

SEMESTER IV**Name of the Programme:** M.Sc. Biotechnology**Course Code:** GBT 605**Title of the Course:** RESEARCH METHODOLOGY**Number of Credits:** 2**Effective from AY:** 2022-23

Pre-requisites for the Course:	None	
Course Objectives:	1) To develop required skills in the students so that they are able to acquire following competency: Plan research, Write research proposal, carry out data collection and analysis and write scientific communication. 2) The course will give the student an overview of research methods.	
Content:	<p style="text-align: center;"><u>MODULE I</u></p> <ul style="list-style-type: none">● Conduct of Research● Good Laboratory Practices, Ethics in research● Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process.● Problem Identification & Experimental Design– Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance.● Project proposal writing, Literature survey- tools for literature survey. Defining the Aims and Objectives, Work Plan – Time-bound Frame.● Making a reading list, Citation, Bibliography and its management software.● Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and	No. of hours 15

	<p>uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.</p> <ul style="list-style-type: none"> ● Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample-Practical considerations in sampling and sample size. ● Data collection, Analysis and Interpretation: Types of data, Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association. 	
	<p style="text-align: center;"><u>MODULE II</u></p> <ul style="list-style-type: none"> ● Importance of communicating research, Ethical aspects in academic writing, Plagiarism and software to detect plagiarism. ● Types of scientific writing and Research manuscript writing: reports, short communication, manuscript/original articles, review articles, thesis writing. ● Fundamentals of scientific paper: Drafting titles and framing abstracts, Authorship, Keywords, Introduction, Material and methods, Results and Discussion, Conclusion, Acknowledgement, Conflicts of Interest, Scientific Objectivity and Bibliography. ● Selection of journal for publication: Tools for suggesting journals for publishing research, Open access and predatory journals, cloned journals. ● Publication/Research metrics - Impact factor, citation count, cite score, h-Index, g-Index. ● Research evaluation: Peer review, Viva Voce. ● Benefits of publishing data. Science and social responsibility. 	15

Pedagogy:	Lectures, tutorials, assignments
References/ Readings:	<ol style="list-style-type: none"> 1. M. Alley, The Craft of Scientific Writing, Springer Science and Business Media, 1996. 2. G. Barbara and R.A. Day How to write and publish a scientific paper. Greenwood, 2016. 3. P.G. Cooray, Guide to Scientific and Technical Writing. P.G. Cooray, Hindagala, Sri Lanka, 1992. 4. C. R. Kothari, Research Methodology Methods and Techniques, New Age International, 2004. 5. R. C. Kumar, Research Methodology. APH Publisher Corporation, New Delhi, 2008. 6. A. E. Shamoo, and D.B. Rasnik, Responsible conduct of research. Oxford, 2021.
Course Outcomes:	<p>At the end of this course, students will be able to</p> <ol style="list-style-type: none"> 1. Understand basic elements of scientific research, including research methods, planning, writing the research proposal, data collection and analysis, and writing scientific communications. 2. Demonstrate the ability to choose methods appropriate to research aims and objectives 3. Understand the limitations of particular research methods 4. Develop skills in qualitative and quantitative data analysis and presentation 5. Develop advanced critical thinking skills 6. Explain key research concepts, read, comprehend, and explain research articles in their academic discipline.