- Proof of HW equilibrium
- Exceptions to the rule
- Problems on HW equilibrium

##### Linkage Mapping

- Proof of crossing over
- Two point cross
- Three point cross
- Use of linkage analysis in gene Mapping

#### Unit 2

##### Genetics 2:

(15 lectures)

##### Sex Determination in Man

- Red herrings along the way
- The Sry story

##### Sex determination

- XX-XY, XX-XO, ZZ-ZW

##### Sex determination in *Drosophila Melanogaster*

##### Chromosomal aberrations

- Deletion, Duplication, Translocation, Inversion, non-disjunction, fragile X

##### DNA mutations

- Transition, Transversion, Insertion, Deletion, Frame shift

### Unit 3

#### **Bioinformatics:**

(15 lectures)

- ✓ http, html, ftp, ip, www, lan, wan: terms and their understanding
- ✓ Introduction to international Databanks
  - NCBI, EBI, DDBJ
  - Literature retrieval, sequence retrieval
- ✓ Sequence Analogy and Homology
- ✓ Di-deoxy DNA sequencing, Pyro sequencing

#### **Recommended References:**

1. Bioinformatics and Molecular Evolution – Higgs and Attwood. Blackwell Publishing
2. Genetics – Strickberger. CB publications
3. iGenetics – Russel.
4. Genetics – Gardener
5. Genetics – Winchester. Oxford IBH publication
6. Principles of Genetic - Sinnot, Dunn and Dobzansky. McGraw Hill Publication
7. Basic human genetics - E.J.Mange and A.P.Mange. Rastogi Publication
8. Bioinformatics and Molecular Evolution – Higgs and Attwood. Blackwell Publishing
9. Lehninger Biochemistry – Nelson and Cox

#### **Practical Course:**

1. Goodness of Fit: Chi square test
2. Validation of Mendel's Monohybrid cross using Drosophila
3. Validation of Mendel's Dihybrid cross using Drosophila
4. Problems on HW law
5. Problems on Linkage analysis
6. Labs for Bioinformatics: Literature retrieval, sequence retrieval, Global Vs Local Alignment, BLAST
7. Methods in Protein structure prediction

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# St. Xavier's College – Autonomous Mumbai

## Syllabus For IV Semester Courses in Zoology (November 2015 onwards)

### **Contents:**

Theory Syllabus for Courses:

S.Zoo.4.01- Developmental Biology and Evolution

S.Zoo.4.02 - Cell Biology

S.Zoo.4.03 - Commercial Zoology and Biostatistics

Practical Syllabus for Course: S.Zoo.4.PR

**S.Y.B.Sc. Zoology**

**S.ZOO.4.01**

## **DEVELOPMENTAL BIOLOGY AND EVOLUTION**

### **Learning Objectives:**

- This course aims at laying strong foundation for developmental biology with regard to the principles and the study of model organisms.
- This course lays the basic framework for evolutionary concepts

**Number of lectures: 45**

### **Unit 1**

#### **Developmental Biology 1:**

**(15 lectures)**

##### **Introduction to developmental biology**

- Early theories of Developmental biology
- Concept of model organisms

##### **Model Organisms: A closer look**

- Amphibians: *Xenopus laevis*
- Birds: Chicken
- Mammals: Mouse
- Invertebrate: *Drosophila melanogaster*
- Invertebrate: *Caenorhabditis elegans*

##### **Regeneration: Remembering previous existence**

- Limb regeneration: Salamander
- Regeneration in Hydra

### **Unit 2**

#### **Developmental Biology 2:**

**(15 lectures)**

##### **Body Plan: Setting up the vertebrate body axes**

- Animal vegetal axis : Amphibians
- Dorsal ventral axis: Amphibians
- Antero-posterior axis: Chick

##### **Fertilization: The Genesis**

- Concept of fertilization
- Fertilizin, Resact, ZP3
- Slow and fast block to polyspermy

##### **Morphogenesis**

- Cleavage: Holoblastic and Meroblastic
- Blastulation: *Drosophila*, Frog, Chick
- Gastrulation: *Drosophila*, Frog, Chick

### **Unit 3**

#### **Evolution:**

(15 lectures)

#### **Natural selection: The driving force in evolution??**

- Darwins idea of natural selection
- Do we really need fossils??
- The missing Link. Is anything missing???

#### **Neo Darwinism: Natural selection revisited**

- Natural selection revisited and remodified

#### **Evolution of genome/gene**

#### **Molecular evolution**

- Phylogenetics – Use of sequence to decipher distance
- Phylogenetic trees - Cladogram, Dendogram

### **Recommended References:**

1. Principles of developmental Biology – Lewis Wolpert. Oxford University Press
2. Developmental Biology 9<sup>th</sup>ed - Scott Gilbert. Sinauer associates
3. Embryology – Bhattacharya
4. Origin of Species – Charles Darwin.
5. Evolution – Strickberger. CBS publication
6. Evolution 2<sup>nd</sup> edition: Douglas Futuyama
7. What Evolution Is- Ernst Mayr

### **Practical Course:**

1. Chick embryo permanent slides (18, 24, 36, 48, 72 hours)
2. Blastula of Frog, Gastrula of Frog
3. Egg of Frog, Bird, reptile, Fish
4. Temporary preparation of Chick embryo
5. Temporary preparation of Drosophila embryo
6. Regeneration in hydra
7. Evolution in Jaw and cranium: Fish, Amphibian, Reptile, Bird, Mammal.
8. From water to land: the evolution of limb in animals
9. Constructing phylogenetic trees.

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**S.Y.B.Sc. Zoology**

**S.ZOO.4.02**

## **CELL BIOLOGY**

### **Learning Objectives:**

- ❖ To learn fundamental biochemical and physiological concepts that governs cell function and its application to understand health and disease.

**Number of Lectures: 45**

### **Unit 1**

**Introduction Membranes and Endomembrane Systems: (15 lectures)**

- Introduction to basic cell structure
- Membrane structure, Transport through membranes Diffusion and Facilitated Diffusion
- Osmosis, Active transport, Bulk transport.
- Endo membrane systems-Endoplasmic reticulum Types of Endoplasmic reticulum and Functions
- Golgi-complex and cell secretion
- Lysosomes – types of lysosome and function

### **Unit 2**

**Cell Energetics And Regulation: (15 lectures)**

- Mitochondria: Structure and ATP Synthesis
- Nuclear structure-Nuclear envelope, Nuclear Pore complex, Nucleolus
- Chromatin structure and compaction
- Giant chromosomes - Polytene chromosomes and Lampbrush chromosomes

### **Unit 3**

**Cell Cycle and Cancer Biology: (15 lectures)**

- Cell cycle – regulation of cell cycle
- Cell division- Mitosis and Meiosis
- Cell culture - Primary cell culture, organ culture, cell lines, cell viability
- Cancer Biology: Cancer and Types of Cancer, Characteristics of Cancer Cells
- Carcinogens: Physical, Chemical and Biological
- Genes and Cancer: Oncogenes and Tumor Suppressor Genes

**Recommended References:**

1. Molecular cell Biology Harvey Lodish David Baltimore Arnold Berk et al Scientific American books
2. Cell Biology, Genetics and Evolution By Verma and Aggarwal S.Chand Publication
3. Cell Biology by Pollard
4. The World of Cell Wayne M. Becker, Lewis J. Kliensmith Jeff Hardin Pearson Publication
5. Principles of Anatomy and Physiology Gerald J Tortora and Sandra Reynolds Grabowski Harper and Row Publisher
6. Biology of Disease Jonathan Phillips and Paul Murray Published by Blackwell science Ltd

**Practical Course:**

1. Study of Osmosis using Erythrocytes
2. Electron micrographs of ER, Golgi Complex, Lysosomes and Mitochondria
3. Vital staining of Mitochondrion
4. Study of Mitosis using Onion Root Tip
5. Study of polytene chromosomes from Chironomous larvae
6. Shell less embryo culture
7. Characteristics of Cancer Cells – Slides / Electron Micrographs
8. Primary Cell Culture / Cell Line Culture

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## S.Y.B.Sc. Zoology

S.ZOO.4.03

### COMMERCIAL ZOOLOGY AND BIOSTATISTICS

#### Learning Objectives:

- To emphasize the commercial aspect of the pure science of zoology
- To enable them to interpret and analyze biological data.

Number of Lectures: 45

#### Unit 1

##### Commercial Zoology

(20 lectures)

- Introduction to types of fisheries – Marine, Freshwater, Brackish
- Comparative account of fishes from the marine, freshwater and brackish waters with examples.
- Types of fisheries – Marine, Freshwater, Brackish
- Crafts & Gears – Traditional and modern
- Fish Preservation and Processing industry
- Fish uses
- Fish diseases
- SONAR, GPS, Remote Sensing
- Crustacean and Molluscan fisheries

#### Unit 2

##### Biostatistics:

(12 lectures)

- Introduction to Biostatistics
- Descriptive statistics
  - Descriptive statistical summaries – Mean, Mode, Median, Variance, Standard deviation
  - Graphic Representation – Bar graph, Histogram, Frequency polygon, Percentiles
- Random variable
- Discrete distribution
- Continuous distribution
- Central tendency
- Measures of dispersion
- Hypothesis testing
- Regression and Correlation
- Z test, t-test, ANOVA
- Probability

### **Unit 3**

#### **Applied Zoology:**

(13 lectures)

- Dairy Science
- Cattle diseases
- Aquaculture – Prawn culture, Fish culture, Pearl culture
- Vermiculture and concept of integrated farming

#### **Recommended References:**

1. A text book of Animal Husbandry – G.C. Banerjee. Oxford Publishers.
2. Wealth of India – VI: Livestock . CSIR
3. Infectious Diseases of Cattle – Rajib Deb, SSPM publication.
4. Textbook of fish diseases – Amlacher, Narendra Publishing House
5. Fish Processing Technology and Product Development – A.S. Ninawe and K. Rathnakumar, Narendra Publishing House
6. Advances in Fish Fisheries and Technology – K. P. Biswas,
7. Understanding The Sea – B.F. Chhapgar, Oxford BNHS
8. Wealth of India – IV: Fish and Fisheries CSIR
9. General and Applied Ichthyology: Fish and Fisheries – SK Gupta & PC Gupta. S. Chand Publishers
10. Fisheries – Chandy.
11. Fisheries – Bal.
12. Biostatistics: A foundation for analysis – Daniel. Wiley Publishing House
13. Biostatistics: How it works - Selvin. Cambridge Low Price edition
14. Biostatistics – PN Arora and PK Mahajan. Himalayan Publications
15. Methods in Biostatistics – BK Mahajan. JP Brothers
16. Economic Zoology – Shukla, Upadhaye. Rastogi Publications.

#### **Practical Course:**

1. Identification of: Crafts and gears.
2. Identification of: Fish, Crustaceans and Molluscs.
3. Estimation of total cholesterol from the given milk sample.
4. Estimation of total lipids from the given milk sample.
5. Estimation of reducing sugars from the given milk sample.
6. Estimation of calcium content in milk.
7. Problems in Biostatistics.
8. Study of cattle breeds.
9. Adulterants in milk.
10. Preparation of Vermicompost.

An excursion for Commercial Zoology

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# St. Xavier's College – Autonomous Mumbai

## Syllabus For V Semester Courses in Zoology (June 2015 onwards)

### **Contents:**

Theory Syllabus for Courses:

S.Zoo.5.01 - Ontogeny of Vertebrates, Behavioural Ecology  
and Conservation Biology

S.Zoo.5.02 – Physiological Adaptations

S.Zoo.5.AC– Economic Entomology – I

Practical Course Syllabus for: S.Zoo.5. PR and S.Zoo.5.AC.PR

**T.Y. B.Sc. Zoology**

**S.ZOO. 5.01**

**ONTOGENY OF VERTEBRATES, BEHAVIOURAL ECOLOGY AND  
CONSERVATION BIOLOGY**

**Learning Objectives:**

- To comprehend the development and modifications of some vertebrate systems.
- To understand the behavioural and distribution patterns of animals and interpret formulation of conservation strategies.

**Number of lectures: 60**

**Unit 1**

**Ontogeny of Vertebrate systems: (15 Lectures)**

- A) Integumentary system
- B) Circulatory system
- C) Urinogenital system

**Unit 2**

**Behavioural Ecology: (15 Lectures)**

- A) Sexual selection
- B) Mating systems
- C) Parental care.

**Unit 3**

**Population and Community Ecology: (15 Lectures)**

- A) Population growth curves, factors affecting population growth.
- B) Life tables and survivorship curves, r and k strategies, Ecological succession.
- C) Social interactions, Parasitism and Predation

**Unit 4**

**Zoogeography and Conservation biology: (15 Lectures)**

- A) Zoogeographic realms, Biogeographic classification of the Indian subcontinent, Means of dispersal and Barriers to dispersal.
- B) Island Biogeography and Wildlife Tourism.
- C) History of Conservation Biology, Population Management and Restoration (case studies)

### **Recommended References:**

1. Conservation Biology- Fred Van Dyke, Springer.
2. Against Extinction- William M.Adams,Earthscan.
3. Wildlife Tourism- D.Newsome, R.Dowling, Susan Moore, Channel View Publication.
4. Conservation Biology- Scott P.Caroll and Charles Fox, Oxford University Press.
5. Comparative Anatomy of Vertebrates- George C.Kent, Mosby Year Book.
6. Elements of Chordate Anatomy- Charles K.Weichert, McGraw Hill Publication.
7. Behavioural Ecology- E.Danchin,L.A.Giraldeau, Frank Cezilly, Oxford University Press.
8. Atlas of World Wildlife- Sir J Huxley, Mitchell Beazely Publishers Limited
9. Biology of the Vertebrates-H E.Walter and LP.Sayles,Macmillan Company.
10. Behavioural Ecology- J.R. Krebs and N.B. Davies, Blackwell Scientific Publications
11. Animal Behaviour- John Alcock, SinauerAssociates,Inc.
12. Ecology- N.S.Subramanyam and A.V.S.S.Sambamurthy,Narosa Publishers.
13. Encyclopedia of Endangered Animals- A.J.Beer and P.Morris, Grange Books.
14. Comparative Anatomy of Vertebrates- Saxena and Saxena, Viva Books.
15. Ecosystem Management- SimanteeSen, ICFAI University Press.
16. Ecology- Theories and Applications-Peter Stiling, Prentice-Hall of India.

### **Practical Course:**

1. Comparative study of the skull and girdles of frog, varanus, bird and rabbit.
2. Dissection of brain of chicken
3. Mountings of Columella of chicken, Hyoid of chicken
4. Identification of integumentary derivatives: feathers, scales (reptile), claw (bird/reptile/mammal), hooves (horse/cattle), horn, antler and teeth.
5. Mounting of epidermal derivatives.
6. Mounting of fish scales: placoid, cycloid, ctenoid.
7. Study of distinctive fauna of zoogeographic realms, and conservation status of the same
8. Study the response of housefly/cockroach to light.
9. Measure the Turbidity, and Conductivity of a given water sample.
10. Population density of Daphnia.
11. Rapid field tests for sulphates, nitrates and base deficiency in different soil samples.

A long excursion to any National Park / Sanctuary for Conservation Biology

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## T.Y.B.Sc. Zoology

## S.ZOO. 5.02

### PHYSIOLOGICAL ADAPTATIONS

#### Learning Objectives:

- The aim of this module is to encourage an awareness of the physiological nature of life.
- To develop an understanding of form, function and adaptation in organ systems central to the maintenance of life and interaction with the environment.
- As an inter-disciplinary approach to the subject there is need to understand adaptations not only on the Earth but also in the space.

### PHYSIOLOGICAL ADAPTATIONS

#### Unit 1: ENVIRONMENT, ADAPTATIONS AND SCALING

(15 Lectures)

##### A) Environment and physiological changes

###### RESPIRATION

- Gas exchange across respiratory surfaces
- Diffusion
- Partial pressures
- Models of gas exchange in vertebrates
- Effects of diving and altitude

###### Blood

- Fluid composition of blood
- Solids
- Formed Elements
- Erythrocytes and haemoglobin
- Leucocytes
- Thrombocytes and clotting mechanism
- Coping with hypoxia and anoxia

##### B) Animal Adaptations and Scaling

- Adaptation at a molecular and genomic level
  - Controlling protein synthesis
  - Controlling protein action
- Physiological regulation of gene expression by proteins
  - Signals
  - Receptors
  - Mediators
- Scaling
  - Isometric and allometric
  - Scaling of metabolic rate and locomotion

## **Unit 2: Astrobiology and physiological adaptations in space conditions(15 lectures)**

### **A) Basic Astrobiology**

- Introduction
- Basic Astronomy
- Early Earth Conditions
- Origin and Evolution of Life on the Earth
- Habitable zones
- Detection of exoplanets and SETI

### **B) Space biology**

- Revision of human physiology
- Effect of space conditions on human physiology
- Problems faced by Astronauts and solutions

## **Unit 3: OSMOREGULATION AND THERMOREGULATION (15 Lectures)**

### **A) Osmoregulation**

- Regulation in aquatic environments (marine and freshwater),
- Regulation in terrestrial environments
  - Evaporative water loss
  - Salt water ingestion and salt excretion
  - Metabolic water
  - Behavioral adaptations
- Hormonal control of water, osmotic, pH and ionic balance
- Osmoregulation in extreme environments
  - Aquatic: transient water bodies and osmotically peculiar environments
  - Terrestrial: hot and cold deserts

### **B) Thermoregulation**

- Patterns of body temperature and temperature tolerance,
- Heat exchange
  - Conduction
  - Convection
  - Radiation
- Temperature regulation in ectotherms
- Temperature regulation in endotherms
  - Concept of critical temperatures
  - Heat gain
  - Heat Loss
- Life in temperature extremes

## **Unit 4: PHYSIOLOGY OF REPRODUCTION (15 Lectures)**

### **A) Human Reproductive Systems**

- Male System
  - Anatomy and histology of the testes
  - Endocrine regulation of the male system
- Female System

- Anatomy and histology of the ovary
- Endocrine regulation of the female system

**B) Breeding cycles**

- Menstrual cycle
- Ovarian cycle
- Oestrous cycle in rats and dogs

❖ **REFERENCE BOOKS**

1. Molecular Biology of the Cell: Harvey Lodish, David Baltimore et al., Scientific American Books
2. Comparative Animal Physiology: P.C. Withers, Thomson Publishing Co.
3. Comparative Animal Physiology: Knut, Schmidt-Neilson, Cambridge
4. Principles of Anatomy and Physiology: G. J. Tortora and S.R. Grabowski, Harper Row Publishers
5. Human Physiology, Vol I: Chatterjee, Central Book Agency
6. Environmental Physiology of Animals: Pat Wilmer and Stone Graham, Blackwell publishers.
7. An Introduction to Astrobiology Edited by Iain Gilmour and Mark Sephton (2004). Cambridge University Press.

- ✓ **FIRST CIA EVALUATION** **20 Marks**
  - Six questions will be set from the portion covered, each of 5 marks. Students could attempt any four.
- ✓ **SECOND CIA EVALUATION** **20 Marks**
  - Essay Writing or MCQ's or Short question and answers
- ✓ **END SEM QUESTION PAPER PATTERN** **60 Marks**
  - Five questions will be set per unit, each of 5 marks. The students will have to answer any three.
- ✓ **Field Trip for Unit 2:** It will be an overnight sky-observation session.



**Practical Course:**

1. Identification:
  - i. T.S. of Testes
  - ii. T.S. of Ovary
  - iii. Blood of fish
  - iv. Blood of lower vertebrate (Frog)
  - v. Blood of calotes
  - vi. Blood of bird
  - vii. Blood of Camel
  - viii. Blood of Mammal
  - ix. Vaginal smear of rat
2. Differential Leucocyte Count in Humans
3. Total Leucocyte count
4. Estimation of Haemoglobin
5. Estimation of plasma proteins (Folin-Ciocalteau method)
6. Estimation of total triglycerides in blood by Phosphovanillin method
7. Fragility test
8. To study effect of osmotic fluids on paramoecium.
9. To study the effect of temperature on respiration in fish
10. Identification:
  - i. Parts of Astronaut suit
  - ii. Parts of Space shuttle and Space station that help maintain normal physiological conditions.
  - iii. Meteorite specimens
11. Group projects: Projects will be given to groups of students and will be evaluated (Practical CIA).

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**T.Y. B.Sc. Economic Entomology**

**S.ZOO. 5.AC**

**INSECT FORM AND FUNCTION, COMMERCIAL ENTOMOLOGY  
AND INSECT ADAPTATIONS**

**Learning Objectives:**

- To understand insect classification and nomenclature of insects
- To study the working of insect systems
- To understand their adaptations to the environment
- To look into some commercial applications of entomology.

**Number of lectures: 60**

**Unit 1**

**Classification of common Insects:**

**(15 Lectures)**

- A) General characteristics, with examples and economic importance of the following orders:
- Thysanura
  - Lepidoptera
  - Hemiptera
  - Coleoptera
  - Diptera
  - Orthoptera
  - Dictyoptera

**Unit 2**

**Morphology and Anatomy:**

**(15 Lectures)**

- A) Morphology and modifications of Mouth-Parts, Antennae, Wings and Legs
- B) An Outline of the Anatomy of Insects
- Digestive and Excretory system
  - Circulatory and Respiratory system
  - Nervous and Endocrine system
  - Reproductive system and development of insects
- C) Metamorphosis in insects

**Unit 3**

**Insects of Commercial importance:**

**(15 lectures)**

- A) Honey Bee (Apiculture)
- B) Silk Moth (Sericulture)
- C) Lac Insect (Lac culture)
- D) Government Agencies involved in research
- E) Introduction to feasibility report and funding agencies

**Unit 4**

**Environmental factors and Special adaptations in Insects:**

**(15 Lectures)**





# St. Xavier's College – Autonomous Mumbai

## Syllabus For VI Semester Courses in Zoology (November 2015 onwards)

### **Contents:**

Theory Syllabus for Courses:

S.Zoo.6.01 – Basics of Enzymes, Toxicology and Histology

S.Zoo.6.02 – Immunology and DNA Recombinant Technology

S.Zoo.6.AC– Economic Entomology – II

Practical Course Syllabus for: S.Zoo.6. PR and S.Zoo.6.AC.PR

## T.Y.B.Sc. Zoology

S.ZOO. 6.01

### BASICS OF ENZYMES, TOXICOLOGY AND HISTOLOGY

#### Learning Objectives:

- To understand the classification and functions of enzymes.
- To study the various effects of toxic substances in our body.
- To understand the structure and function of some of the glands in our body.

**Number of lectures: 60**

#### Unit 1

##### Enzymes:

(15 Lectures)

##### A) Introduction to enzymes

- Definition
- Structure of enzyme
- Mechanism of enzyme action
- Specificity of enzymes

##### B) Classification Of Enzymes

##### C) Factors affecting enzyme activity

- pH
- Temperature
- Substrate concentration
- Enzyme substrate
- Inhibitors:
  - a. Types of Inhibitors
  - b. Feedback Inhibition
  - c. Allosteric Regulation and Inhibition

##### D) Enzyme Kinetics – Michaelis Menten Equation and significance of $K_m$ and $V_{max}$

##### E) Enzyme Induction and Repression – Lac Operon Model

#### Unit 2

##### Basic Toxicology:

(15 Lectures)

##### A) Introduction To Toxicology

- Definition of toxicology, toxicant, toxicity,  $LC_{50}$  ,  $LD_{50}$
- Measurements of toxicants and toxicity

##### B) Class of chemicals of toxic importance

- Sources of toxic compounds
- Absorption and distribution of toxicants
- Routes of absorption in mammals
- Distribution of a Toxicant

##### C) Toxicodynamics

- D) Metabolism of toxicants
- E) Applications of toxicology
- F) Toxicity studies of liver in animals

### **Unit 3**

#### **Histology of Endocrine glands (15 Lectures)**

- A) Embryological origin, histological structure, blood supply, nervous supply, functions and abnormalities of Pituitary, Adrenal, Thyroid and Parathyroid

### **Unit 4**

#### **Histology of Exocrine glands (15 Lectures)**

- A) Embryological origin, histological structure, blood supply, nervous supply, functions of Liver, Kidney, Pancreas.

### **Recommended References:**

1. Biochemistry - Lehninger
2. Biochemistry – Harper
3. Biochemistry – Conn & Stumpf
4. Biochemistry – Deb
5. Biochemistry – Satyanarayan
6. Histology – Baileys
7. Histology – Lange
8. Anatomy and Physiology – Tortora
9. Toxicology – Casarett and Doull's
10. Modern toxicology – Hodgson Levi
11. Fundamentals of toxicology – Pandey, Shukla, Trivedi
12. Diseases of the liver and biliary system – Blackwel

### **Practical Course:**

1. Estimation of proteins from the given tissue sample
2. Effect of varying pH on Acid Phosphatase activity.
3. Effect of Inhibitor (Competitive Inhibitor-  $\text{KH}_2\text{PO}_4$ ) on Acid Phosphatase activity.
4. Effect of varying Enzyme Concentration on Acid Phosphatase activity.
5. Effect of a given pesticide on the heart beat of Daphnia.
6. To find the activity of GOT in the liver of rat/mouse.
7. To find the activity of GPT in the liver of rat/mouse.
8. Identification of the histological structure of the following glands:
  - a) Pituitary
  - b) Adrenal

- c) Thyroid
- d) Parathyroid
- e) Liver
- f) Kidney
- g) Pancreas
- h) Spleen
- i) Thymus
- j) Lymph gland



**T.Y. B.Sc. Zoology**

**S.ZOO. 6.02**

## **IMMUNOLOGY AND RECOMBINANT DNA TECHNOLOGY**

### **Learning Objectives:**

- To understand the functioning of the immune system and to know the molecules of the immune system
- To understand how the immune system counters pathogens we come across on a daily basis
- To teach students the power of recombinant DNA and strategies that are used by modern science to create the same

**Number of lectures: 60**

### **Unit 1**

#### **Immunology 1:**

**(15 lectures)**

##### A) Structure of Antibodies

- Structure of different classes of Antibodies
- Hinge region, Light chain, heavy chain
- Proteolytic cleavage of an antibody by papain and pepsin

##### B) Hypersensitivity reactions (type I to IV)

- Type I (Allergic reaction)
- Type II
- Type III
- Type IV (DTH)

##### C) Antigens: Study of Antigenic properties

- Concept of antigens and immunogens, Haptens
- Properties of an antigen
- Properties of a host cell which helps in antigen detection
- Concept of Haptens and its uses in immunology

### **Unit 2**

#### **Immunology 2:**

**(15 lectures)**

##### D) Antigen – Antibody Interactions

- Precipitation reaction – Radial immunodiffusion, Double immunodiffusion
- Agglutination reaction – Hemagglutination reaction, Bacterial agglutination
- ELISA – Indirect, Sandwich and Competitive

##### E) Vaccines

- Active and Passive immunization
- Types of vaccines – Attenuated, Recombinant vaccines, DNA vaccines, multivalent subunit vaccines

##### F) Cells and Molecules of the immune system



- Phagocytes, Basophils, Eosinophils, Mast cells, Dendritic cells, T cells, B cells, Neutrophils
  - Interleukins, Interferons, Growth factors
- G) Immune Response to Protozoan diseases and Worms
- Malaria
  - Leishmaniasis
  - Ascariasis
  - Shistosomiasis

### **Unit 3**

#### **Recombinant DNA technology 1:**

**(15 lectures)**

- A) Restriction Enzymes and their types
- Concept of RE's
  - Type I, Type II, Type III
- B) Cutting and Joining DNA – Restriction/Modification system and ligation techniques
- Mechanism of Restriction (type II)
  - Restriction modification system
  - Ligation reactions and mechanisms of ligation
- C) Vectors used in RdT – Plasmids, Cosmids, BACs, YACs
- Plasmids: introduction, concept of copy number, properties of a cloning vector
  - Cosmids: introduction, creation of a cosmid, uses
  - BACs & YACs: introduction and its uses in cloning

### **Unit 4**

#### **Recombinant DNA technology 2:**

**(15 lectures)**

- D) Cloning strategies
- Blunt end ligation, Sticky end ligation
  - Homopolymer tailing, Adapter based ligation
  - Screening strategies: Insertional inactivation, gel mobility shift assay, PCR based screening
- E) Transformation strategies
- Introduction to transformation
  - CaCl<sub>2</sub> based transformation strategy
  - Electroporation based transformation strategy
  - Virus based transformation strategy
- F) Applications of RdT
- Generation of novel drugs and therapies
  - Use of sequence as a diagnostic tool

### **Recommended References:**

1. Immunology 7ed. – Janis Kuby
2. Immunology – Janeway
3. Recombination DNA: Genes and genomes a short course – Watson, Myers.  
W.H.Freeman and Co.
4. Immunity to Parasites: How parasitic infections are controlled – Derek Wakelin.  
Cambridge University press
5. Roitt's Essential Immunology – Delves P, Martin S, Burton D, Roitt I. Blackwell  
Publishing
6. Immunology 2ed – C.V.Rao. Narosa Publication
7. Molecular Biology of the Cell – Alberts et al. Garland Science
8. Molecular cell Biology – Lodish et al. Freeman Publishers
9. Principles of RdT – Greenwood and Rai
10. Recombinant DNA technology – Ole and Primrose

### **Practical Course:**

1. ELISA (Sandwich ELISA)
2. Agglutination and precipitation reactions (Blood grouping and Rheumatoid arthritis)
3. Plasmid Isolation (pUC 18/ pUC 19) and Electrophoresis
4. Electrophoresis of serum proteins
5. Study of various kinds of vectors used: Plasmids, Cosmids, BACs, YACs
6. Restriction mapping and problems on the same
7. Restriction digestion of plasmid DNA using any two restriction enzymes
8. Transformation

## T.Y.B.Sc. Economic Entomology

S.ZOO.6.AC

### FORENSIC ENTOMOLOGY AND PEST MANAGEMENT

#### Learning Objectives:

- To understand the role of insects in crime investigation.
- To study the various measures used to control pests.
- To understand the value of insects and the role they play in the lives of human beings.
- To appreciate the intricacies of the social life of insects.

**Number of lectures: 60**

#### Unit 1

##### **Forensic Entomology & Insect Plant interaction: ( 15 Lectures)**

- A) Brief mention of common insects of forensic importance (Flies and Beetles)
- B) Collection of entomological evidence (Preservation and handling of maggots) and other climatological data during crime investigation and analysis of entomological evidence and calculation of PMI (Post Mortem Index) using maggot age and insect succession
- C) Insect Plant interaction: Courier service, lodging, boarding, crime and deception

#### Unit 2

##### **Pest Management: (15 Lectures)**

- A) Origin of pests and pest control practices
- B) Chemical control and insecticide resistance
- C) Biological control and Integrated Pest Management

#### Unit 3

##### **Economic importance of Insects: (15 Lectures)**

- A) Insects useful to man (Insect products and other uses)
- B) Insects harmful to crops, animals, and stored grain (grasshopper, locust, cotton bug, ox warble, horse bots, green bottle fly, pea weevil, rice weevil, flour beetle, rice moth)
- C) Insects of medical importance (mosquitos, tsetse fly, sand fly, flea, horsefly)

#### Unit 4

##### **Social life of Insects: (15 Lectures)**

- A) Social organization in Termites, Bees and Ants
- B) Communication in Insects using
  - Sound
  - Light
  - Pheromones

### **Recommended References:**

1. General and Applied Entomology-David & Ananthkrishnan, Tata McGraw Hill.
2. Applied Entomology-V.B.Awasthi, Scientific Publication.
3. Agricultural Pests & their control- V.B.Awasthi, Scientific Publication.
4. A manual of Practical Entomology- M.M Trigunayat, Scientific Publication.
5. Applied Entomology- Alka Prakash, & Fennemore, New Age Publishers.
6. Laboratory manual of Entomology- Alka Prakash, New Age Publishers.
7. Entomology & Pest Management- Larry.P.Pedigo & Rice, Pearson Education.
8. Destructive and Useful Insects- Metcalf & Flint, McGraw Hill Publication.
9. Insect Year Book of Agriculture- American Agriculture Department Publication.
10. Public Health Pests- N.R.H.Burgess, Chapman & Hall.

### **Practical Course:**

1. Identification of insect products: Silk, Shellac, Honey and Beeswax.
2. Identification of harmful insects: Grasshopper, locust, Cotton bug, Oxwarble, Horsebot, green bottle fly, Pea weevil, Flour beetle, Rice Weevil, Rice Moth, Mosquitos- (anopheles, aedes, culex), Sandfly, Tsetse fly, horse fly, flea.
3. Identification of castes of social insects: Termite - queen, worker, soldier (nasute and mandibulate), Honeybee - queen, drone, worker, Ant - reproductives and worker.
4. Mounting of mouthparts, sting and legs of honeybee.
5. Identification of insects with respect to mode of communication: Cicada, Firefly and Moth.
6. Identification of insects of forensic importance: Fleshfly, Blowfly, Clown beetle, and Rove beetle, hide beetle.
7. Forensic entomology- Case studies.
8. Study of LC<sub>50</sub> of Nicotine on a suitable organism (mosquito larvae, chironomous larvae or daphnia).
9. Identification and working of food lure and pheromone trap
10. Identification of biological control agents: Ichneumon wasp, Lady bird beetle and Red ant.

Field visit to Central Bee Research Institute Pune / Kokan Krishi Vidyapeeth Dapoli

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