

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) :

COURSE	External Examination Max. Marks	Internal Examination Max. Marks
1. Microbiological Techniques	80	20
2. Biostatistics & Bioinformatics	80	20
3. Microbial Technology, IPR and Patent	80	20
4. Clinical Microbiology	80	20
Project (two semester)		

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-filtration, 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:

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. Talaro K. P. & Talaro A. (2006). Foundations in Microbiology. McGraw-Hill College Dimensi.
4. Potter GWH and Potter GW (1995). Analysis of Biological Molecules: An Introduction to Principles, Instrumentation and Techniques, Kluwer Academic Publishers.
5. Willey J, Sherwood L. and Woolverton C (2007). Prescott/Harley/Klein's Microbiology, McGraw Hill.
6. Willard, HH and Merritt LL (1986). Instrumental Methods of Analysis. CBS Publishers and Distributors.
7. Williams, BL. and Wilson, K. (1975). A Biologists Guide to Principles and Techniques of Practical Biochemistry. John Wiley and Sons. Inc., New York.
8. Thornburn CC (1987). Isotopes and Radiations in Biology. Butterworth and Co. Ltd., London.
9. Aneja KR. (2005). Experiments in Microbiology, Plant Pathology and Biotechnology. New Age International (P) Ltd, Publishers.

M. Phil Microbiology
Department of Microbiology
Ch. Charan Singh University, Meerut
w.e.f. 2009- 2010

Course MP 102: Biostatistics and Bioinformatics

- Unit I:** Probability theory: Classical and Statistical definitions, conditional probability, Bayes' Theorem. Introduction to Random variable and Mathematical expectation. Probability Distributions: Binomial, Multinomial, Poisson and Normal Distribution.
- 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 III:** Analysis of variance for one way and two way classification. Principles of Design of experiment: Replication, Randomization and Local control. Statistical analysis of Completely randomized Design, Randomized block design and Latin square design; Analysis of Covariance.
- 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:

1. Sharma, Munjal and Shankar (2008). A text Book of Bioinformatics. Rastogi Publication, Meerut.
2. White R (2000). How Computers work. Tech. Media.
3. Gralla P (2000). How the Internet Work. Tech. Media.
4. Bailey, NT J (2000). Statistical Methods in Biology. English Univ. Press.
5. Campbell R.C (1974). Statistics for Biologist. Cambridge University Press, UK.
6. Shina PK (2002). Fundamentals of computers. BPB Publication, New Delhi

M. Phil Microbiology
Department of Microbiology
Ch. Charan Singh University, Meerut
w.e.f. 2009- 2010

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 II:** 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).
- 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.)
2. Stanbury PF, Whitekar A. and Hall (1995). Principles of Fermentation Technology. Pergaman. McNeul and Harvey.
3. Rehm and Reed (1983). Biotechnology. Verlag Chemie.
4. Bhosh, Fiecht er and Blakebrough (1999). Advances in Biochemical Engineering. Springer Verlag Publications.
5. Creuger and Creuger (2001). Biotechnology- A textbook of Industrial Microbiology, Sinaeur Associates.
6. Casida LE (1997). Industrial Microbiology, Wiley Eastern.
7. Agrios, GN (1997). Plant Pathology. Academic Press, San Diego.
8. Cook RJ and Baker KF (1983). The Nature and practice of Biological Control of plant pathogens. Amereca Phytopathological Society Press, St. Paul, MN.
9. Butt, TM, Jackson CW and Magan N (2001). Fungi as Biocontrol agent. CABI Publishing, UK
10. Maier RM, Pepper IL and Gerba CP (2000). Environmental Microbiology. Academic Press. USA
11. Pepper IL, Gerba CP and Brusseau ML (2006). Environmental and Pollution Science. Academic Press. USA
12. Baker KH and Herson DS (1994). Bioremediation. MacGraw Hill Inc. N.Y.

M. Phil Microbiology
Department of Microbiology
Ch. Charan Singh University, Meerut
w.e.f. 2009- 2010

Course MP 202: Clinical Microbiology

- 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 III:** Virology: algorithms for detection and identification of viruses; HIV, human T cell lymphotropic virus, Hepatitis A, B, C, D and G viruses; polyoma viruses, rabies virus, Epstein barr virus, Varicella zoster virus, human cytomegalovirus and respiratory syncytial virus .
- 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:

1. Greenwood D (2007). Medical Microbiology. I.K. International.
2. Murray PR, Pfaller MA, Tenover FC and Tenover RH (2007). Clinical Microbiology. ASM Press.
3. Talaro KP and Talaro A. (2006). Foundations in Microbiology. McGraw-Hill College Dimensi.
4. Willey J, Sherwood L. and Woolverton C (2007). Prescott/Harley/Klein's Microbiology, McGraw Hill.
5. Atlas RM (1997). Principles of Microbiology. McGraw Hill.
6. Nester E.W, Anderson DG and Nester MT (2006). Microbiology. A Human Perspective. McGraw Hill.