

M. Phil. Microbiology

Syllabus-2018

Course of Study

The course of study shall extend over a period of one academic year. An intensive programme of study of 1 year duration is divided into three core courses of study and one essential Dissertation as shown below:

Scheme of examination:

Course No. & paper

Course code	Paper nomenclature	Hrs/ Week	Max. Marks	Min. Passing Marks (40 in individual paper; 50 % in aggregate)
MPM I	Research Methodology and Bioinstrumentation	3	100	40
MPM II	Recent trends in Biology and Bioinformatics	3	100	40
MPM III	Environmental and Industrial Microbiology	3	100	40
MPM IV	Research Project/Case Study		100	40
				200 (aggregate)
Grand total			400	

Note: Every theory paper shall consist of 10 questions, two questions from each unit. Student will have to attempt five questions, selecting one from each unit. All questions will carry equal marks.

PAPER MPM I

RESEARCH METHODOLOGY AND BIOINSTRUMENTATION

Instructions to Paper Setters

The question paper will consist of three Sections: A, B and C. Section A will consist of 10 compulsory questions. Section B will consist of 10 questions (2 questions from each unit of the syllabus). Section C will consist of 5 questions (1 question from each unit of the syllabus).

TIME: 3Hours

Maximum Marks: 100

Unit I:

Data, population, sample, statistic. Need of statistics. Variables: types independent/dependent, qualitative/quantitative, discrete/continuous, Error producing variables-intervening, extraneous and attribute variables, methods of controlling variables. Statistical manipulation of variables. Physical and selective manipulation of variables. Basic assumptions in qualitative and quantitative, parametric and non parametric studies.

Unit II

Scientific writing as a means of communication. Forms of scientific writing: Articles, notes, reports, review articles, monographs, dissertations, bibliographies, popular science articles, news items, science fiction, conference proceedings, history of science, biographies. Formatting of Scientific articles.

Presentation of research data. General guidelines to present data. Types and characteristics of good tables, diagrams, graphs and other illustrations. Interpreting and analysis of data. Drawing inference on the basis of assumptions, experimental layout, limitations of the statistical method.

Unit III

Biostatistics: Measures of Central tendency and Dispersion. Probability distribution : Binomial, Poisson and Normal. Parametric and Nonparametric statistics, Confidence Interval, Errors.

Quantitative Techniques: Levels of significance, Regression and Correlation, Use of Statistics in Biosciences.

Unit: IV

Computer applications in Biology:

Spreadsheet tools : Introduction to spreadsheet applications, features, Using formulas and functions, Data storing, Features for Statistical data analysis, Generating charts / graph and other features, Tools – Microsoft Excel or similar.

Presentation tools: Introduction, features and functions, Customizing presentation, Showing presentation, Tools – Microsoft Power Point or Similar.

Unit :V

Principle & application of scanning & Transmission Electron Microscopy; Fixation and staining techniques for EM, Freeze-etch and Freez-fracture method for EM, flow Cytometry. Principles & applications of gel-filtration, Ion-exchange & Affinity Chromatography: Thin layer & Gas chromatography; High pressure liquid chromatography (HPLC), Electrophoresis & Electro-focusing; Ultracentrifugation (velocity & Buoyant density); Fractionation of Microbial Cells and Cell organelles.

Suggested Reading:

1. Kothari CR. (1990). Research methodology- Methods and Techniques (2/e). Vishva Prakashan, C.A. Division of Wiley Eastern, New Delhi.
2. Baumgartner TA and Strong CH (1994). Concluding and reading research in health and human performance. Brown and Benchmark (Div of Wm. C. Brown Communication Inc.)

3. Gupta SP. (1999). Research methodology and statistical techniques. Deep and Deep Publications, New Delhi.
4. Pettitti DB. (2000). Meta-analysis, decision analysis and cost-effectiveness analysis: Methods for quantitative analysis in medicine. Oxford Univ Press, New York.
5. Creswell J (1994). Research design: Qualitative and quantitative approaches. Thousand Oaks. CA, Sage Pub.
6. Denzin NK and Lincoln YS (1994). Handbook of qualitative research. Sage pub.
7. Mienert CL (1986). Clinical trials: Design, conduct and analysis. Oxford Univ Press, New York.
8. Bryman A and Cramer D (1996). Quantitative data analysis with minitabs. Rutledge, London.
9. Bailey, NT J (2000). Statistical Methods in Biology. English Univ. Press.
10. Campbell R.C (1974). Statistics for Biologist. Cambridge University Press, UK.
11. Shina PK (2002). Fundamentals of computers. BPB Publication, New Delhi

PAPER: MPM II

RECENT TRENDS IN BIOLOGY AND BIOINFORMATICS

Instructions to Paper Setters

The question paper will consist of three Sections: A, B and C. Section A will consist of 10 compulsory questions. Section B will consist of 10 questions (2 questions from each unit of the syllabus). Section C will consist of 5 questions (1 question from each unit of the syllabus).

TIME: 3Hours

Maximum Marks: 100

Unit I:

Enzymes: DNA polymerase, restriction endonucleases, topoisomerase I and DNA ligase, reverse transcriptase, kinase, alkaline phosphatase, nuclease, RNAse H. Vectors: plasmids;(Ti/Ri), Cosmids, bacteriophage, M13 vectors, BAC, YAC and synthetic plasmids.

DNA sequencing dideoxy chain termination and Sanger's +/- method.

cDNA library – screening by oligonucleotide probe, nick translation, site directed mutagenesis, linkage analysis.

Gene cloning- General strategy for gene cloning, transformation.

Application of gene technology, Gene Silencing, Geneknock out and gene therapy

Unit II:

Complement fixation, structure and classes of antibodies, genetic basis of antibody diversity.

MHC I and II: structure and antigen presentation.

T and B lymphocytes activation and role in humoral and cell mediated immunity.

Vaccines live and attenuated, killed, multi-subunit and DNA vaccines.

Hypersensitivity and auto immune diseases. ELISA, RIA, Hybridoma Technology.

Unit III:

Media requirements and sterilization techniques, primary and established cell lines. Culture methods: hanging drop, monolayer and suspension. Advantages and disadvantages. Scale up methods. Roux tubes roller bottles. Stem cells: adult and embryonic, applications to tissue engineering. Applications of animal cells.

Unit IV:

Cell and callus culture, anther culture. Micropropagation, somatic cell hybridization, protoplast fusion, cybrids, artificial seeds, Agrobacterium mediated gene transfer and use of Ti plasmid. Applications of plant tissue culture engineering, pathogen resistance (BT gene), herbicide tolerance, salt tolerance, production of secondary metabolites and transgenic plants.

Unit V:

Biological Database- Primary Database & Secondary Database; Submitting Sequence to the Database and Information Retrieval through ENTREZ; Sequence Databases (EMBL, GenBank, DDBJ, SWISS-PROT, PIR, TrEMBL); Protein Family/Domain Databases (PROSITE, Pfam, PRINTS & SMART), & Structure Database (PDB), BLAST Programs.

Sequence analysis: Types of sequence alignment (pair wise, multiple, global and local), Gap and Gap penalties, Scoring schemes, Methods of sequence alignment, DOT PLOT or DOT MATRIX; Sequence database similarity searching algorithms, local alignment, global alignment, FASTA, BLAST (BLASTP, BLASTN, BLASTX, TBLASTN, TBLASTX) and similarity searching scores and their statistical interpretation.

Suggested Reading:

1. Wilson K. and Walker J. (2008). Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.
2. Nelson D and Cox MM. (2009). Principles of Biochemistry. W.H. Freeman and Company, New York.
3. Potter GWH and Potter GW. (1995). Analysis of Biological Molecules: An Introduction to Principles, Instrumentation and Techniques, Kluwer Academic Publishers.
4. Williams, BL. and Wilson, K. (1975). A Biologists Guide to Principles and Techniques of Practical Biochemistry. John Wiley and Sons. Inc., New York.
5. Friefelder, D. 1987. Molecular Biology. Narosa publishing House. New Delhi.

6. Old R.W and Primrose SB. (1995). Principles of gene manipulation-An introduction to Genetic engineering. 5th edition. Blackwell scientific publications. London.
7. Sharma, Munjal and Shankar (2008). A text Book of Bioinformatics. Rastogi Publication, Meerut.
8. Ewens W and Grant GR. Statistical methods in bioinformatics Springer
9. Genetic Engineering of microorganisms. Ed. By Alfred publishers. (1993). VCH. Weinheim FRG and New York USA.
10. Gibson, G. A Primer of Genome Science, 3rd Edition (2009)

PAPER: MPM III
ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY
Instructions to Paper Setters

The question paper will consist of three Sections: A, B and C. Section A will consist of 10 compulsory questions. Section B will consist of 10 questions (2 questions from each unit of the syllabus). Section C will consist of 5 questions (1 question from each unit of the syllabus).

TIME: 3Hours

Maximum Marks: 100

Unit I:

Bioremediation of various ecosystem-contaminated aquifers-Bioremediation of oil pollutants-Biodegradation, enhancement–stimulation of oil spills degradation. Bioremediation of air pollutants. Xenobiotics, Biomagnification. Bioaccumulation- removal of heavy metals from effluents.

Unit II:

Quality control: Aspects of water and food analysis, BIS codes for microbial analysis. Guidelines of NABL, BIS and MOEF.

Intellectual Property Rights (IPR), Patents, Trademarks, Copyrights. Introduction to Patenting of Microbiological materials and GMO, implication of patenting, current issues, patenting of genes and DNA sequences.

Unit III:

Concept of plant growth promotion, Rhizosphere, Phyllosphere-N₂ fixation, P,K solubilization by microbes, induced systemic resistance, Biocontrols, role of lipochito-oligosaccharide in plant growth enhancement.of medical importance.

Unit IV:

Sources and characters of industrial microbes, their isolation, purification & maintenance. Screening of useful strains: primary screening & secondary screening. Strain improvement through random mutation (random & rational selection), Role of genetic recombination & genetic engineering in strain improvement.

Unit V:

Fermentation technology: microbial growth kinetics in batch, continuous & fed-batch fermentation process. Stirred aerobic bioreactor: principles & designing. Other types of bioreactors. Raw materials used in fermentation media and upstream processes. Solid state fermentation & submerged fermentation: Downstream Processing (product recovery).

Suggested Reading:

1. Creuger and Creuger (2001). Biotechnology- A textbook of Industrial Microbiology, Sinaeur Associates.
2. Agrios, GN (1997). Plant Pathology. Academic Press, San Diego.
3. Cook RJ and Baker KF (1983). The Nature and practice of Biological Control of plant pathogens. America Phytopathological Society Press, St. Paul, MN.
4. Prasad, TVS. (2011). A Textbook of Soil Microbiology ISBN 9788178886299
5. Josdand,SN. (1995). Environmental Biotechnology. Himalaya Publishing House, Bombay.
6. Periman, D. Advances in Applied Microbiology. ISBN 19730120026163
7. Singh, A (2010). Biodegradation and Bioremediation. ISBN 9788184893540
8. Verrall, MS. Discovery and Isolation of Microbial Products. ISBN 08531274841985
9. Stanbury PF, Whittaker A and Hall SJ. Principles of fermentation technology. 2nd edition.

PAPER- MPM 1V

Research Project/Case Study

Scheme of examination

The student shall prepare a report of his/her work carried out as mentioned below and shall present it to the external examiner. The examiner will evaluate the work carried out and shall award the marks accordingly.

Maximum Marks: 100

Duration: 20 min presentation per student

Minimum Passing Marks: 40

The student will select a topic of research in consultation with his/her supervisor/guide to do a research work or carry out a case study on any topic related to microbiology or allied sciences.