

St. Xavier's College (Autonomous), Ahmedabad

Syllabus of Semester – IV of the following departments under Faculty of Science
based on Post Graduate Curriculum Framework - 2024 to be implemented
from the Academic Year 2024-25.

FACULTY OF SCIENCE

DEPARTMENT OF MICROBIOLOGY

MSc. Microbiology

CORE PAPER: RESEARCH METHODOLOGY & SCIENTIFIC WRITING

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course			Eligibility Criteria	Pre-requisite(s) of the Course (if any)
	Lecture	Tutorial	Practical / Practice		
Research Methodology & Scientific Writing (PMB 4801)	4	0	0	Life Science Graduate from a UGC recognized University	Basic knowledge of microbiological practicals scientific approach and thinking

LEARNING OBJECTIVES (LO)	
LO-1	Understand importance of educational research
LO-2	Understand basics of research design
LO-3	Understand concepts of quantitative and qualitative data collection
COURSE OUTCOMES (CO)	
On Completion of this course, the student will be able to	
CO-1	Understand the overall process of designing a research study from its inception to its report.
CO-2	Distinguish between the writing structure used for a quantitative study and one used for a qualitative study.

CO-3	Develop and elevate skills of scientific writing to present research interpretations in a form of research paper, presentation, book chapters and short communication
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Unit-1: Research methodology, terminology and report writing (15 L)

1. Meaning and objective of research: features of a good research study, scientific method
2. 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
3. Report writing and presentation: types of research reports, guidelines for writing a report, report format, appendices, miscellaneous information, poster and oral presentations (use of software), project proposal

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

1. Hypothesis, theory and scientific law: difference between hypothesis, theory and scientific law, formulation of hypothesis
2. Methods and techniques of data collection: 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
3. Experimental data collection and data processing: processing operations, problems in processing, elements of analysis in data processing

Unit-3: Computational data management and bio-entrepreneurship (15 L)

1. Web search: use of publication search engines and libraries (PubMed, PubMed central, CrossRef, Google scholar).
2. Use of biological data bases to retrieve data.
3. Introduction and significance of bio-entrepreneur, skill sets in science-business.
4. Forms of business organization and source of funds, investments.
5. The biotechnology sector, start-up ecosystem and BT policy of Gujarat (2022-2027).

Unit-4: Scientific writing (15 L)

1. Components of a research paper: the IMRAD system, title, authors and addresses, abstract, acknowledgements, references, tables and illustrations.

2. Use of automated referencing software (Mendley, EndNote, etc.), introducing various publishers (Nature, Elsevier, Springer, etc.), understanding essential terms (Citations, Impact factor, h-index and i10-index), selecting appropriate journal to publish an article.
3. Preparing manuscript, submission of manuscript, basic formats of thesis and writing thesis, oral and poster presentation of research papers in conferences/symposia.
4. Preparation and submission of research project proposals to funding agencies.
5. Conflict of interest, violation of publication ethics: authorship and contributor-ship.

Suggestive Readings:

- Research Methodology - Methods and Techniques, Kothari, C.R., 2004, 2nd ed., New Delhi, New age international publishers.
- Research Methodology - Bhattacharya, D.K., 2006, 2nd ed., New Delhi, Excel Books.
- Design and analysis of experiments, D.C. Montgomery, Wiley Student Ed., 8th ed., 2009.
- Ljubomir Todorovic. Original (Scientific) Paper – the IMRAD Layout. Archive of Oncology 2013.

CORE PAPER: BIOINFORMATICS, IPR, BIOSAFETY, BIOETHICS AND REGULATORY AFFAIRS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course			Eligibility Criteria	Pre-requisite(s) of the Course (if any)
	Lecture	Tutorial	Practical / Practice		
Bioinformatics, IPR, Biosafety, Bioethics & Regulatory affairs (PMB 4802)	4	0	0	Life Science Graduate from a UGC recognized University	Basic knowledge of computers and bioethics

LEARNING OBJECTIVES (LO)

LO-1	Using computers how to retrieve data from biological database and their analysis is learnt by students.
LO-2	To understand the importance of patents in research.
LO-3	To understand the significance of bioethics in research and learning.

COURSE OUTCOMES (CO)

On Completion of this course, the student will be able to

CO-1	Specialized computational tools needed to retrieve and analyze data of microbes, their genes and proteins are taught to improve the skillsets of the students.
CO-2	In-depth knowledge on intellectual property rights for microbiological and biotechnological interventions is imparted.
CO-3	Wisdom on biosafety and bioethics is inculcated.

Unit-1: Basic bioinformatics (15 L)

1. Introduction to databases: primary, secondary, composite.
2. Databases related to human diseases: OMIM, HGMD
3. Sequence similarity search: local, global, multiple and pairwise
4. Comparison of bacterial genome
5. Protein structure: PDB, protein structure prediction

6. Human genome variation
7. Functional genomics.

Unit-2: Introduction to Omics (15 L)

1. Bioinformatics approach to RNA: eQtls, understanding the Genetic basis of Variation in Gene expression.
2. Protein analysis and proteomics.
3. Molecular phylogeny & evaluation.
4. Pharmacognosy: protein drug interaction, protein - protein interaction.
5. DNA-Drug interaction, gene prediction, analysis of gene expression by microarray, homology modelling.

Unit-3: IPR, biosafety and bioethics (15 L)

1. Types of IPR
2. Patent types and process, inclusions, and exclusions in various IPRs, overview on rules and sections of Indian Patent act 1970
3. Case Study of Indian Patents (Any two)
4. Biosafety guidelines, risk and risk assessment, biosafety levels and laboratory biosecurity concepts.
5. Basics of bioethics principles, international codes and guidelines in Indian ethics in post genomic era.

Unit-4: Regulatory affairs (15 L)

1. Introduction to pharmacopoeia, good microbiological techniques and good laboratory practice (GLP) & good manufacturing practice (GMP).
2. Overview of pharmaceutical regulatory affairs.
3. Role of regulatory writer in pharma industry, types of regulatory documents.
4. Principles of regulatory writing, scientific vs regulatory vs medical Writing
5. Global regulatory agencies: U.S. Food and Drug Administration, European Medicines Agency, Central Drugs Standard Control Organization.
6. Validation study and toxicity testing.
7. Role of culture collection center, public health laboratories and regulatory agencies.

Suggestive Readings:

- Mario Cimoli et. Al., “Intellectual Property Rights: Legal and Economic Challenges for Development” 2014, OUP publisher, UK.
- Jeremy Ramsden, “Bioinformatics: An Introduction” 3rd Edition, 2004.
- Jin Xiong, “Essential Bioinformatics”, Cambridge press, 2006.

CORE PAPER: Research Project

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course			Eligibility Criteria	Pre-requisite(s) of the Course (if any)
	Lecture	Tutorial	Practical / Practice		
Research Project (PMB 4803)	0	0	16	Life Science Graduate from a UGC recognized University	Basic knowledge of research and review of literature

LEARNING OBJECTIVES (LO)

LO-1	The student imbibes necessary skills to represent scientific data in form of scientific report.
LO-2	The course intends to inculcate individual research methodology skill sets.

COURSE OUTCOMES (CO)

On Completion of this course, the student will be able to	
CO-1	Enables the student to develop aptitude to carry out research independently.
CO-2	Acquire skills to plan and execute experiments individually as well as in groups.