



CERTIFICATE COURSE
Methods in

MOLECULAR BIOLOGY AND BIOINFORMATICS

Course Highlights

- Molecular Biology
- Tools in Bioinformatics
- Theory and Practical sessions in Bioinformatics

Hybrid Mode

Course Coordinator



Fr Royston Madtha SJ
Department of Biotechnology

DEPARTMENT OF BIOTECHNOLOGY
ST ALOYSIUS COLLEGE
(AUTONOMOUS), MANGALURU

Course Title:

"Molecular Biology and Bioinformatics: Techniques and Tools for Data Analysis"

Course Description:

This course is designed to introduce participants to the essential techniques and tools used in molecular biology and bioinformatics. With a blend of theoretical concepts and hands-on training, participants will learn about experimental methods, molecular data analysis, and bioinformatics tools to enhance their research capabilities in the biological sciences. The course is ideal for students, researchers, and professionals looking to deepen their understanding of molecular biology techniques and apply computational methods for data analysis.

Learning Objectives:

By the end of this course, participants will:

- Understand core molecular biology techniques used in experimental research.
 - Learn the use of essential laboratory tools and instruments in molecular biology.
 - Gain basic proficiency in bioinformatics, including database navigation and analysis tools.
 - Develop skills to analyze molecular data using bioinformatics software.
 - Be able to critically evaluate molecular data and apply bioinformatics approaches in research projects.
-

Target Audience:

- Undergraduate and graduate students in biology, biotechnology, and life sciences.
 - Early-career researchers in molecular biology and genetics.
 - Professionals looking to enhance their skill sets in bioinformatics.
-

Course Structure:

The course consists of **5 modules**, with a mix of lectures, hands-on practical sessions, assignments, and project work. Each module builds on the previous one, progressing from basic techniques to advanced bioinformatics tools.

Course Modules:

Module 1: Methods in Molecular Biology

- Introduction to molecular biology and experimental techniques.
- DNA extraction, PCR, and gel electrophoresis.
- Sequencing techniques (Sanger, NGS).
- Lab: Hands-on DNA extraction and PCR.

Module 2: Tools for Molecular Data Analysis

- Overview of tools used in molecular biology (centrifuges, spectrophotometers, etc.).
- Introduction to molecular cloning techniques and CRISPR.
- Lab: Use of molecular biology instruments, data collection.

Module 3: Fundamentals of Bioinformatics

- Introduction to bioinformatics and its role in biological research.
- Understanding DNA, RNA, and protein sequence analysis.
- Basics of sequence alignment: BLAST, ClustalW.
- Lab: Running BLAST queries for gene and protein identification.

Module 4: Bioinformatics Databases

- Overview of key bioinformatics databases (NCBI, EMBL, UniProt).
- Data retrieval from genomic and proteomic databases.
- Understanding database annotations and their biological relevance.
- Lab: Exploration of major bioinformatics databases.

Module 5: Bioinformatics Tools for Data Analysis

- Introduction to computational tools for molecular data analysis (Geneious, MEGA, etc.).
- Phylogenetic analysis and evolutionary biology techniques.
- Protein structure visualization and analysis (PyMOL, Swiss-Model).
- Lab: Performing phylogenetic analysis and protein structure prediction.

Assessment and Evaluation:

- **Quizzes and assignments** after each module to assess understanding.
- **Final project:** Analyzing a given set of molecular data using bioinformatics tools, preparing a report and presentation.
- **Lab practicals** to evaluate hands-on proficiency.