



# St. Xavier's College – Autonomous Mumbai

## Syllabus For VI Semester Courses in Zoology (November 2016 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

### BASIC STUDY OF ENZYMES, TOXICOLOGY, HISTOLOGY AND NANOSCIENCE

#### 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.
- To learn basics of nano-particles.

**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:
  - Types of Inhibitors
  - Feedback Inhibition
  - 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:

##### **Basics of 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) Histology of Liver and its role in toxicity study

### **Unit 3:**

#### **Histology of endocrine and exocrine glands**

**(15 lectures)**

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

### **Unit 4:**

#### **Basics of nanoscience**

**(15 lectures)**

- A) Introduction to nanotechnology and nanoscience  
B) Types of nanoscale materials  
C) Techniques used in synthesis of nanoscale materials  
D) Stabilization of nanoparticles and capping agents  
E) Characterization methods to study nanomaterials  
F) Applications of nanomaterials

#### **❖ Recommended References**



1. Biochemistry - Lehninger
2. Biochemistry – Harper
3. Biochemistry – Conn and 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 – Blackwell
13. Nanoscale Science and Technology – Kelsall, Hamley and Georgehegan
14. A laboratory course in nanoscience and nanotechnology
15. Nanotechnology – Jeremy Ramsden
16. Nanotechnology application and markets – Lawrence Gasmen
17. Nanotechnologies Hazards and Resource Efficiency - Steinfeldt

#### **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



**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
9. Identification of glands of immunological significance - Thymus, Lymph gland and Spleen

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