Syllabus

First Semester Courses in MSc

(MICROBIOLOGY)

2023-2024

Contents:

- **Syllabus for Research Methodology:**
  - **PSMIC6001RM1 Research methodology and Biostatistics**
- Evaluation and Assessment guidelines

PRINCIPAL
ST. XAVIER'S COLLEGE
AUTONOMOUS
MUMBAI - 400 001.

APPROVED SYLLABUS

M.Sc. Part 1, Sem 1 MICROBIOLOGY **Course code: PSMIC6001RM1**

TITLE: RESEARCH METHODOLOGY AND BIOSTATISTICS

Credits 4 - Theory 3 (Total 45 hr) and Practical 1 (Total 30 hr)

Course Objectives:

- Understand the overall process of designing a research study from its inception to its report.
- Distinguish between the writing structure used for a quantitative study and one used for a qualitative study.
- Review the different conventions for scholarly/ report writing

Number of lectures: 45

Course Outcomes (COs):

- Describe various research designs, formulate hypothesis and design a research experiment
- Write research proposals, discuss experimental results in written and oral formats
- Select the appropriate data collection method for a particular study and process the acquired data
- Describe the need, methods used in sampling and evaluate these methods for their suitability in various scientific scenarios
- Analyze experimental data using descriptive and inferential statistics
- Understand the concept of type I and II error and appl it to data amenable to analysis by t test

Unit 1: Research fundamentals, terminology and report writing **(15 lectures)**

1. Meaning and Objective of research **2L**

- Features of a good research study
- Scientific method

2. Study designs and variations **8L**

- Basic, applied, historical, exploratory, experimental, ex-post-facto
- Case study, diagnostic research
- Crossover design, case control design, cohort study design, multifactorial design

3. Report writing and presentation **5L**

- Types of research reports, guidelines for writing a report, report format, appendices
- Miscellaneous information
- Poster and oral presentations (use of software)

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Unit 2: Defining a research problem, data collection and data analysis (15 lectures)

1. Methods and techniques of data collection 9L

- Types of data
- Methods of primary data collection (observation/ experimentation/ questionnaire/ interviewing/ case/ pilot study)
- Methods of secondary data collection (internal/ external), schedule method
- Use of computers in data collection- Literature survey using web, handling search engines

2. Experimental data collection and data processing 4L

- Processing operations, problems in processing
- Elements of analysis in data processing

3. Introduction to design of experiments 2L

Unit 3: Introduction to biostatistics (15 lectures)

1. Sampling, Sampling Distributions and Sampling Errors 3L

- Simple random sampling, systematic sampling, stratified random sampling, cluster sampling
- Non random sampling
- Sampling Errors
- Sample size calculations

2. Types of data and distribution 4L

- Nominal, ordinal, interval and ratio scale
- Continuous and discrete data
- Skewness and Kurtosis
- Normal distribution- Box plot
- Poisson distribution
- Data presentation

3. Test of Significance 3L

- Null Hypothesis, Alternate Hypothesis, Type I and Type II errors
- Level of Significance, one tailed and two tailed test
- Concept of Standard error

5. Comparison of means of one or two samples 5L

- t test
- z test
- test for homogeneity of variance
- Effect size calculations

List Of Recommended Reference Books

Units 1 and 2:

1. Research Methodology for practical and scientific approach, Bairagi V., Nousami M., 2019, CRC press
2. Design and analysis of experiments, D.C. Montgomery, Wiley Student Ed., 8th ed., 2009
3. Research methodology in medical and biological sciences, Laake P., Benestad H. B., Olsen B. R., 2007, Elsevier ltd.
4. Research Methodology, (2nd.ed.), Bhattacharya, D.K., 2006, New Delhi, Excel Books.
5. Research Methodology - Methods and Techniques, Kothari, C.R., 2004, 2nd ed., New Delhi, New age international publishers.
6. http://www.cebm.net/study-designs/

Unit 3:

1. Biostatistical Analysis, Czar J. H., 5th ed., 2014, Pearson India education services, India.
2. Biostatistics The Bare Essentials, Norman G.R., Streiner D.L., 3rd ed., 2008, B. C. Decker Inc

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PRACTICAL

Details of practical sessions:

1. Concept of plagiarism
2. Oral and poster presentation
3. Summary writing
4. Referencing, literature survey and reference management tools
5. Use of software in biostatistical analysis
6. Introduction to mathematical modeling and artificial intelligence (AI)
7. Introduction to Python
8. Mathematics:
    i. Limits, derivatives and integration
    ii. Vectors and matrices
    iii. Basic Algorithms

Evaluation (Theory): Total marks – 100

I. Formative Assessment 'for' Learning (continuous internal assessment - CIA to improve learning).
CIA – 40 marks
CIA 1: Test – 20 marks
CIA 2: Written assignment – 20 marks

II. Summative Assessment 'of' Learning (focus on outcomes, quantitative data for outcomes of instruction).
End Semester Examination – 60 marks

One question from each unit for 20 marks, with internal choice. Total marks per question with choice – 25-30 marks

Evaluation (Practical): Total marks – 50

CIA: 20 marks

End Semester Practical Examination – 30 marks

Template for End Semester examination

UNITS	KNOWLEDGE	UNDERSTANDING	APPLICATION and ANALYSES	TOTAL MARKS- Per unit
1	6	6	8	20
2	6	6	8	20
3	6	6	8	20
-TOTAL - Per objective	18	18	24	60
% WEIGHTAGE	30	30	40	100%

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