Course contents for Research Methodology and Ethics in Biological Sciences

1. **Faculty:** FLSB

2. **Program:** MSc. Biotechnology, Sem-3 and PhD Biotechnology, Sem-1

3. **Course code:** LSB-708

4. **Course title:** Research Methodology and Ethics in Biological Sciences

5. **Number of credits:** 2 (2L+0T+0P)

6. **Course objectives:** The coursework is primarily designed to introduce principles of conducting biomedical research and to provide an overview of ethical considerations and guidelines relevant to careers in biotechnology.

7. **Minimum prerequisites for taking this course, if any:** Undergraduate degree in a field of biological sciences is required with basic knowledge of format of research articles in biotechnology. Good understanding of general laboratory techniques used in biotechnological research.

8. **Course structure with units, if applicable:**

Each unit will be introduced through interactive lectures and open discussions to explain key concepts in biomedical research. Students will also take part directly in activities such as seminars, journal clubs and scientific reviews to build foundational understanding of biomedical research. Participants are encouraged to share their own experiences or useful information they might have come across related to any of the topics.

Units:

i). Philosophy of Science and Experimental Structure

Concept of logic, evidence, and observation; Generation of hypothesis and theory; Knowledge creation and paradigm shifts; Origin and advances of Biotechnology as an experimental science; Principles of experimental design, Controls, randomization, replication, and data management; Exploratory and hypothesis-driven research.

ii). Research Integrity, Rigor, Reproducibility and Responsibility

Covers ethical principles guiding research conduct with integrity, transparency, and accountability, Issues of selective reporting, data manipulation, and the importance of open and reproducible research in biomedical sciences; Scientific processing and formatting of data and images for publication in research journals; Ethical handling of data in

research publications; Plagiarism- what constitutes plagiarism, steps to detect and avoid plagiarism; Case studies on intentional or unintentional examples of scientific misconduct and unethical practices in biomedical research.

iii). Scientific Writing and Communication

Manuscript preparation, use of citation managers; Cardinal principles for AI assistance in natural sciences; Open access publications and initiatives, predatory publishers and journals; Communication of experimental results, and interpretations through articles, posters and oral presentations

iv). Authorship, Inventorship, ethics and Conflict of Interest

Guidelines for authorship and inventorship; Introduction to COPE (Committee on Publication Ethics) guidelines in scholarly publishing; Ethical responsibility of researchers toward human health, animal welfare, and the societal implications of biotechnological advances; Conflicts of interest, collaborative agreements, and intellectual property considerations in academic and industrial settings.

v). Biosafety and Role of Regulatory Bodies

Biosafety practices, chemical and biological hazard management; Overview of national and international regulatory frameworks governing biotechnology and biomedical research; Institutional review boards, bioethics committees, biosafety authorities, and agencies overseeing clinical and translational research.

vi). Exploring Classic and Modern Research Articles

Engagement of participants in analysis of historical and latest biotechnological findings with respect to their publication as original research articles; Review of original research articles and systemic structure of a peer-review report.

Attendance to the lectures, seminars, talks or any other related event in relation to the coursework will be documented.

9. **Suggested readings:**

A. National Academy of Sciences (2017). Fostering Integrity in Research.

B. Ruxton, G.D. & Colegrave, N. (2011). Experimental Design for the Life Sciences. (Oxford University Press)

C. Research and review articles published in leading scientific journals covering new concepts in biological research methodology and techniques.

10. **Evaluation:**

Mid-semester examination – 30%

End-semester examination – 30%

Quiz/Presentation/Assignment/Others – 40%