DISCIPLINE SPECIFIC ELECTIVE COURSE: **ALS ZOO DSE 09**

MODERN TOOLS AND TECHNIQUES FOR ENTOMOLOGICAL RESEARCH

Credits distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practicals/ Practice		
Modern tools and Techniques for Entomological research **ALS ZOO DSE 09**	4	2	Nil	2	Appeared in Sem-VI	

Learning Objectives:

The learning objectives of this course are as follows:

- To understand modern techniques used in biotechnology for research, diagnostics, and industrial applications.
- To learn the principles, applications, and limitations of bioinstrumentation methods.
- To gain hands-on experience in the operation and maintenance of advanced instruments.
- To develop critical thinking to select and apply suitable techniques for solving specific biological problems.
- To learn to interpret experimental data and troubleshoot issues in instrumentation.

Learning Outcomes:

By studying this course, students will be able to:

- Gain a better understanding of diverse cellular processes and cellular interactions.
- Explain the principles and working mechanisms of advanced instruments in biotechnology.
- Demonstrate proficiency in operating instruments such as spectrophotometers, chromatographs, and PCR machines.
- Design experiments using advanced techniques like chromatography, electrophoresis, and mass spectrometry.
- Analyze experimental data generated by advanced bioinstrumentation.

- to apply biotechnological tools to solve problems in diagnostics, genomics, proteomics, and drug discovery.

Theory: **30h**

UNIT-1: Overview of Basic instruments used in Entomology laboratory **4 h**

Microscopes: Principles and applications of various microscopes, Laminar-Flow Hood, Autoclave, Centrifuge, Hamocytometer, Incubator, Cryostorage Container, pH meter. 2 h

UNIT-2: Spectroscopic Techniques **8 h**

Principles and Applications: UV-Visible spectroscopy, Fluorescence spectroscopy, Advanced Techniques: Infrared (IR) spectroscopy, Atomic Absorption Spectroscopy (AAS), and Nuclear Magnetic Resonance (NMR). Applications: Structure determination, protein folding studies and biomolecular interactions.

UNIT-4: Chromatography and Electrophoresis 6 h

Chromatography: Principles, instrumentation, and applications of HPLC, Gas Chromatography (GC), and Ion Exchange Chromatography. Electrophoresis: Polyacrylamide Gel Electrophoresis (PAGE), Agarose Gel Electrophoresis, 2D Gel Electrophoresis. Applications in genomics and proteomics. Mass Spectrometry (MS): Principles, instrumentation, and applications.

UNIT-4: Molecular Biology Techniques **10 h**

Polymerase Chain Reaction (PCR): qPCR, RT-PCR, and digital PCR. DNA Sequencing: Sanger sequencing and Next-Generation Sequencing (NGS). CRISPR-Cas9 Technology: Gene editing and applications. Biosensors: Principles, components, and applications in diagnostics.

Practicals **60 h**

(Laboratory periods:15classes of 4 hours each)

1. Chromatography Techniques: Separation of biomolecules using Chromatography.

2. Electrophoresis techniques: SDS-PAGE for protein separation.

3. Amplification of DNA. Gel documentation and analysis of PCR products.

4, Imaging Techniques: Demonstration of SEM/TEM.

5. Biosensors: Demonstration of glucose biosensors and ELISA techniques.

Project related to topics covered in theory/ project report based on visit to labs/ institutions/industry.

Essential/recommended readings

1. Principles and Techniques of Biochemistry and Molecular Biologyby Keith Wilson and John Walker, 7th Edition (2010), Cambridge University Press.
2. Biophysical Chemistry: Principles and Techniques by Upadhyay, Upadhyay, and Nath, Revised Edition (2020), Himalaya Publishing.

3. IntroductiontoSpectroscopybyDonaldL.Paviaetal,5th Edition (2015), Cengage Learning.
4. Bioinstrumentation by John G. Webster,1st Edition (2004), Wiley-Interscience.

Suggested readings

1. Fundamentals of Analytical Chemistry by Douglas A. Skoog et al., 9th Edition (2013), Cengage Learning.
2. Molecular Biology of the Gene by James D. Watson etal., 7th Edition (2013), Pearson.
3. Chromatography: Principles and Instrumentation byB.K. Sharma, Revised Edition (2007), Goel Publishing House.

NOTE: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.