

VANITA VISHRAM WOMEN'S UNIVERSITY
SCHOOL OF SCIENCES
DEPARTMENT OF MICROBIOLOGY



MASTER OF SCIENCE (M.Sc.) MICROBIOLOGY
PROGRAMME
under Learning Outcomes-based Curriculum Framework (LOCF)
for Post Graduate (PG) Education

SEMESTERS 4
Department Specific Elective (DE)

Syllabus applicable to the students seeking admission in the
M.Sc.- Microbiology
under LOCF
w.e.f. the Academic Year 2021-2022

Structure of the Course

Semester IV				
Number of Department Elective Courses	Credits in each Elective Course			
Course	Theory	Practical	Tutorial	Credits
MB24050: Research Methodology	3+1	0	0	4
MB24060: Scientific Writing	3+1	0	0	4
Elective Course 'n'(total no) = 1T	-	-	-	-
Total credits in Elective Courses	4			
Elective will be from list of remaining two subjects				

List of Elective Courses

Department Elective (DE)

1. MB24010: Biophysical and Biochemical Methods**
2. MB24020: Advance Instrumental Microbiology
3. MB24030: Plant-Pathogen Interactions**
4. MB24040: Food Microbiology**
5. MB24050: Research Methodology
6. MB24060: Scientific Writing

MASTER OF SCIENCE MICROBIOLOGY

SEMESTER 4

DEPARTMENT ELECTIVE COURSE PAPER 5

MB24050 RESEARCH METHODOLOGY

Course Objectives:

The course is introduced to induct student toward scientific way to design experiment, data collection, analysis and report writing skills.

Course learning outcomes :By the end of this course the students-

CO1: will understand scientific terminology used in research

CO2: will learn to generate and test hypothesis with appropriate method of data collection

CO3: will understand the data analysis and writing the outcome of the project in form of report

THEORY COURSE (3+1 Credits)

Unit-1	Research Fundamentals and Terminology: Meaning and Objective of research, features of a good research study, scientific method, Study designs and variations: basic, applied, historical, exploratory, experimental, ex-post-facto, case study, diagnostic research, crossover design, case control design, cohort study design, multifactorial design.	10 Lectures
Uni-2	Defining Research problem and data Collection: Hypothesis, theory and scientific law: development, structure, conditions, sources, formulation, explanation of hypothesis; structure, identification, elements, classification, functions of theory; scientific laws and principles, Methods and techniques of data collection: types of data, methods of primary data collection(observation/ experimentation/ questionnaire/ interviewing/ case/ pilot study , methods), methods of secondary data collection(internal/ external), schedule method.	12 Lectures
Unit-3	Sampling and sampling distributions: Sampling frame, importance of probability sampling, simple random sampling, systematic sampling, stratified random sampling, cluster sampling, problems due to unintended sampling, ecological and statistical population in the laboratory, Variables: nominal, ordinal, discontinuous, continuous and derived.	11 Lectures
Unit-4	Data analysis and report writing: Experimental data collection and data processing: Processing operations, problems in processing, elements of analysis in data processing, software for data processing, Report writing and presentation: types of research reports, guidelines for writing a report, report format, appendices, Miscellaneous information, poster and oral presentations.	11 Lectures

Reference Book

1. Kothari, C.R.1985, Research Methodology- Methods and Techniques, New Delhi, Wiley Eastern Limited.
2. Das, S.K. 1986. An Introduction to Research, Kolkata, Mukherjee and Company Pvt. Ltd.
3. Misra R.P., 1989, Research Methodology: A Handbook, New Delhi, Concept Publishing Company
4. Kumar, R., 2005, Research Methodology-A Step-by-Step Guide for Beginners (2nd.ed.), Singapore, Pearson Education.
5. Bhattachraya, D.K., 2006, Research Methodology (2nd.ed.), New Delhi, Excel Books.
6. Panneerselvam R.,2012, Research Methodology, New Delhi, PHI Learning Pvt. Ltd.
7. Khan, Irfan Ali, 2008, Fundamentals of Biostatistics, Ukaaz Publications
8. Rosner B.A., 2011, Fundamentals of Biostatistics, Cengage Learning
9. Katz J.M., 2009, From Research to Manuscript: A guide to scientific writing, USA, Springer Science
10. Saravanavel, P. 1990. Research methodology. Allahabad, Kitab Mahal

**SEMESTER 4
DEPARTMENT ELECTIVE COURSE PAPER 6**

MB24060 Scientific Writing and biostatistics

Course Objectives:

The objectives of this course are to give background on history of science, emphasizing methodologies used to do research, use framework of these methodologies for understanding effective lab practices and scientific communication and appreciate scientific ethics.

Course learning outcomes :By the end of this course the students-

OC1: Understand history and methodologies of scientific research, applying these to recent published papers;

OC2: Understand and practice scientific reading, writing and presentations;

OC3: Appreciate scientific ethics through case studies.

**THEORY COURSE
(3+1 Credits)**

Unit-1	History of science and science methodologies: Empirical science; scientific method; manipulative experiments and controls; deductive and inductive reasoning; descriptive science; reductionist vs holistic biology.	8 Lectures
Unit-2	Process of Communication: Concept of effective communication-setting clear goals for communication; determining outcomes and results; initiating communication; avoiding breakdowns while communicating; creating value in conversation; barriers to effective communication; non-verbal communication-interpreting non-verbal	12 Lectures

	cues; importance of body language, power of effective listening; recognizing cultural differences; Presentation skills - formal presentation skills; preparing and presenting using over-head projector, PowerPoint; defending interrogation; scientific poster preparation & presentation; participating in group discussions; Computing skills for scientific research - web browsing for information search; search engines and their mechanism of searching; hidden Web and its importance in scientific research; internet as a medium of interaction between scientists; effective email strategy using the right tone and conciseness	
Unit-3	Scientific Communication: Technical writing skills - types of reports; layout of a formal report; scientific writing skills - importance of communicating science; problems while writing a scientific document; plagiarism, software for plagiarism; scientific publication writing: elements of a scientific paper including abstract, introduction, materials & methods, results, discussion, references; drafting titles and framing abstracts; publishing scientific papers - peer review process and problems, recent developments such as open access and nonblind review; plagiarism; characteristics of effective technical communication; scientific presentations; ethical issues; scientific misconduct. 13	13 Lectures
Unit4	Biostatistics: Probability: counting, conditional probability, discrete and continuous random variables; Error propagation; Populations and samples, expectation, parametric tests of statistical significance, nonparametric hypothesis tests, linear regression, correlation & causality, analysis of variance, factorial experiment design. Introduction and applications of SPSS and R softwares.	12 Lectures
Reference Books		
<ol style="list-style-type: none"> 1. Valiela, I. (2001). Doing Science: Design, Analysis, and Communication of Scientific Research. Oxford: Oxford University Press. 2. On Being a Scientist: a Guide to Responsible Conduct in Research. (2009). Washington, D.C.: National Academies Press. 3. Gopen, G. D., & Smith, J. A. The Science of Scientific Writing. American Scientist, 78 (Nov-Dec 1990), 550-558. 4. Mohan, K., & Singh, N. P. (2010). Speaking English Effectively. Delhi: Macmillan India. 5. Movie: Naturally Obsessed, The Making of a Scientist. 6. Rosner, B. (2000). Fundamentals of Biostatistics. Boston, MA: Duxbury Press. 7. Daniel, W. W. (1987). Biostatistics, a Foundation for Analysis in the Health Sciences. New York: Wiley. 		