

Branch Name:	M.Sc. Biotechnology / Microbiology
Program Code:	SC201 / SC202
Course Name:	Advance Research Methodology & design
Course Code:	3SC2000201
Pre-requisite Course:	

Course Objectives:

- To understand Meaning of Research, Objectives of Research, Motivation in Research
- To understand Significance of Research
- To understand Research Problem and Data Collection
- To understand Research planning and Sampling
- To understand Data Analysis and Research Writing

Teaching and Examination Scheme:

Teaching Scheme(Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
4	--	--	4	50	50	--	--	100

Subject Contents:

Unit	Content	Lectures	Weightage
1	Research Fundamentals Meaning of Research, Objectives of Research, Motivation in Research Basic types of Research: Descriptive, Analytical, Applied, Fundamental, Quantitative, Qualitative, Conceptual, Empirical, Clinical, Laboratory, Historical research Significance of Research Research methods vs. methodology Research and Scientific method Research process Criteria of good research Problems encountered by Researchers in India	15	25%
2	Research Problem and Data Collection Meaning of Hypothesis and its characteristics Nature, function and importance of hypothesis Basic concepts concerning testing of hypothesis Procedure for Hypothesis testing Introduction to research problem Techniques involved in defining a problem Meaning of data and needs for data collection Methods of primary data collection (Observation, Interviewing, questionnaire, schedule, and other methods. Methods of secondary data collection: Characteristics, Selection of appropriate method, Case study method	15	25%
3	Research planning and Sampling Meaning and need for Research design Features of good research design Category of research design Design format for a research proposal Concept of Sampling Steps in sample design Types of sampling design: Probability sampling, Nonprobability sampling Criteria in selecting sampling procedure Characteristics of good sample	15	25%

4	Data Analysis and Research Writing Experimental data collection and data processing: Processing operations, problems in processing, elements of analysis in data processing, software for data processing Significance of report writing Different steps in writing report General format of research report Types of reports Mechanics of report writing Precautions for writing research reports Poster and oral presentations	15	25%
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Textbooks:

- Kothari, C.R., 1985, Research Methodology- Methods and Techniques, New Delhi, Wiley Eastern Limited

Reference Books:

- Das, S.K., 1986, An Introduction to Research, Kolkata, Mukherjee and Company Pvt. Ltd.
- Misra R.P., 1989, Research Methodology: A Handbook, New Delhi, Concept Publishing Company
- Kumar, R., 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nd.ed.), Singapore, Pearson Education.
- Bhattacharya, D.K., 2006, Research Methodology, (2nd.ed.), New Delhi, Excel Books.
- Panneerselvam R., 2012, Research Methodology, New Delhi, PHI Learning Pvt. Ltd.
- Khan, Irfan Ali, 2008, Fundamentals of Biostatistics, Ukaaz Publications
- Rosner B.A., 2011, Fundamentals of Biostatistics, Cengage Learning
- Katz J.M., 2009, From Research to Manuscript: A guide to scientific writing, USA, Springer Science
- Saravanel, P. 1990. Research methodology. Allahabad, Kitab Mahal

List of Open-Source Software/learning website:

- <https://archive.nptel.ac.in/courses/109108158/>
- <https://archive.nptel.ac.in/courses/109103153/>
- <https://www.youtube.com/watch?v=lqqJ5BmXzB0>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Define and explain the fundamental concepts of research, including its objectives, types, significance, and the distinction between research methods, methodology, and the scientific method.	1 Remember 2 Understand
CLO2	Explain and apply the research process, including formulation of research problems and hypotheses, and the criteria for conducting good quality research.	2 Understand 3 Apply
CLO3	Describe, apply, and analyze various methods of data collection, including primary and secondary techniques, and evaluate their suitability for different research contexts.	2 Understand 3 Apply 4 Analyze
CLO4	Explain, apply, and analyze sampling methods, sample design, and data processing techniques, including the use of appropriate software tools.	2 Understand 3 Apply 4 Analyze
CLO5	Apply, analyze, and evaluate different research designs and experimental approaches for effective planning and execution of research studies.	3 Apply 4 Analyze 5 Evaluate
CLO6	Apply, evaluate, and develop structured research reports and proposals by integrating appropriate writing formats, analytical interpretation, and ethical considerations.	3 Apply 5 Evaluate 6 Create

Mapping of CLO s with POs & PSOs

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3
CLO1	1	2	1	1	1	2			2							1		1	
CLO2	1	2	1	1	1	2			2							1		1	
CLO3	1	2	1	1	1	2			2	2					1	1		1	
CLO4	1	2	1	1	1	2			2	2					2	1		2	
CLO5	3	3	3	3	2	2			2	3			1			3		1	
CLO6	3	3	3	3	3	2			2	3			2			3		1	

3: High, 2: Medium, 1: Low