Syllabus

for

P.hD.

Course Work

IN

MICROBIOLOGY

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2020
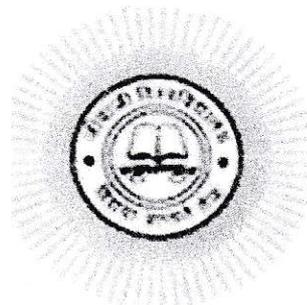
Jiwaji University, Gwalior

(NAAC accredited 'A' grade University)

Paper I : Research Methodology (For Life Sciences)

1. Introduction to Research Design

Nature and objectives of research, Methods of research: Historical, descriptive and experimental, research process, research approaches, criteria for good research, meaning of research design, need of research design, features of good design, different research designs & basic principles of experimental designs, designs of experiments.

2. Data collection and Analysis

Types of data, methods and techniques of data collection, primary and secondary data, meta analysis, historical methods content analysis, devices used in data collection, pilot study and pretest of tools, choice of data collection method.

3. Data processing and Analysis

Measures of Central Tendency, Measures of Dispersion, Measures of Variation, Measures of Central Tendency vs Measures of Dispersion, Normal Distribution, Measures of Skewness and Interpretation, Correlation and Regression: Types and Applications.

4. Test of Significance

Significance of difference in means: Standard deviation and standard error; Z-test, 't' test and Chi-square test: purpose and use, Analysis of variance.

5. Paper Writing and report generation

Basic concept of paper/ thesis writing, and report generation, writing Research Abstract. Introduction, Review of Literature, Results, Conclusion, Concepts of Bibliography and References, significance of Report Writing, Types of Research Reports, Methods of presentation of Reports, Formats of publication in Research Journals.

Reference Books*:

1. Research Methodology: Methods and Techniques – C.R. Kothari, New Age Publisher.
1. Research Methodology: R.N. Trivedi and D.P. Shukla, College Book Depot, Jaipur.
2. Research Methodology: D. Chakraborty, Lotus Press.
3. Research Methodology for Life Sciences: N. Arumugam, Saras Publication.
4. Random Data Analysis and Measurements Procedures: Bendat and Picrsol, Wiley Interscience.
5. Research Methodology: Bin Taylor, G. Sinha and T. Ghoshal, Prentice Hall of India Pvt. Ltd.
6. Methods in Biostatistics: B.K. Mahajan, Jaypee Brothers Medical Publishers, N.Delhi, India.
7. Research Design: J.W. Creswell, Sage Publications, INC.
8. Principles of Biostatistics: Marcello Pagano, CRC Press, Taylor and Francls
   *Latest Editions of the Books

Paper II : Computer Applications and Bioinformatics (For Life Sciences)

1. **Computer Fundamentals**

   Computer Basics and Terminology, Input and output devices, Computer memory, Computer generation and Classification, Types of software, Operating System, Their Types, Basic terms related to Windows OS, Computer Networks, LAN, MAN, WAN.
   Research Polishing Tool- MS Word, Creating, editing and seving an word document, Use of Autotext Tables related operations, graphics.

2. **Introduction to Spreadsheet and Presentation**

   Introduction to Excel, use of Spreadsheet in Research, Data Storing, Various Data Types, Use of Formula and Functions, Calculate, Manipulate and Analyses of Data preparing charts.
   M.S. Power Point, Features and Functions, Creating presentation, Animation, Customizing presentation.

3. **Introduction to Internet and Computer Applications**

   Introduction to Internet, WWW, Searching on Internet, Literature survey, website, Search Engines, Anti- Plagiarism software, Viruses and its Types, Protection from Viruses.
   Introduction of computers in Research: Literature Search using various Search Engines, Writing References, Software for Reference arrangement, Statistical Packages: Sigma plot etc.

4. **Bioinformatics**

   Applications of Bioinformatics in Life Sciences, Biological Database: Primary, Secondary and Composite Database, Sequence Database: Nucleic acid (EMBL and GenBank), Protein Database (PIR and SWISS-PROT), Structure Database: Protein Data Bank.
   Sequence Analysis: Biological Motivation of Sequence Analysis, Homology, Base Pair Alignment: Local, Global and Tools for Base Pair Alignment: BLAST and FASTA, Multiple Sequence Alignment: Methods.

5. **Phylogenetic Analysis, Protein Structure Predication, Drug Designing**

   Phylogenetic Analysis: Methods, character based and distance based methods, tree evaluation.
   Protein Structure Predications: homology modeling, threading, ab-initio methods.
   Expression Sequence Tags (EST) and its Applications, Microarray Database and its Applications.

   Reference Books*:
   1. An Introduction to Computational Biochemistry: C. Stan and T. Sal
   2. Introduction to Bioinformatics: A Theoretical and Practical Approach: S.A krawetz & D.D. Womble.
   3. Bioinformatics, Genes, Proteins and Computers: C.a. Orengo, D.T. Jopnes, J.M. Thornton.

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4. Instant Notes on Bioinformatics, D.R. Westhead, J.H. Parish, R.M. Twyman Publisher: Taylor & Francis.
5. Essential Bioinformatics: Jin Xiong Publisher: Cambridge.
6. An introduction to Bioinformatics Algorithms: N.C. Jones, P.A. Pevzner..
7. Bioinformatics Sequences and Genome Analysis: D.W. Mount. Publisher: The M.I. press Cambidge.
8. Statistical Methods in Bioinformatics: An introduction S. Misener, S.A. Krawetz. Publisher: Humana press.
9. Bioinformatics Database and Algorithms: N. Gautham. Publisher: Alpha Science INTI Ltd.
10. Bioinformatics Technology: Yi-Ping Phoebe Chen. Publisher: Springer.
11. Data Mining: Multimedia, Soft Computing and Bioinformatics: S.Mitra, T.Acharya. Publisher: John Willey Sl Sons, inc.

Ph.D. Course Work

Paper-III Advances in MIcrobiology

There will be a total of ten questions. All questions are long answer type questions without any internal choice and it shall cover the entire syllabus. Candidates will be required to attempt any five questions to all.

Max. Marks: 100   **Time: 3 Hrs.**

1   Advance microscopy techniques: Electron microscopy,confocal microscopy

2   Advance chromatography technique: Principal and application of GCMS, LCMS , HPTLC,FPLC

3   Quantitative DNA amplification: Basic principal and application of real time PCR, droplet PCR

4   Nanobiotechnology: Nanomaterials, types and applications.

5   Flow cytometry: Basic Principal and applications

6   Biosensors: Principle, types and applications

7   Latest techniques in molecular Biology : Next generation DNA sequencing, genome editing, CRYSPR

8   Drug discovery: overview of drug discovery, drug development, clinical trials

9   Role of soil microbes in the degradation of heavy metals, pesticides and polycyclic aromatic hydrocarbons (PAHs)

10   Biotechnological application of hazardous waste management and management of resources.

11   Isolation, preservation and improvement of industrially useful microbial strains.

12   Downstream process development and process economics.

13   Vaccines live and attenuated killed multi- subunit and DNA vaccines

14   Cancer: Molecular basis carcinogenesis oncogenes.

15   Microbiology of the extreme environment

16   Recent development in a etiology, pathogenesis diagnosis and control of AIDS.