

**Central University of Punjab,
Bathinda**



**Department of Biochemistry and
Microbial Sciences
2019-20**

School of Basic and Applied Sciences

Ph.D. Program in Microbial Sciences

Sr. No	Course Code	Course Title	L	P	Cr
1	LMS.701	Research Methodology and Computer Applications	4	-	4
2	LMS.702	Advanced Microbiology	4	-	4
3	LMS.XXX	Any other Life Sciences PhD Course	4	-	4
		Total Credits			12

L: Lectures; P: Practical; Cr: Credits

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

LMS.701: Research Methodology and Computer Applications

General Principles of Research

20 Hours

Meaning and importance of research, Critical thinking, Formulating hypothesis and development of research plan, Review of literature, Interpretation of results and discussion. Bibliographic index and research quality parameters: citation index, impact factor, *h* index, i10 index, etc. Research engines such as google scholar, Scopus, web of science, etc.

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. Library: Classification systems, e-Library, Reference management, PUBMED, Web-based literature search engines.

Introduction and Principles of Good Lab Practices

20 Hours

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, data manipulations, subject 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.

Plagiarism: Plagiarism, definition, Search engines, regulations, policies and documents/thesis/manuscripts checking through software, Knowing and Avoiding Plagiarism during documents/thesis/manuscripts/scientific writing.

Computer Application Software

16 Hours

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 T cell and B cell epitopes for vaccine designing.

Bioinformatics

16 Hours

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.

LMS.702: Advanced Microbiology

Advanced Techniques to Study Microbial Pathogenesis

18 Hours

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.

Mechanism of Microbial Pathogenesis

18 Hours

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.

Pathogenesis of Selected Organisms

18 Hours

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*.

Mechanisms of Interference with Pathogenesis

18 Hours

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

Suggested Reading:

Research papers and reviews published in peer-reviewed international journals in the above areas.