

DEPARTMENT OF MICROBIOLOGY
M.PHIL/PHD COURSEWORK SYLLABUS

Paper Code	Paper Number and Name	Credits	Full Marks
MIC-RS-C101	Research Methodology (School of Life Sciences Level Paper)	4	100
MIC-RS-C102	Recent Advances in Microbiology	4	100
MIC-RS-C103	Preparation of Research Proposal	4	100

MIC-RS-C101: Research Methodology

Unit I- Research Design and Data Collection

Research methodology- definition, different types of research design. Basic principles of experimental designs. Sampling design- sample survey, steps in sample design, criteria of selecting a sampling procedure and different types of sample designs. Methods of Data Collection: Primary and secondary data.

Literature collection and citation, bibliography. Writing skills - Preparation of research report, presentations, and writing scientific paper. Impact factor, Citation factor, Plagiarism, ISBN, ISSN.

Unit II: Processing and Analysis of Data and Sampling

Processing operations, elements/types of analysis, statistics in research, measures of central tendency, dispersion, asymmetry, relationships. Simple regression analysis, multiple correlation and regression, partial correlation, association in case of attributes and other measures.

Unit III: Testing of Hypotheses

Basic concepts of testing of hypothesis, procedures for hypothesis testing. Hypothesis testing for differences between means, hypothesis testing for comparing two related samples, hypothesis testing of proportions. Testing the equality of variances of two normal populations, hypothesis testing of correlation coefficient. Chi square test

Unit IV: Analysis of Variance and Covariance

Analysis of Variance and Covariance (basic principles of one-way ANOVA, two-way ANOVA and ANCOVA). Multivariate analysis techniques (Characteristics and applications, classification of Multivariate analysis, important multivariate techniques, important method of factor analysis). Ethics in research.

Reading List:

1. Bernard Rosner, B. 2005. *Fundamentals of Biostatistics*, 6th edition Duxbury Press.
2. Gerry, Q. P and Keough, M. J. 2002. *Experimental Design and Data Analysis for Biologists*. Cambridge Univ. Press.
3. Kothari, C.R. 2004. *Research Methodology, Methods & Techniques*. 2nd Revised Edition. New Age International Publisher, India.

4. Norman, N. G. and Streiner, D. 2008. *Biostatistics: The Bare Essentials*. 3rd edition, BC Decker Inc.
5. Paulson, D. S. 2008. *Biostatistics and Microbiology*. Springer.
6. Sokal, R. R. and Rohlf, F. J. 2008. *Introduction to Biostatistics*. Dover Publication.
7. Laake, P., Benestat, H.B. and Olsen, B.R. 2007. *Research Methodology in the Medical and the Biological Sciences*. Academic Press, UK.

MIC-RS-102: Recent Advances in Microbiology

Unit I: Microbiological Techniques

Aseptic techniques: (Physical and chemical methods), Isolation and pure culture Techniques, Staining (Simple staining, Grams staining, Capsule, Spore and Acid fast staining), Preservation Techniques. Antibiotic susceptibility techniques: disc diffusion and Minimum Inhibitory Concentration. Phenotypic Identification of bacteria and fungi including automated method (Biolog).

Unit II: Advances in Clinical Microbiology

Pathogenesis, clinical feature and Laboratory diagnosis of important bacterial, viral, fungal and parasitic diseases. Important molecular methods of identification and typing of pathogenic microorganisms.

Unit III: Advances in Food Microbiology

Classification, physiology and Genotypic identification of microorganisms associated with the foods: Lactic acid bacteria, Bifidobacteria, Propionibacteria, Bacillus and yeasts; Prebiotic and Probiotic: Prebiotics and the microorganisms, Development of Probiotics for animal and human use; Functional foods- health claims and benefits, Development of functional foods; Food Safety and Molecular Detection: Indicators of food safety, Codex Alimentarius, hazard analysis critical control point (HACCP) System and Food safety objectives (FSO), Introduction to GFSI, ISO22000, FSSC 22000, Detection of pathogenic bacteria and viruses in the foods by various methods.

Unit IV: Advances in Environmental Microbiology

Extremophiles: Various types of extremophiles (Psychrophiles, thermophiles, halophiles, acidophiles, alkaliphiles. Definition, diversity, life strategies and applications. New molecular methods for detection of waterborne pathogens. Nucleic acid based Methods of Analysis of environmental samples (Gene probes and probing; Polymerase Chain Reaction; Restriction Fragment Length Polymorphism Analysis, Denaturing/Temperature Gradient Gel Electrophoresis).

Reading List:

1. Balows, A., Trüper, H.G., Dworkin, M., Harder, W. and Schleifer, K.H. 1992. *The Prokaryotes, A Handbook on the Biology of Bacteria: Ecophysiology, Isolation, Identification, Application*. 2nd edition, 4 volumes. Springer-Verlag, New York.
2. Cullimore, D. R. 2000. *Practical Atlas for Bacterial Identification*. 1st edition, Francis and Taylor Group, New York.

3. Sneath, P.H.A., Mair, N.S., Elizabeth, M. 2005. *Bergey's Manual of Systematic Bacteriology*. 4 volumes, Williams and Wilkins.
4. Cappuccino, J. G. and Sherman, N. 2007. *Microbiology- A Laboratory Manual*. Seventh Edition, Pearson Education, Inc. and Dorling Kindersley (India) Pvt Ltd, Delhi, India.
5. Goldman, E and Green, L.H. 2008. *Practical Handbook of Microbiology*. Second Edition, CRC Press.
6. Brooks, G., Carroll, K. C., Butel, J. and Morse, S. 2007. *Medical Microbiology (Jawetz, Melnick, and Adelberg's Medical Microbiology)*. 24th edition McGraw-Hill Medical.
7. Forbes, B. A., Sahm, D. F. and Weissfeld, A. S.2007. *Bailey and Scott's Diagnostic Microbiology*. 12th edition, Mosby.
8. Ananthanarayan and Paniker. 2013. *Ananthanarayan and Paniker's Textbook of Microbiology*. C. K. Jayaram Paniker, 9th edition, Orient Blackswan.
9. Bottone, E. J. 2006. *Atlas of the Clinical Microbiology of Infectious Diseases, Volume 2: Viral, Fungal and Parasitic Agents*. 1st edition, Informa Health Care Publishing.
10. Collee, J.G., Fraser, A. G., Marmion, B. P. Simmons. 2011. *Mackie & McCartney Practical Medical Microbiology*. 14th edition, Churchill Livingstone.

MIC-RS-103: Preparation of Research Proposal

Preparation of Research Proposal through review and survey of literature in the topic of research. Identification of gaps in the knowledge and preparation of specific objectives and rationale to bridge the gaps. Preparation of a real time budget and infrastructure requirements.