



St. Xavier's College – Autonomous Mumbai

Syllabus For VI Semester Courses in Zoology (November 2019 onwards)

Contents:

Theory Syllabus for Courses:

SZOO0601– Basics of Enzymes, Toxicology and Histology

SZOO0602– Immunology and DNA Recombinant Technology

SZOO06AC– Economic Entomology – II

Practical Course Syllabus for: SZOO6PR and SZOO6ACPR

T.Y.B.Sc. Zoology

SZOO0601

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.

UNIT 1

ENZYMES

(15 lectures)

- Introduction to enzymes
 - Definition
 - Structure of enzyme
 - Mechanism of enzyme action
 - Specificity of enzymes
- Classification Of Enzymes
- Factors affecting enzyme activity
 - pH
 - Temperature
 - Substrate concentration
 - Enzyme substrate
 - Inhibitors:
 - Types of Inhibitors
 - Feedback Inhibition
 - Allosteric Regulation and Inhibition
- Enzyme Kinetics – Michaelis Menten Equation and significance of K_m and V_{max}
- Enzyme Induction and Repression – Lac Operon Model

UNIT 2

BASICS OF TOXICOLOGY

(15 lectures)

- Introduction To Toxicology
 - Definition of toxicology, toxicant, toxicity, LC_{50} , LD_{50}
 - Measurements of toxicants and toxicity
- Class of chemicals of toxic importance
 - Sources of toxic compounds
 - Absorption and distribution of toxicants
 - Routes of absorption in mammals
 - Distribution of a Toxicant
- Toxicodynamics
- Metabolism of toxicants
- Applications of toxicology
- Histology of Liver and its role in toxicity study

UNIT 3

HISTOLOGY OF ENDOCRINE AND EXOCRINE GLANDS (15 lectures)

- 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)

- Introduction to nanotechnology and nanoscience
- Types of nanoscale materials
- Techniques used in synthesis of nanoscale materials
- Stabilization of nanoparticles and capping agents
- Characterization methods to study nanomaterials
- 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

CIA modalities:

CIA I – Short answers for 5 marks each, with options

CIA II – Multiple choice questions

Practical Course:

1. Estimation of proteins from the given tissue sample
2. Effect of varying pH on Acid Phosphatase and Amylase activity.
3. Effect of Inhibitor (Competitive Inhibitor- KH_2PO_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 specific activity of GOT in the liver of rat/mouse.
7. To find the specific activity of GPT in the liver of rat/mouse.
8. Bio synthesis of Silver nano particles
9. Synthesis of Carbon nano particles
10. Identification of the histological structure of the following glands:
 - a) Pituitary
 - b) Adrenal
 - c) Thyroid
 - d) Parathyroid
 - e) Liver
 - f) Kidney
 - g) Pancreas

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T.Y. B.Sc. Zoology

SZOO0602

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

UNIT 1

IMMUNOLOGY 1

(15 lectures)

- Organs of the immune system: Spleen, Lymph and Thymus
- 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
- Antigen Processing and Presentation
- Structure of Antibodies
 - Structure of different classes of Antibodies
 - Hinge region, Light chain, heavy chain
 - Proteolytic cleavage of an antibody by papain and pepsin

UNIT 2

IMMUNOLOGY 2

(15 lectures)

- Hypersensitivity reactions (type I to IV)
 - Type I (Allergic reaction)
 - Type II
 - Type III
 - Type IV (DTH)
- Vaccines
 - Active and Passive immunization (herd immunity) and the need for Immunization
 - Types of vaccines – Attenuated, Recombinant vaccines, DNA vaccines, multivalent subunit vaccines
- Transplant biology
- ELISA – Indirect, Sandwich and Competitive
- Immune evasion by parasites
 - Malaria

- Leishmania

UNIT 3

RECOMBINANT DNA TECHNOLOGY 1

(15 lectures)

- Restriction Enzymes and their types
 - Concept of RE's
 - Type I, Type II, Type III
- Cutting and Joining DNA – Restriction/Modification system and ligation techniques
 - Mechanism of Restriction (type II)
 - Restriction modification system
 - Ligation reactions and mechanisms of ligation

UNIT 4

RECOMBINANT DNA TECHNOLOGY 2

(15 lectures)

- Cloning strategies
 - Blunt end ligation, Sticky end ligation
 - Homopolymer tailing, Adapter based ligation
 - Screening strategies: Insertional inactivation, gel mobility shift assay, PCR based screening
- Transformation strategies
 - Introduction to transformation
 - CaCl₂ based transformation strategy
 - Electroporation based transformation strategy
 - Virus based transformation strategy

Recommended References:

1. Kuby Immunology 7ed. – Owen, Punt, Stranford. MacMillan public education (Int. Ed)
2. Janeway's Immunology 9th ed - Kenneth Murphy & Casey Weaver. Garland Science publishers
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 11th ed– 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 gene manipulation and Genomics 7th ed- Sandy Primrose and Richard Twyman. Wiley Blackwell Publishers

CIA modalities:

CIA I – Short answers for 5 marks each, with options

CIA II – Multiple choice questions

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
10. Project or Model Making

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T.Y.B.Sc. Applied Component

SZOO06AC

PEST MANAGEMENT (IRM) AND FORENSIC ENTOMOLOGY

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.

UNIT 1

FORENSIC ENTOMOLOGY & INSECT PLANT INTERACTION

(15 Lectures)

- Brief mention of common insects of forensic importance (Flies and Beetles)
- 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
- Insect Plant interaction – Role of wild pollinators

UNIT 2

PEST MANAGEMENT

(15 Lectures)

- Chemical control and insecticide resistance
- Biological control and Integrated Pest Management
- Pests of Veterinary, Agriculture and Medical importance

UNIT 3

INSECT COLOURS AND MIMICRY

(15 Lectures)

- Pigment production in insects
- Mechanisms and types of iridescence in insects
- Mimicry
 - Batesian Mimicry
 - Mullerian Mimicry
 - Mertensian Mimicry

- Biomimicry
 - Mirasol display tech- & camouflage gear – inspired by animals that produce structural colour
 - Mimicking the termite mound structure - buildings with temperature regulation

UNIT 4

INSECT COMMUNICATION

(15 Lectures)

- 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.

CIA modalities:

CIA I – Short answers for 5 marks each, with options

CIA II – Multiple choice questions

Practical Course:

1. 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), Sand fly, Tsetse fly, Horse bot, Pink ball worm
2. Identification of castes in Ants: Reproductives, worker and Soldier
3. Mounting of mouthparts, sting and legs of honeybee.
4. Identification of insects with respect to mode of communication: Cicada, Firefly and Moth.
5. Identification of insects of forensic importance: Fleshfly, Blowfly, Clown beetle, and Rove beetle, Hide beetle.
6. Study of LC₅₀ of Nicotine on a suitable organism (mosquito larvae, chironomous larvae or daphnia).
7. Effect of Fumigants on stored grain pest
8. Identification and working of food lure and pheromone trap
9. Identification of biological control agents: Ichneumon wasp, Lady bird beetle and Red ant.
10. Project or model making

Field Trip: Visit to Central Bee Research Institute Pune / Kokan Krishi Vidyapeeth Dapoli/ Bee keeping Centre, Mahabaleshwar
