Interdisciplinary Studies - RESEARCH METHODOLOGY -SYLLABUS 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 control selection
- Review of literature — use of databases (PubMed, Scopus, Web of Science)
- Reference management (Mendeley, Zotero, EndNote)
- Research metrics and Indexing.

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
- Protein purification and analysis (ELISA, Western blot)
- Advanced techniques: CRISPR-Cas9, RNA interference, Next-Generation Sequencing (NGS)
- Introduction to omics approaches (genomics, proteomics, metabolomics)

Unit III: Scientific Communication and Dissemination

- **Technical and Scientific Writing**
  – Structure of a thesis, dissertation, and journal article
  – Abstract, introduction, materials & methods, results, and discussion
- **Proposal and Grant Writing**
  – Funding agencies (DBT, DST, CSIR, ICMR, SERB) and proposal format
- **Presentation Skills**
  – Poster and oral presentation techniques
- **Citation and Referencing**
  – APA, Vancouver, Harvard styles
  – Plagiarism detection tools (Turnitin, iThenticate)

Unit – IV Biostatistics Principles and practice of statistical methods in biological research

- Data collection and presentation of Data
- Measures of central tendency – Mean, Median, Mode,
- Correlation coefficient,
- Standard deviation
- Student ‘t’ test,
- chi-square test.
- Analysis of variance (ANOVA) and its uses.
- Basics of computers – types, servers, operating systems – Windows, UNIX and Linux.
- Parametric and Non parametric test,
- Qualitative analysis, Questionnaire designing and validation, Interview

Unit – V Research and Publication Ethics (Theory) (15 Hours)

PHILOSOPHY AND ETHICS: (3 Hours)

1.Introduction to philosophy: definition, nature and scope, concept, branches 2. Ethics: definition, moral philosophy, nature of moral judgments and reactions.

SCIENTIFIC CONDUCT: (5 Hours)

1.Ethics with respect to science and research 2. Intellectual honesty and research integrity 3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP) 4. Redundant publications: duplicate and overlapping publications, salami slicing 5. Selective reporting and misrepresentation of data,

PUBLICATION ETHICS:(7 Hours)

1.Publication ethics: definition, introduction and importance 2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. 3. Conflicts of interest 4. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types 5. Violation of publication ethics, authorship and contributor ship 6. Identification of publication misconduct, complaints and appeals 7. Predatory publishers and journals

RESEARCH AND PUBLICATION ETHICS (PRACTICE) (15 HOURS) (INTERNAL)

OPEN ACCESS PUBLISHING:(4 Hours) 1. Open access publications and initiatives 2. 2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies 3. Software tool to identify predatory publications developed by SPPU 4. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

PUBLICATION MISCONDUCT:(4 Hours) (A) Group Discussions: 1. Subject specific ethical issues, FFP, authorship 2.Conflicts of interest, 3. Complaints and appeals: examples and fraud from India and abroad (B) Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools,

DATABASES AND RESEARCH METRICS:(7 Hours) (A) Databases: 1. Indexing databases 2. Citation databases: Web of Science, Scopus, etc. (B) Research Metrics: 1. Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score 2. Metrics: h-index, g index, i10 index, altimetric. Introduction to philosophy: definition, nature and scope, concept, branches 2. Ethics: definition, moral philosophy, nature of moral judgments and reactions.