

Central University of Punjab, Bathinda



Ph.D. Microbiology

Session- 2020

Department of Microbiology

Programme Outcomes

- The programme will escalate the skilled scientific manpower with an understanding of research ethics and vast knowledge of microorganisms.
- Scholar will be equipped with the knowledge of microbial, molecular and cellular processes and their applications which can be utilized for the betterment of society and careers in the industry, agriculture, and applied research.

- **Course Structure**

Sr. No	Course Code	Course Title	L	P	Credits
1	LMS.751	Research and Publication Ethics	2	0	2
2	LMS.701	Research Methodology and Computer Applications	4	0	4
3	LMS.702	Advanced Microbiology	4	0	4
4	LMS.XXX	Any other Life Sciences PhD Course	4	0	4
		Total Credits			14

L: Lectures; P: Practical; Cr: Credits

In addition to the course work, 80 research credits are required for the award of PhD degree.

Evaluation Criteria for Theory Courses

End Semester Examination: Based on Subjective Type Test [100 Marks]

Learning Outcomes

L	T	P	Credits
2	0	0	2

LMS.751: Research and Publication Ethics

Unit I Philosophy and Ethics

3 hours

- Introduction to Philosophy : definition, nature and scope, content, branches
- Ethics : definition, moral philosophy, nature of moral judgements and reactions

Unit II Scientific Conduct

5 hours

- Ethics with respect to science and research
- Intellectual honesty and research integrity
- Scientific misconducts : Falsification, Fabrication, and Plagiarism (FFP)
- Redundant publications : duplicate and overlapping publications, salami slicing
- Selective reporting and misrepresentation of data

Unit III: Publication Ethics

7 hours

- Publication ethics : definition, introduction and importance
- Best practices/ standards setting initiatives and guidelines: COPE, WAME, etc.
- Conflicts of interest
- Publication misconduct : definition, concept, problems that lead to unethical behaviour and vice versa, types
- Violation of publication ethics, authorship and contributor ship
- Identification of publication misconduct, complaints and appeals
- Predatory publishers and journals

Unit IV Open Access publishing

4 hours

- Open access publications and initiatives
- SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
- Software tool to identify predatory publication developed by SPPU
- Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer, Journal Suggester etc.

Unit V Publication Misconduct

(4 hours)

- Group Discussions: Subject specific ethical issues, FFP, authorship; conflicts of interest; complaints and appeals: examples and fraud from India and abroad
- Software tools: Use of plagiarism software like Turnitin Urkund and other open source software tools

Unit IV Databases and Research Metrics**7 hours**

- Databases: Indexing databases; Citation database: Web of Science, Scopus etc.
- Research Metrics: Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score; Metrics : h-index, g-index, i10 index, almetrics

L	T	P	Credits
4	0	0	4

Course Code: LMS.701**Course Title: Research Methodology and Computer Applications****Learning Outcomes**

Students will be able to:

- Illustrate the basic good practices to be followed in research.
- Formulate Classify the principles ethics in research which will help them to understand the set of conduct norms applied in science.
- Interpret the ethical issues involved in human, animals and plants research.
- Judge the misconduct, fraud and plagiarism in research.
- Utilize the computer and bioinformatics tools for analyzing and interpreting the data.
- Demonstrate the outcome of results using biostatistical approaches in testing hypothesis, designing experiments, analyzing experimental data and interpreting the results.

Unit-I**15 hours**

General Principles of Research: Meaning and importance of research, Critical thinking, Formulating hypothesis and development of research plan, Review of literature, Interpretation of results and discussion. Bibliographic index

Technical Writing: Scientific writing, Writing synopsis, Research paper, Poster preparation, oral presentations and Dissertations. Reference Management using various softwares such as Endnote, reference manager, Refworks, etc. Communication skills: defining communication; type of communication; techniques of communication, etc.

Unit-II**15 hours**

Introduction and Principles of Good Lab Practices: Good laboratory practices, Biosafety for human health and environment. Biosafety issues for using cloned genes in medicine, agriculture, industry, and eco-protection, Biological containment and physical containment, CDC Biosafety levels, Biosafety in Clinical laboratories and biohazard management, Physical, Chemical & Biological hazards and their mitigation. Biosafety level/category of pathogens. Biosafety level of laboratories. **Research Ethics:** Ethical theories, Ethical considerations during research, consent, Animal testing. Animal rights, Perspectives and methodology & Ethical issues of the human genome

project. Intellectual property protection (IPP) and intellectual property rights (IPR), WTO (World Trade Organization), WIPO (World Intellectual Property Organization), GATT (General Agreement on Tariff and Trade), TRIPs (Trade Related Intellectual Property Rights), TRIMS (Trade Related Investment Measures) and GATS (General Agreement on Trades in Services). Patents, Technology Development/Transfer Commercialization Related Aspects, Ethics.

Unit-III

15 hours

Computer Application Software: Spreadsheet applications, Word-processing applications, Presentation applications, Internet browsers, Reference Management, and Image processing applications. World wide web: Origin and concepts, Overview of internet and its application for quality literature collection and secondary data related to research work. Exploring various websites and search engines. Computer applications to statistical packages. *In silico* approaches for drug designing and identification of cell types epitopes for vaccine designing.

Unit-IV

15 hours

Bioinformatics: Organization, management and analysis of biological data, use of computers in data analysis, biological databases - DNA sequence databases and protein sequence databases, BLAST, FASTA, multiple sequence alignment, primers in biology (design and types of primers) genome projects (human, *Arabidopsis* and other genome projects), NCBI, UCSC and other database searches.

Suggested Reading:

1. Gupta, S. (2008). *Research Methodology and statistical techniques*. Deep & Deep Publications (P) Limited, New Delhi.
2. Kothari, C. R. (2014). *Research methodology (s)*. New Age International (p) Limited. New Delhi.
3. Sahay, Vinaya and Pradumna Singh (2009). *Encyclopedia of Research Methodology in life sciences*. Anmol Publications. New Delhi.
4. Kauda J. (2012). *Research Methodology: A Project Guide for University Students*. Samfunds literature Publications.
5. Dharmapalan B. (2012). *Scientific Research Methodology*. Narosa Publishing
6. Norman, G. and Streiner, D. (2008). *Biostatistics: The Bare Essentials.3/e* (with SPSS). Decker Inc. USA.
7. Rao, P. P., S. Sundar and Richard, J. (2009). *Introduction to Biostatistics and Research Methods*. PHI learning.
8. Christensen, L. (2007). *Experimental Methodology*. Boston: Allyn & Bacon.
9. Fleming, D. O. and Hunt, D.L. (2006). *Biological Safety: Principles and Practices*. American Society for Microbiology, USA.
10. Rockman, H. B. (2004). *Intellectual Property Law for Engineers and Scientists*. Wiley-IEEE Press, USA.
11. Shannon, T. A. (2009). *An Introduction to Bioethics*. Paulist Press, USA.
12. Vaughn, L. (2009). *Bioethics: Principles, Issues, and Cases*. Oxford University Press, UK

Course Code: LMS.702
Course Title: Advanced Microbiology

L	T	P	Credits
4	0	0	4

Learning Outcomes:

The students will be able to:

- Outline the concept of epidemiology and various cellular processes during disease development.
- Comprehend the clinical diagnostics and treatment of the different diseases caused by microbes.
- Describe virulence determinants – colonization, toxins, enzymes and invasiveness with varied examples from different pathogens.
- Illustrate facultative or obligate intracellular and describe molecular Koch's postulates and multiplicity of virulence factors and coordinated regulation of virulence genes.
- Categorise 1-IV secretion systems, importance of biofilms and quorum sensing
- Propose the concepts of antimicrobial, multidrug efflux pumps, extended spectrum β -lactamases, X-MDR Mycobacterial tuberculosis, methicillin-resistant *S.aureus* (MRSA)

Unit-I

15 hours

Advanced Techniques to Study Microbial Pathogenesis: Host defense mechanisms such as phagocytosis, opsonization and complement, Nonspecific, innate and adaptive host defenses. Genetic, bioinformatic, proteomic and systems biology approaches to study host pathogen interactions.

Unit-II

15 hours

Mechanism of Microbial Pathogenesis: Microbial colonization and adherence strategies, Microbial invasion strategies, Bacterial secretion systems, Bacterial surface structures, Antigenic variation, Biofilms and quorum sensing, modulation of apoptotic processes and microbial toxins.

Unit-III

15 hours

Pathogenesis of Selected Organisms: Spirochetes such as *Treponema pallidum*, *Borrelia burgdorferi* and *Borrelia hermsii*. Intracellular pathogens/Gram-negative bacteria: *Salmonella* and *Helicobacter pylori*. Gram positive bacteria: *Staphylococcus aureus*, *Listeria monocytis*. Myxobacteria: *Mycobacterium tuberculosis*.

Unit-IV

15 hours

Mechanisms of Interference with Pathogenesis: Mechanisms of action of antimicrobial agents and resistance; Recent advances in development of antibiotics and vaccine. Human Microbiome and their role in therapeutics

Suggested Reading:

1. Pelczar, M. J., Chan, E.C.S. and Krieg, N.R. (2001). *Microbiology: Concepts and Applications*. McGraw-Hill Inc. USA.
2. Prescott, L.M., Harley, J.P. and Klein, D.A. (2005). *Microbiology*. McGraw-Hill Science, USA.
3. Tortora, G.J., Funke, B.R. and Case, C.L. (2009). *Microbiology: An Introduction*. Benjamin Cummings, USA.
4. Research papers and reviews published in peer-reviewed international journals in the above areas