# M.Sc. (Applied Microbiology) Syllabus, C.C.S. University, Meerut

**Effective from the session 2009-2010**

<table>
<thead>
<tr>
<th>Course no.</th>
<th>Name of the course</th>
<th>Internal (M.M.)</th>
<th>External (M.M.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FIRST SEMESTER</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AM 101</td>
<td>Instrumentation and Microbial Techniques</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>AM 102</td>
<td>Microbial Diversity- Prokaryotes and Viruses</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>AM 103</td>
<td>Microbial Diversity- Eukaryotes</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>AM 104</td>
<td>Biostatistics, Computer Application and Bioinformatics</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td><strong>Practical</strong></td>
<td></td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>SECOND SEMESTER</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AM 201</td>
<td>Microbial Physiology and Biochemistry</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>AM 202</td>
<td>Molecular Biology and Microbial Genetics</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>AM 203</td>
<td>Recombinant DNA Technology</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>AM 204</td>
<td>Environmental Microbial Technology</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td><strong>Practical</strong></td>
<td></td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>THIRD SEMESTER</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AM 301</td>
<td>Medical Microbiology</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>AM 302</td>
<td>Molecular Immunology</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>AM 303</td>
<td>Agricultural, Food and Dairy Microbiology</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>AM 304</td>
<td>Microbial Technology, Fermentation, IPR and Patent</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td><strong>Practical</strong></td>
<td></td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>FOURTH SEMESTER</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AM 401</td>
<td>Project VIVA</td>
<td></td>
<td>400</td>
</tr>
<tr>
<td><strong>Total Marks</strong></td>
<td></td>
<td></td>
<td>2200</td>
</tr>
</tbody>
</table>

All rules for examination pattern, pass percentage and admissions shall be the same as for the post-graduate courses in the Faculty of Science on the University campus. Minimum eligibility for admission in this two year M.Sc. (Applied Microbiology) course shall be B.Sc. (Biology group). There shall be 50% internal and 50% external assessment in all the aforesaid courses. The pattern of internal assessment shall be decided by the Department, however, it will mainly be based on tests, quizzes, seminars, term papers, group discussions and home assignments. Specialization shall be allowed in the fields of Medical Microbiology / Industrial Microbiology / Environmental Microbiology / Agricultural Microbiology. It shall start from the very first semester and the student will have to complete a project related to his / her specialization in the final fourth semester for a period of 4 to 6 months. The student may be allowed to complete the project outside the University. At the end of the fourth semester the project report shall be submitted. It will be jointly evaluated by the Board of Examiners. One of the supervisors may be opted from outside the University where the candidate has completed the project. The candidate will make an open short presentation and will defend his/her experimental design, results and conclusions. The Department shall be free to alter the sequence of the courses in any semester depending upon the resources available.
Course AM 101: Instrumentation and Microbial Techniques

Unit I: Microscopy & Staining techniques: Basic principles for the examination of microbes by light, dark field, phase contrast, confocal, fluorescent and electron (transmission and scanning) microscopy; Micrometry; Specimen preparation and basic principles of Simple, Gram, Capsule, Endospore, Flagella, Acid fast, Fluorochrome and Nuclear/Geimsa’s staining.

Unit II: Basic principles and methods of sterilization: control of microorganisms by physical methods: heat, filtration and radiation; chemical methods: phenolics, alcohols, halogens, heavy metals, quartenary ammonium compounds, aldehydes and sterilizing gases; evaluation of antimicrobial agent effectiveness. Principle and functioning of LAF.

Unit III: Basic principles and methods of media preparation: types of culture media: simple media, complex media, synthetic media, enriched media, selective media, indicator media, differential media, anaerobic media; pH and buffers; Pure culture techniques: streak plate, pour plate and spread plate method; maintenance of pure culture; methods of preservation of various microbes.

Unit IV: Basic principles and applications of spectrophotometry & Chromatography: Beer-Lambert law; interaction of radiation with matter, absorption of radiation, emission of radiation; UV-Vis spectrophotometry, Fluorimetry, Flame photometry and atomic absorption spectrophotometry; Chromatography (paper, thin layer, column, gel filtration, ion-exchange and affinity chromatography); GLC, HPLC and FPLC.

Unit V: Miscellaneous techniques: Principles and applications of Electrophoresis for protein and DNA; Iso-electric focusing and 2D gel electrophoresis; Autoradiography, X-Ray diffraction; Centrifugation; Ultracentrifugation; Dialysis, Ultrafiltration; Lyophilization and Speed vac.

Suggested Reading:


Note: The examiner is expected to set the question paper based on the entire course content. In Section A, the question paper shall include 5 long question (10 marks each) out of which the candidate is required to attempt 3 questions. Section B shall be based on short answers 100-200 words and shall include 4 questions of which the candidate is required to attempt 2 questions of 5 marks each. Section C shall include 10 to 20 questions of half / one mark each and shall be based on objective type / true-false / very short answers like definitions.
Course AM 102: Microbial Diversity - Prokaryotes and Viruses

Unit I: Discovery of microbial world; History, Scope and relevance of Microbiology; Current thoughts on microbial evolution including the origin of life; Introduction to microbial biodiversity – distribution, abundance, ecological niche of bacteria and archaea.

Unit II: Current status of microbes in the living world, Haeckel’s three kingdom concept, Whittaker’s five kingdom concept, three domain concept of Carl Woese, eight kingdom system of classification of Cavalier Smith; Modern trends in the classification of microbial world including 16S rRNA sequencing, Numerical and molecular taxonomy; Classification and salient features of bacteria according to the Bergey’s Manual of Determinative bacteriology. Morphology and ultra structure of bacterial cell.

Unit III: General characteristics of Archae; cell wall of Archae, classification of Archae; General characteristics of thermophiles, psychrophiles, osmophiles, methanogens, methylotrophs, acidophiles, alkaliophiles, halophiles and methanogens. Applications and commercial aspects of extremophiles. Adaptations and role of archeabacteria in the evolution of microbial world. General characters of Cyanobacteria, their classification, ultrastructure and economic importance.

Unit VI: History of discovery of viruses; General characters, nomenclature, classification, morphology and ultra-structure of viruses; Capsid and their arrangement; Cultivation of viruses using embryonated eggs, experimental animals and cell cultures (Cell-lines, cell strains and transgenic systems). Purification of viruses by adsorption, precipitation, enzymes, serological methods (haeme agglutination and ELISA). Assay of viruses (physical and chemical methods).

Unit V: Bacteriophages: Structure and life cycle patterns of T-even phages; one step growth curve; Bacteriophage typing; Structure of Cyanophages, Mycophages; General characters and structure of viroids and prions, their structure and major diseases caused by them, controversies about their nature.

Suggested Reading:


Note: The examiner is expected to set the question paper based on the entire course content. In Section A, the question paper shall include 5 long question (10 marks each) out of which the candidate is required to attempt 3 questions. Section B shall be based on short answers 100-200 words and shall include 4 questions of which the candidate is required to attempt 2 questions of 5 marks each. Section C shall include 10 to 20 questions of half / one mark each and shall be based on objective type / true-false / very short answers like definitions.
**Course AM 103: Microbial Diversity - Eukaryotes**

**Unit I:** General characteristics of eukaryotic microbes; Ultrastructure and organization of a typical eukaryotic cell (membrane structure and functions, cytoskeleton, intracellular compartments---nucleus, mitochondria, chloroplast and their genetic organization); Structure and organization of chromatin; cell cycle; meiosis and mitosis; Classification of eukaryotic microbes; Evolutionary relationship of each group based on modern systems of classification.

**Unit II:** Current status of fungi; their classification with reference to Ainsworth; General characters, somatic structure, asexual and sexual reproduction of microbiologically important genera of Myxomycota, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina.

**Unit III:** Heterothallism; sex hormones in fungi; physiological specialization and phylogeny of fungi. Parasexual life cycle; Economic importance of fungi. Lichen and their symbiotic relationship. Economic importance of lichens.

**Unit IV:** General characteristics of algae; Classification of algae; Somatic structure, asexual and sexual reproduction of microbiologically important genera of Chlorophyceae, Phaeophyceae, Bacillariophyceae, Rhodophyceae and Dinophyceae. Algal nutrition, ecology and biotechnology; Economic importance of algae.

**Unit V:** General characteristics of Protozoans; and Nematodes; Difference between protozoans and nematodes; Structure and reproduction of microbiologically important genera of protozoans (Entamoeba, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium) and Nematodes: Ancylostoma, Ascaris lumbricoides, Necator; Cestodes: Taenia solium, Taenia saginata, Diphyllolothrium, Echinococcus granulosus and Trematodes: Paragonimus, Fasciola hepatica, Schistosoma; Difference between Protozoans and Nematodes.

**Suggested Reading:**


**Note:** The examiner is expected to set the question paper based on the entire course content. In Section A, the question paper shall include 5 long question (10 marks each) out of which the candidate is required to attempt 3 questions. Section B shall be based on short answers 100-200 words and shall include 4 questions of which the candidate is required to attempt 2 questions of 5 marks each. Section C shall include 10 to 20 questions of half / one mark each and shall be based on objective type / true-false / very short answers like definitions.
M. Sc. Applied Microbiology  
Department of Microbiology  
Ch. Charan Singh University, Meerut  
w.e.f. 2009-2010

**Course AM 104: Biostatistics, Computer Application and Bioinformatics**

**Unit I:** Presentation of data; Frequency distributions; Graphical representation of data by histogram, polygon, frequency curves and pie diagram. Measures of central tendency: Mean, median and mode; Measures of dispersion: Mean deviation, standard deviation, variance, Standard error, coefficient of variation; Correlation and regression: properties, nature, coefficient of correlation, rank correlation, linear regression and regression equations and multiple linear regression, significance of correlation and regression.

**Unit II:** Probability: Basic concepts related to probability theory, classical probability. Probability Distributions: Introduction and simple properties of Binomial, Poisson and Normal Distributions and their applications in biology. Sampling: Concept of sampling and sampling techniques.

**Unit III:** Testing of hypotheses: Some basic concepts, Errors in hypothesis testing; critical region; Students t-test for the significance of population mean and the difference between two population means; Paired t-test; Chi square test for population variance, goodness of fit and for the independence of two attributes in a contingency table; F-test for the equality of two population variance; Analysis of variance: One-way and two-way analysis of variance.

**Unit IV:** Introduction to Computers: Definition, Components of computer, Classification of Computers, Generation of Computers; Introduction to Software; Translators (Compiler & Interpreter); Basics for operating systems (MS-DOS, Windows, Unix and Linux); Introduction to MS Office (MS-Word, MS-Excel, MS-Power Point); Introduction to Networking, Internet (E-Mail, File Transfer Protocol, Usenet, Telnet).

**Unit V:** Introduction to Bioinformatics: Definition and scope; Search engines: tools for web search; Introduction to biological databases (NCBI, EBI, DDBJ, GenBank, PDB, NDB and MMDB), Introduction to BLAST and FASTA; Brief idea about important softwares for microbiological studies.

**Suggested Reading:**


**Note:** The examiner is expected to set the question paper based on the entire course content. In Section A, the question paper shall include 5 long question (10 marks each) out of which the candidate is required to attempt 3 questions. Section B shall be based on short answers 100-200 words and shall include 4 questions of which the candidate is required to attempt 2 questions of 5 marks each. Section C shall include 10 to 20 questions of half / one mark each and shall be based on objective type / true-false / very short answers like definitions.
M. Sc. Applied Microbiology  
Department of Microbiology  
Ch. Charan Singh University, Meerut  
w.e.f. 2009-2010

Course AM 201: Microbial Physiology & Biochemistry

Unit I: Nutritional requirements of major groups of microbes, nutritional uptake; transport across the membranes and cell wall (diffusion, passive diffusion, active transport, group translocation and iron uptake); Physiology of growth and kinetics, Growth curve, measurement of growth (biomass, turbidity, dry weight, protein content); environmental factors affecting microbial growth.

Unit II: Photosynthesis: Adsorption light, photosynthetic and accessory pigments, (chlorophyll, bacteriochlorophyll, carotenoids, phycobiliproteins); Oxygenic and non-oxygenic photosynthesis in prokaryotes, electron transport chain and phosphorylation; Calvin cycle; effect of light, temperature, pH, and CO₂ on the rate of photosynthesis; Photosynthetic yield and Photorespiration.

Unit III: Respiratory metabolism: Glycolytic pathway of carbohydrates breakdown, Embden Meyer Hoff pathway, Kreb's cycle, and Entner-Duodoroff pathway, Phospho-ketolase pathway; Pentose phosphate pathway; oxidative and substrate level phosphorylation; Gluconeogenesis, glyoxylate cycle, reverse TCA cycle; Fermentation of carbohydrates, homo and heterolactic fermentation.

Unit IV: Carbohydrates: Structure and properties of starch, cellulose, hemicellulose, glycogen and their derivatives; structure of lignin; General characters of fats, saturated and unsaturated fatty acids, biosynthesis of fatty acids, oxidation of fatty acids; distribution and functions of lipids in microbes.

Unit V: Classification, structure and properties of proteins, Structure of amino acids, classification of essential amino acids based on polarity, protein sequencing, peptide synthesis; methods of protein purification. Classification and nomenclature of enzymes; mechanism of enzyme action, enzyme inhibition, allosteric enzymes, enzyme kinetics. Principles of Physical chemistry; Thermodynamic principles in biology; Energy rich bonds; Weak interactions; Bioenergetics.

Suggested Reading:

Note: The examiner is expected to set the question paper based on the entire course content. In Section A, the question paper shall include 5 long question (10 marks each) out of which the candidate is required to attempt 3 questions. Section B shall be based on short answers 100-200 words and shall include 4 questions of which the candidate is required to attempt 2 questions of 5 marks each. Section C shall include 10 to 20 questions of half / one mark each and shall be based on objective type / true-false / very short answers like definitions.
Course AM 202: Molecular Biology and Microbial Genetics

Unit I: Nucleic acids as genetic information carriers: experimental evidences; DNA structure: historical aspects & current aspects, Structure of chromosomes (lampbrush and polytene chromosomes); melting of DNA, types of DNA. DNA replication in prokaryotes: types of polymerases, steps: initiation, elongation (Asymmetric & dimeric nature of DNA polymerase III & simultaneous synthesis of leading & lagging strands), termination. DNA replication in eukaryotes: types of polymerases, replication origins & initiation, steps involved in synthesis of telomeric DNA. Various modes of replication; Central dogma of life.


Unit III: Basic features of the genetic code. Protein synthesis in prokaryotes and eukaryotes; steps: details of initiation, elongation & termination, roles of various factors in the above steps, inhibitors of protein synthesis. Synthesis of exported proteins on membrane bound ribosomes: signal hypothesis. Post translational modification of proteins.

Unit IV: Regulation of gene expression: operon concept, negative & positive regulation, instability of bacterial mRNA, inducers and corepressors, catabolite repression. Negative regulation- E. coli lac operon; positive regulation- E. coli ara operon; regulation by attenuation- his and trp operons; anti-termination-N protein and nut sites in lambda.

Unit V: Mutations: Spontaneous and induced mutations; mutagens (physical mutagens: non ionizing radiation; chemical mutagens: Base analogues, alkylating agents, deaminating agents, intercalating agents & others); Molecular mechanism of mutagensis. Detection & isolation of mutants. DNA repair mechanisms. Plasmids and their types; Gene transfer mechanisms; Transposable elements; Molecular biology of cancer; Genetic load and genetic counseling.

Suggested Reading:


Note: The examiner is expected to set the question paper based on the entire course content. In Section A, the question paper shall include 5 long question (10 marks each) out of which the candidate is required to attempt 3 questions. Section B shall be based on short answers 100-200 words and shall include 4 questions of which the candidate is required to attempt 2 questions of 5 marks each. Section C shall include 10 to 20 questions of half / one mark each and shall be based on objective type / true-false / very short answers like definitions.
Course AM 203: Recombinant DNA Technology

Unit I: Basics of r-DNA technology: Enzymes used in r-DNA technology; DNA ligase, DNA Polymerase, Klenow Fragment, Reverse transcriptase, exonuclease, endonuclease, terminal deoxynucleotidyl transferase, Alkaline phosphatase, Polynucleotide kinase, and dephosphatases, Restriction modification systems and their types; Ligation- joining of DNA molecules together: blunt end ligation, joining with linkers, adapters & homopolymer tailing; Applications of rDNA technology.

Unit II: PCR and its various schemes (basic PCR, inverse-PCR, multiplex-PCR, RT-PCR, anchored-PCR, asymmetric-PCR, realtime-PCR, etc.) and applications; DNA sequencing methods: dideoxy and chemical methods, strategies for sequencing large DNA fragments, automated sequencing and pyrosequencing. Non-radioactive & radioactive labeling of probes. RFLP, RAPD, REMI, PFGE, microarray and northern blotting.

Unit III: Cloning vectors: general properties, plasmids, bacteriophages, cosmids, shuttle vectors, bacterial artificial chromosomes. Eukaryotic cloning vectors for yeast (YIp, YEp, YCp, YAC), higher plants (Ti based vectors; binary and coinTEGRATE, chloroplast-based vectors) & for animal cells (SV 40, vaccinia, retroviruses). Isolation and purification of genomic and plasmid DNA


Unit V: Expression vectors for expressing foreign genes in E. coli: problems associated with the production of r-proteins in E. coli, production of r-protein by eukaryotic cells. Applications of gene technology: production of Pharmaceuticals- humulin, somatotropin, somatostatin, recombinant vaccines, Brief discussion of Bt-cotton, Flavr Savr tomato and golden rice.

Suggested Reading:


Note: The examiner is expected to set the question paper based on the entire course content. In Section A, the question paper shall include 5 long question (10 marks each) out of which the candidate is required to attempt 3 questions. Section B shall be based on short answers 100-200 words and shall include 4 questions of which the candidate is required to attempt 2 questions of 5 marks each. Section C shall include 10 to 20 questions of half / one mark each and shall be based on objective type / true-false / very short answers like definitions.
Course AM 204: Environmental Microbial Technology

Unit I: Definitions, biotic and abiotic environment; Composition and structure of environment. History of Environmental microbiology; Microorganism in the Environment; Microbial habitats in the aquatic and extreme environment; Biogeochemical cycling.

Unit II: Biodegradation: Microbial degradation of natural substances - cellulose, xylan, lignin, chitin and keratin; Biodeterioration: Biodeterioration of cultural heritage; microbial deterioration of paper, textile, wood, paint and metal corrosion. Principal methods for their protection.

Unit III: Bioremediation: Microbial degradation of xenobiotics; hydrocarbons; clean up of sites polluted with oil spills, heavy metals and chlorinated solvents; biological treatment of effluents of textile, sugar, leather and paper and pulp industry; Recovery of minerals and metals from ores.

Unit IV: Techniques in environmental microbiology: Methods for determination of numbers, biomass and activities of microbes in soil, water, air and on plant surfaces and dead organic materials. Environment sample collection and processing.

Unit V: Microbiology of waste disposal: Microbes in solid waste and solid waste management; Sewage treatment systems (primary, secondary, tertiary and disinfection); Disinfection of potable water supplies; Indicators organism for water safety; Microbial assessment of water quality; Standards for tolerable levels of faecal contamination.

Suggested Reading:


Note: The examiner is expected to set the question paper based on the entire course content. In Section A, the question paper shall include 5 long question (10 marks each) out of which the candidate is required to attempt 3 questions. Section B shall be based on short answers 100-200 words and shall include 4 questions of which the candidate is required to attempt 2 questions of 5 marks each. Section C shall include 10 to 20 questions of half / one mark each and shall be based on objective type / true-false / very short answers like definitions.
M. Sc. Applied Microbiology  
Department of Microbiology  
Ch. Charan Singh University, Meerut  
w.e.f. 2009-2010  

Course AM 301: Medical Microbiology

Unit I: Classification of medially important bacteria; Normal flora of human body, role of the resident flora; collection of clinical samples and laboratory diagnosis of important bacterial infections, pathogenic microorganisms. Brief account of major air, water and soil borne diseases of microbial origin and their prevention and control measures.

Unit II: Bacteriology: Important human diseases caused by *Staphylococcus; Streptococcus; Neisseria; Bacillus; Corynebacterium; Clostridium*; Organisms belonging to Enterobacteriaceae (*Escherichia coli, Klebsiella, Salmonella, Shigella and Proteus*); *Pseudomonas; Haemophilus; Mycobacterium*; Antibacterial drugs and susceptibility test; Bacterial vaccines. Mechanism of drug resistance in pathogenic bacteria and fungi.

Unit III: Virology: Collection of clinical samples and laboratory diagnosis of important viral diseases; Mumps; Measles; Influenza; Adenovirus; Enterovirus; Rhinovirus; Poxvirus; Hepatitis; Herpesvirus; AIDS; Antiviral drugs; Viral vaccines; Interferons; Tumor viruses; antiviral agents and susceptibility test.

Unit IV: Mycology: Classification of medically relevant fungi: Collection of clinical sample and laboratory diagnosis of important human fungal diseases: Phycomycosis; Candidiasis; Dermatophytosis; Aspergillosis; Otomycosis; Cutaneous and subcutaneous mycoses; Systemic mycoses; Opportunistic mycoses; Antifungal agents and susceptibility test.

Unit V: Parasitology: Important diseases caused by intestinal and urogenital protozoa: *Entamoeba; Giardia; Trichomonas*; Blood and tissue protozoa; *Plasmodium; Trypanosoma; Leishmania*; Cestodes: *Taenia*; Trematodes: *Schistosoma; Paragonimus*; Nematodes: *Ascaris; Ancylostoma; Necator*; their laboratory diagnosis, treatment and prevention; antiparasitic agents and susceptibility test.

Suggested Reading:


Note: The examiner is expected to set the question paper based on the entire course content. In Section A, the question paper shall include 5 long question (10 marks each) out of which the candidate is required to attempt 3 questions. Section B shall be based on short answers 100-200 words and shall include 4 questions of which the candidate is required to attempt 2 questions of 5 marks each. Section C shall include 10 to 20 questions of half / one mark each and shall be based on objective type / true-false / very short answers like definitions.


Unit III: Vaccines immunizations: types of vaccines (DNA vaccines, recombinant DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines) & their characteristics. Immunization of test animals, hyperimmune antisera; Prophylactic immunization; Immune Disorders: hypersensitivities, autoimmune diseases, transplantation (tissue) rejection, immunodeficiency’s.

Unit IV: Complement: Classical alternative and lectin pathway of complement activation, regulation of complement system, biological consequence of complement activation. Cytokines: interferons (α, β & γ), TNF, interleukins (1-16), hematopoietins & chemokines, Regulation of immune response.


Suggested Reading:

Note: The examiner is expected to set the question paper based on the entire course content. In Section A, the question paper shall include 5 long question (10 marks each) out of which the candidate is required to attempt 3 questions. Section B shall be based on short answers 100-200 words and shall include 4 questions of which the candidate is required to attempt 2 questions of 5 marks each. Section C shall include 10 to 20 questions of half / one mark each and shall be based on objective type / true-false / very short answers like definitions.
M. Sc. Applied Microbiology
Department of Microbiology
Ch. Charan Singh University, Meerut
w.e.f. 2009-2010

**Course AM 303: Agricultural, Food and Dairy Microbiology**

**Unit I:** Microorganisms as biofertilizers (*Rhizobium, Azospirillum, Azotobacter, Cyanobacteria, Mycorrhiza and actinorrhiza*) and biopesticides (*Trichoderma, Beauveria, Metarrhizium, Nomuraea, Bacillus thuringiensis* and NPVs): 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; Microbiology of composting; reclamation of barren lands using microbial technology.

**Unit II:** Disease forecasting and basic principles of plant disease control; Pathology, etiology and control of economically important crop diseases of wheat, rice, barley, maize, sugarcane, vegetables and pulses caused by fungi, bacteria and viruses; Management and storage of agricultural products; Post-harvest diseases; their prevention and their control.

**Unit III:** Important microbes involved in spoilage of food, meat, poultry, vegetables and dairy products; food preservation. Microbial deterioration of cereals, pulses, fish and sea-foods during storage; Toxins : Bacterial and mycotoxins, Important microbes secreting toxins, chemical nature of important toxins; their role in food poisoning; physiology and mechanism of action, modification and detoxification; prevention and control of toxin contamination.

**Unit IV:** Microbial biomass: Single cell proteins and myco-protein; Use of microbial enzymes in food; Food quality monitoring, Fermented foods and traditional fungal foods (shoya, miso, tempe etc.). Fermented vegetable, meat and milk products (cheeses, butter and yoghurt).

**Unit V:** Feed for cattle’s, use of microbes and microbial enzymes in the improvement of nutritive quality of feed. Fermented feeds (Ensiling feed grains and hay crops). Aids to ensiling. Product of microbial processes added to feeds; Rumen microbiology.

**Suggested Reading:**


**Note:** The examiner is expected to set the question paper based on the entire course content. In Section A, the question paper shall include 5 long question (10 marks each) out of which the candidate is required to attempt 3 questions. Section B shall be based on short answers 100-200 words and shall include 4 questions of which the candidate is required to attempt 2 questions of 5 marks each. Section C shall include 10 to 20 questions of half / one mark each and shall be based on objective type / true-false / very short answers like definitions.
Course AM 304: Microbial Technology, Fermentation, IPR and Patents


Unit II: Microbial transformations with special reference to steroids & alkaloids. Primary & secondary metabolites. Commercial production of antibiotics with special reference to penicillin, streptomycin and their derivatives.

Unit III: Microbiology & production of alcoholic beverages: malt beverages, distilled beverages, wine & champagne. Commercial production of organic acids like acetic, lactic, citric, & gluconic acids. Commercial production of important amino acids (glutamic acid, lysine & tryptophan), insulin & vitamins (vitamin B_{12}, riboflavin & vitamin A).


Unit V: Bioconversion of wastes for fuels (gases fuel and fuel from algae); Production of bio ethanol from molasses, starch and cellulosic materials; Microbial production of hydrogen gas. Intellectual Property Rights (IPR), Patents, Trademarks, Copyrights, Secrets; Patenting of microbiological materials and GMOs; patenting of genes and DNA sequences.

Suggested Reading:


Note: The examiner is expected to set the question paper based on the entire course content. In Section A, the question paper shall include 5 long question (10 marks each) out of which the candidate is required to attempt 3 questions. Section B shall be based on short answers 100-200 words and shall include 4 questions of which the candidate is required to attempt 2 questions of 5 marks each. Section C shall include 10 to 20 questions of half / one mark each and shall be based on objective type / true-false / very short answers like definitions.
AM 401: Project Viva                      400 marks
A meeting of the Board of Studies in Microbiology was held at 11:00 a.m. on 26-6-2000 in the Department of Microbiology to finalize the syllabus and ordinances for M.Sc. (Applied Microbiology) on the University Campus w.e.f. the session 2000-2001. Following members were present:

1. Professor S.C. Agrawal, Dean, Faculty of Science, CCS Univ., Meerut – Chairman
2. Professor Amar P. Garg, Head, Department of Microbiology, Convener
3. Professor P.D. Sharma, Delhi University, Subject expert & V.C. nominee
4. Professor D.K. Maheshwari, G.K.U., Hardwar, Subject expert & V.C. nominee

The Committee went through the course contents and the Ordinances and approved the same for 2 year M.Sc. course in Applied Microbiology w.e.f. the session 2000-2001. The Committee also approved the specialization in Medical / Industrial / Environmental / Agricultural Microbiology based on one objective type question paper + project in the relevant branch of specialization in Microbiology.

(P.D. Sharma) (D.K. Maheswari) (Amar P. Garg) (S.C. Agrawal)
Subject Expert & Subject Expert & Convener Dean, Faculty of
V.C. nominee V.C. nominee Science
A meeting of the Research Degree Committee was held at 2:00 p.m. on 26-6-2000 in the Department of Microbiology. Following members were present:

1. Professor Amar P. Garg, Convener

2. Professor P.D. Sharma, Environmental Microbiology Lab, Dept. of Botany, DU, Subject expert & V.C. nominee

3. Professor D.K. Maheshwari, G.K.U., Hardwar, Subject expert & V.C. nominee

The Committee approved the transfer of registration for the Ph.D. degree of following candidates from the subject of Botany to Microbiology under the supervision of Dr. Amar P. Garg as the synopsis submitted by them come under the subject of Microbiology. The Committee recommends that the date of registration of them be considered the same as it was in Botany.

<table>
<thead>
<tr>
<th>Name of the candidate</th>
<th>Title of his/her synopsis</th>
<th>Date of registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>(P.D. Sharma)</td>
<td>(D.K. Maheshwari)</td>
<td>(Amar P. Garg)</td>
</tr>
<tr>
<td>Subject Expert &amp; V.C. nominee</td>
<td>Subject Expert &amp; V.C. nominee</td>
<td>Supervisor &amp; Convener</td>
</tr>
</tbody>
</table>