M. Phil (Microbiology)  
Syllabus, C.C.S. University, Meerut  
Effective from the session 2009-2010

All general rules and regulations for this one year course of M.Phil. in Microbiology shall be the same as for other M.Phil. courses in the Faculty of Science in the University. The additional rules and regulations are being framed as follows:

Eligibility: A candidate must possess a post-graduate degree from any recognized University in India or abroad in Microbiology/ Biotechnology.

Examination: A student is required to complete following four theory courses (two in each semester):

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<tr>
<th>COURSE</th>
<th>External Examination</th>
<th>Internal Examination</th>
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<tr>
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<td>Max. Marks</td>
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<tr>
<td>1. Microbiological Techniques</td>
<td>80</td>
<td>20</td>
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<td>2. Biostatistics &amp; Bioinformatics</td>
<td>80</td>
<td>20</td>
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<td>3. Microbial Technology, IPR and Patent</td>
<td>80</td>
<td>20</td>
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<td>4. Clinical Microbiology</td>
<td>80</td>
<td>20</td>
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<td>Project (two semester)</td>
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The pattern of examination shall be the same as for other subjects in the Faculty of Science. The question paper shall be based on the prescribed syllabus and it will be set by the external examiner in consultation with the internal examiner. A candidate is required to attempt 5 questions over a period of three hours. The answer books shall be evaluated by the external as well as internal examiner independently and the final marks awarded to the candidate shall be based on average of the two.

For the project work, the candidate shall be allotted a topic on which he/she shall do the research and shall submit the project report which shall be evaluated jointly by the external and internal examiner appointed by the University. The division shall be awarded based on the total percentage of marks secured by the candidate as per the existing rules of Faculty of Science.
M. Phil Microbiology  
Department of Microbiology  
Ch. Charan Singh University, Meerut  
w.e.f. 2009-2010

Course MP 101: Microbiological Techniques

Unit I: Principle & application of scanning & transmission electron microscopy; Fixation and staining techniques for EM, freeze-etch and freeze-fracture method for EM, flow cytometry.

Unit II: Principles & applications of gel-filteration, ion-exchange & affinity chromatography: Thin layer & gas chromatography; High pressure liquid chromatography (HPLC), FPLC; Electrophoresis & electrofocussing; Ultracentrifugation (velocity & Buoyant density); Fractionation of microbial cells and cell organelles.

Unit III: Principles & techniques of nucleic acid hybridization; Southern and Northern blotting, Cot curves; Development and labeling of DNA/RNA probes; Polymerase chain reaction and application; Methods for measuring nucleic acid & protein interactions; Western Blotting; Whole genome sequencing strategies.

Unit IV: Principles and methods used for analysis biopolymers; X-ray Crystallography, fluorescence, UV, ORD/CD, Visible, NMR & ESR spectroscopy; Hydrodynamic methods; Atomic absorption & Plasma emission spectroscopy.

Unit V: Principles & applications of tracer techniques in biology; Radiation dosimetry; Radioactive isotopes & half life of isotopes; Effect of radiation on biological system; Autoradiography; Liquid scintillation counters.

Suggested Reading:

Course MP 102: Biostatistics and Bioinformatics


Unit II: Correlation and regression: Scatter Diagram, Coefficient of Correlation, Rank correlation; Lines of Regression; Multiple correlation and Regression; Curve fitting: Linear relationship, Power Laws, Exponential Laws, Method of least squares.


Unit VI: 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.

Unit V: 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:

Course MP 201: Microbial Technology, IPR and Patent

Unit I: 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 III: Bioremediation: biodegradability of Petroleum hydrocarbons, Halocarbons, Chlorophenols, Nitroaromatics; Applicability of bioremediation: Intrinsic bioremediation, Biostimulation, Bioaugmentation. Applications of bioremediation to various contaminants & sites: Hydrocarbon-contaminated soils & aquifers, Halocarbon-contaminated soils & aquifers, Marine oil spills & Metal-contaminated soils; Carbon sequestration.

Unit III: Microorganisms as biofertilizers (Rhizobium, Azospirillum, Azotobacter, Acetobacter, Cyanobacteria, Mycorrhiza, Actinorrhiza and Phosphate solubilising microorganisms) and biopesticides (Trichoderma, Beauveria, Metarhizium, Nomuraea and Bacillus thuringiensis); Commercial production of biofertilizers and biopesticides; Their applications and limitations for Indian agriculture. Principles and mechanism of biological control. Bioherbicide and weed control, their role in agriculture.

Unit V: Biofuels: From organic residue (ethanol), biogas production, fuel from algae. Production of bioethanol from molasses, starchy and cellulosic materials. 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.

Suggested Reading:

1. Reed G (1997), Industrial Microbiology, CBS Publishers (AVI Publishing Co.)
Unit I: Specimens: collection, transport & storage. Prevention & control of laboratory acquired-infections; Investigation of food borne & water borne disease outbreaks; Manual & automated systems for microbial identification, immunoassays for the diagnosis of infectious diseases; Molecular detection and identification of microorganisms.

Unit II: Bacteriology: Gram positive cocci – Algorithm for identification of aerobic gram positive cocci; Staphylococcus and Micrococcus; Streptococcus; Enterococcus. Gram positive rods– Algorithm for identification of aerobic gram positive rods Coryneforms, Listeria, Mycobacterium and Nocardia. Gram negative rods- algorithm for identification of aerobic gram negative rods; Klebsiella, Salmonella, Shigella, Neisseria, Haemophilus and Pseudomonas. Anaerobic bacteria algorithm for identification of anaerobic bacteria; Clostridium.


Unit IV: Mycology: Algorithms for detection and identification of fungi; Candida, Cryptococcus, Pneumocystis, Aspergillus, Fusarium & Other opportunistic fungi; Rhizopus, Rhizomucor, Absidia & Other agents of systemic & subcutaneous Zygomycoses; Histoplasma, Blastomyces, Coccidioides & Other dimorphic fungi causing systemic mycoses; Trichophyton, Microsporum, Epidermophyton & Agents of superficial mycoses; Fungi causing Eumycotic Mycetoma.

Unit V: Antimicrobial agents and susceptibility testing: Antibacterial agents, Mechanism of resistance to antimicrobial agents, Susceptibility testing of fastidious bacteria, Susceptibility testing of anaerobic bacteria, Special phenotypic methods for detecting antibacterial resistance, genetic methods for detecting antibacterial and antiviral resistance gene; Antimycobacterial agents and susceptibility test; Antiviral agents and susceptibility test; Antifungal agents and susceptibility test.

Suggested Reading: