

## Interdisciplinary Studies – RESEARCH METHODOLOGY

Total Hours: 60 Credits: 4

### Unit I: Introduction to Research Methodology

- Definition, nature, and scope of research
- Types of research: Basic, Applied, Translational, Interdisciplinary
- Steps in the research process
- Formulation of a research problem and hypothesis
- Designing experiments and selection of controls
- Review of literature — use of databases (PubMed, Scopus, Web of Science)
- Reference management tools (Mendeley, Zotero, EndNote)
- Research metrics and indexing systems

### Unit II: Core Molecular Biology Research Techniques

- Isolation and quantification of DNA, RNA, and proteins
- Polymerase Chain Reaction (PCR, RT-PCR, qPCR)
- Gel electrophoresis and blotting techniques
- Gene cloning and expression analysis
- Advanced techniques: CRISPR-Cas9, RNA interference, Next-Generation Sequencing (NGS)
- Introduction to omics approaches: Genomics, Proteomics, and Metabolomics

### Unit III: Scientific Communication, Proposal Writing, and Ethics

- **Scientific and Technical Writing**
  - Structure of a thesis, dissertation, and journal article
  - Abstract, Introduction, Materials & Methods, Results, and Discussion sections
- **Proposal and Grant Writing**
  - Funding agencies: DBT, DST, CSIR, ICMR, SERB — formats and key components
- **Presentation Skills**
  - Poster and oral presentation techniques
- **Publication and Research Ethics**
  - Intellectual honesty, research integrity, and scientific misconduct (FFP)
  - Plagiarism detection tools (Turnitin, iThenticate)
  - Conflicts of interest, authorship guidelines, and predatory publishing
  - Best practice guidelines: COPE, WAME, and open access initiatives

### Unit IV: Biostatistics

- Data collection and presentation of data
- Measures of central tendency: Mean, Median, Mode
- Measures of dispersion: Standard deviation and variance
- Correlation coefficient and regression

### Unit V: Data Analysis

- Parametric and non-parametric tests
- Student's *t*-test, Chi-square test, and ANOVA
- Qualitative analysis, questionnaire design and validation, interviews
- Basics of computers: Types, servers, operating systems (Windows, UNIX, Linux)
- Use of software tools for statistical analysis and data visualization