

FACULTY OF LIFE SCIENCES

Syllabus

For

Pre Ph.D. Course in Microbiology (Credit Based Evaluation & Grading System)

Examinations: 2019–20



Guru Nanak Dev University
Amritsar

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**Pre Ph.D. Course in Microbiology
(Credit Based Evaluation & Grading System)**

LSL-901 - Research Methodology

Time: 3 Hrs.

**Credits 3-1-0
Max. Marks : 100
Mid Semester Marks : 20
End Semester Marks : 80**

**Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage**

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Note: The course will be numerical oriented to train the students for the analysis of research data. Use of calculators will be allowed in the examination.

SECTION-A

1. **Descriptive statistics:** Statistical expressions, central tendency, dispersion of data (arithmetic and geometric), moments, skewness, kurtosis, sample size estimation.
2. **Probability:** Concept of probability, conditional probability, distributions: Normal, Poisson, binomial, 't', χ^2 , F-distributions.

SECTION-B

3. **Testing of hypothesis:** Central limit theorem, null hypothesis and alternative hypotheses, Z-test, Student's t-test, χ^2 -square, F-test, sample size, confidence intervals, odds ratio, index numbers, Probit analysis.
4. **Correlation and regression analysis:** Linear correlation and regression, exponential regression, logarithmic regression, reciprocal regression, Michael-Menten's regression, logistic regression, Gompertz regression, monomolecular regression.

SECTION-C

5. **Multiple correlation and regression:** MLR with 2 and 3 independent variables, quadratic and cubic polynomial regressions, Beta regression, sine curve, multiple correlation, partial correlation, path analysis, time series analysis.
6. **Experimental designs:** Experimental designs, central composite designs with 2 and 3 factors.

SECTION-D

7. **Analysis of Variance:** Assessing normality, one way and 2-way ANOVA, Tukey's multiple comparison test, HSD.
8. **Multivariate analysis:** Cluster analysis and dendrogram, principal component analysis, factor analysis, artificial neural networks.
9. **Non-parametric tests:** Wilcoxon's, Mann-Whitney's tests, Spearman's rank correlation, Kendall's Tau.
10. **Basic Greek and Latin words:** The students will learn Greek alphabet and more than 100 basic roots and words used in science.

Note: The students will be asked to submit an assignment of computer softwares designed by them on the basis of the Research methodology syllabus.

References:

1. Bailey, N.T.J. (1995). Statistical Methods in Biology. Cambridge University Press, Cambridge.
2. Kothari, C.R. (2004). Research Methodology: Methods and Techniques, New Age International Publishers, New Delhi.

**Pre Ph.D. Course in Microbiology
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MCL 902 - Applied Microbiology

Credit: 3-0-0

Time: 3 Hrs.

Max. Marks : 100

Mid Semester Marks : 20

End Semester Marks : 80

Mid Semester Examination: 20% weightage

End Semester Examination: 80% weightage

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION - A

Bioactive metabolites from microorganisms and plants Antibiotics, enzyme-inhibitors (acetylcholinesterase inhibitors, chitinase inhibitors, protease inhibitors), immunomodulators, antitumour agents, bio-insecticides.

SECTION- B

Biosynthesis of isoprenoids, PUFA, Flavonoids and farnescene by microorganisms. Biosynthesis of metallic nanoparticles, Involvement of Laccase, Lignin peroxidase, manganese peroxidase and other oxidases involved in ligninolysis. Biotechnological applications of ligninolytic fungi with particular reference to the pulp and paper industries, industrial effluent treatment and animal feed nutrition.

SECTION - C

Microbial degradation of xenobiotics, Catabolic genes and their regulation, isolation of DNA from different environmental niches and its manipulation to assess taxonomic and functional diversity.

SECTION - D

Concepts and techniques of molecular microbial ecology. Auto fluorescence proteins. Immune evasion mechanism by pathogens and their long term survival in hosts.

Books recommended:

1. Manual of Environmental Microbiology, 3rd Edition 2007, Editors: Christon J. Hurst, Ronald L. Crawford, Jay L. Garland, David A. Lipson, Aaron L. Mills, Linda D. Stetzenbach, ASM Press Title: Manual of Environmental Microbiology, 3rd Edition.
2. Methods for General and Molecular Microbiology, 3rd Edition, 2007, Editors: C. A. Reddy, Terry J. Beveridge, John A. Breznak, George Marzluf, Thomas M. Schmidt, Loren R. Snyder, ASM Press.

**Pre Ph.D. Course in Microbiology
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MCL 903 - Recent Trends in Microbiology

Time: 3 Hrs.

Credit: 3-0-0

Max. Marks : 100

Mid Semester Marks : 20

End Semester Marks : 80

Mid Semester Examination: 20% weightage

End Semester Examination: 80% weightage

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION- A

Innovative aspects in the application of lactic acid bacteria in biotechnology, probiotics and functional foods. Criteria for the selection of probiotic microorganisms, Isolation and selection of potential probiotic strains, and In vivo assessment.

SECTION - B

Role of endophytic microorganisms in terrestrial communities and ecosystems. Retroviruses and gene therapy. Stem cell research and its future in modern world. Application of cytochrome P450 in drug discovery and bioremediation. CRISPR/CAS system a modern tool for biotechnology.

SECTION - C

Quorum sensing in bacteria. Defining resistance, mechanism to develop resistance. Up scaling of metabolites from laboratory level to industrial level and its significance.

SECTION- D

Recent advances in bacterial metabolism, stress and survival of bacteria: Prokaryotic responses to environmental stress, heat shock and molecular chaperones, oxidative stress, hydrostatic stress, osmotic shock, cross responses to stress factors, use of proteomics and genomics to understand physiology under stress conditions.

Books recommended:

1. Microbial Physiology, 4th Edition, 2003 Albert G. Moat John W. Foster, Michael P. Spector, Michael P. Sector, Publisher Willy-Liss.
2. Lehninger Principles of Biochemistry 5E 2009, Dave Nelson and Mike Cox Publisher, WH Freeman.
3. Modern Microbial Genetics, 2nd Edition, 2002 Uldis N. Streips, Ronald E. Yasbin Publisher Willy-Liss.
4. Genes IX, Lewin, Benjamin 2007, CBS Publishers and Distributors.
5. Molecular Biology of the Gene, 6th Edition, 2008, Ed. James Watson, Tania Baker, Stephen Bell, Alexander Gann, Michael Levine, Richard Losick Pearson Education.

**Pre Ph.D. Course in Microbiology
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MCL 905 - Techniques in Microbiology

Time: 3 Hrs.

Credit: 3-0-0

Max. Marks : 100

Mid Semester Marks : 20

End Semester Marks : 80

Mid Semester Examination: 20% weightage

End Semester Examination: 80% weightage

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION – A

Molecular techniques for discriminating taxa and assessing microbial diversity. Immunological and biochemical methods for identification of microorganisms.

SECTION- B

Electron microscopy and its applications in Microbiological sciences. Chromatographic techniques for the separation and purification of metabolites , MS for structure elucidation .

SECTION-C

Yeast for understanding complex biological processes. Flow cytometry and flow cell sorting techniques, peptide mass fingerprinting.

SECTION - D

DNA microarray- basic components, organization, working components and analysis, FISH-MAR. High throughput screening of biomolecules with anticancer, antimicrobial, anti-inflammatory and anti oxidant properties

Books recommended:

1. Manual of Environmental Microbiology, 3rd Edition 2007, Editors: Christon J. Hurst, Ronald L. Crawford, Jay L. Garland, David A. Lipson, Aaron L. Mills, Linda D. Stetzenbach, ASM Press Title: Manual of Environmental Microbiology, 3rd Edition.
2. Methods for General and Molecular Microbiology, 3rd Edition, 2007, Editors: C. A. Reddy, Terry J. Beveridge, John A. Breznak, George Marzluf, Thomas M. Schmidt, Loren R. Snyder, ASM Press.
3. Molecular Microbial Ecology 2005 Ed Orborn, AM, Smith CJ Taylor and Francis