A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (AUTONOMOUS) KAKINADA

(Under the jurisdiction of Adikavi Nannaya University)

Reaccredited by NAAC with B Grade (3rd Cycle)

Board of Studies Meeting 2018-19
On
16-04-2018

DEPARTMENT OF MICROBIOLOGY

A.S.D Govt. Degree College for Women (A), Kakinada

Course-Wise Syllabus
MICROBIOLOGY (Semester: I)
Introduction to Microbiology And Microbial Diversity

UNIT-I:

History and Mile stones in Microbiology- Meaning, definition and history of Microbiology.
• Contributions of Antony von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Iwanowsky, Beijerinck, Winogradsky and Alexander Fleming.
• Importance and applications of Microbiology.
Classification of microorganisms – Hackel's three -kingdom concept – Whittaker's five kingdom
concept and three domain concept of Carl Woese.
Outline classification of Bacteria as per Bergy's Manual of systematic Bacteriology

UNIT-II:

Ultra-structure of Prokaryotic cell- Cell Wall, Cell Membrane, Cytoplasm, Nucleoid, Plasmid, Inclusion Bodies, Flagella Pili, Capsule, Endospore
General characteristics of Bacteria, Archea, Rickettsia, Mycoplasmas, Cyanobacteria,
General characteristics of viruses, Cultivation of Viruses (in brief)
Morphology, Structure and replication of TMV and HIV

UNIT-III:

Fungi – Habitat, nutrition, vegetative structure and modes of reproduction; outline classification
Algae – Habitat, thallus organization, photosynthetic pigments, storage forms of food, reproduction.
Protozoa – Habitat, cell structure, nutrition, locomotion, excretion, reproduction, encystment, outline classification
Principles of microscopy – Bright field and Electron microscopy (SEM and TEM).

UNIT-IV:

Staining Techniques – Simple and Differential staining techniques (Gram staining, Spore staining).
Sterilization and disinfection techniques –
Physical methods – autoclave, hot- air oven, pressure cooker, laminar air flow, filter sterilization, Radiation methods – UV rays, Gamma rays.
Chemical methods – alcohols, aldehydes, fumigants, phenols, halogens and hypochlorites.

UNIT-V:

Isolation of microorganisms from natural habitats
Pure culture techniques – dilution-plating, Streak-plate, Spread-plate, Pour-Plate and micromanipulator.
Preservation of microbial cultures – sub culturing, overlaying cultures with mineral oils, 2icroorganisms, sand cultures, storage at low temperature.

MBP- I: Introduction To Microbiology And Microbial Diversity

Skill & Employability

1. Microbiology Good Laboratory Practices and Biosafety.
2. Preparation of culture media for cultivation of bacteria- Nutrient broth & Nutrient agar
3. Preparation of culture media for cultivation of fungi – Sabourauds agar
4. Sterilization of medium using Autoclave
5. Sterilization of glassware using Hot Air Oven
6. Light compound microscope and its handling
7. Microscopic observation of bacteria (Gram +ve bacilli and cocci, Gram –ve bacilli), Algae and Fungi.
8. Simple staining
9. Gram's staining
10. Hanging-drop method& temporary wet mount (TWM) for observation of living 3icroorganisms.
11. Isolation of pure cultures of bacteria by serial dilution and Streak/Spread/Pour Plate Method.
12. Preservation of bacterial cultures by Serial subculturing & Slant Preparation with mineral oil overlay.
13. Observation of electron micrographs of bacterial cells

- **Additional input**: Isolation of microbes from natural habitat air/soil/Hospital environment / different crops

A.S.D Govt. Degree College for Women (A), Kakinada

MICROBIAL BIOCHEMISTRY & METABOLISM
MICROBIOLOGY (Semester: II)

UNIT-I

General characters and outline classification of Carbohydrates (Monosaccharides-Glucose, Fructose, Ribose, Disaccharides- Sucrose, Lactose, Polysaccharides- Starch, glycogen, Cellulose)

General characters of Amino acids & Proteins

Structure of nitrogenous bases, nucleotides,

- Fatty acids (saturated and unsaturated)
- Lipids (spingolipds, sterols and phospholipids).

UNIT – II

Principle and applications of - Colorimetry

Chromatography (paper, thin-layer, and column),

Spectrophotometry (UV & visible),

UNIT-III:

Properties and classification of Enzymes.

Biocatalysis- induced fit and lock and key models.

Coenzymes and Cofactors.

Inhibition of enzyme activity- competitive, non-competitive, uncompetitive and allosteric.

Factors effecting enzyme activity

UNIT – IV:

Nutritional requirements of Microorganisms

Nutritional groups of microorganisms- autotrophs, heterotrophs, lithotrophs, organotrophs, phototrophs, chemotrophs

Microbial Growth- different phases of growth in batch cultures; Synchronous, continuous, biphasic growth.

Factors influencing microbial growth

Methods for measuring microbial growth - Direct microscopy, viable count estimates, turbidometry and biomass.

UNIT- V : Enterpreneurship

Aerobic respiration - Glycolysis, TCA cycle, ED Pathway, Electron transport

Oxidative and substrate level phosphorylation.

Anaerobic respiration (Nitrate and sulphate respiration)

Fermentation- lactic acid and ethanol fermentations

Outlines of oxygenic and anoxygenic photosynthesis in bacteria

MBP – II: MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY

Skill & Employability

1. Qualitative Analysis of Carbohydrates.
2. Qualitative Analysis of Aminoacids.
3. Colorimetric estimation DNA by diphenylamine method
4. Colorimetric estimation of proteins by Biuret/Lowry method.
5. Paper chromatographic separation of sugars and amino acids.
6. Preparation of different media- Synthetic and Complex Media.
7. Setting and observation of Winogradsky column.
8. Estimation of CFU count by spread plate method/pour plate method.
9. Bacterial growth curve.
10. Factors affecting bacterial growth – PH.
11. Factors affecting bacterial growth – Temperature.
12. Factors affecting bacterial growth –Salts.

A.S.D Govt. Degree College for Women (A), Kakinada

MICROBIOLOGY (Semester: 3)

MICROBIAL GENETICS AND MOLECULAR BIOLOGY

UNIT- I: Skill & Employability
• DNA and RNA as genetic material.
• Structure and organization of prokaryotic DNA.
• Extra chromosomal genetic elements – Plasmids and transposons in bacteria.
• Replication of DNA – Semi conservative mechanism, Enzymes involved in replication.
UNIT – II: Skill & Employability
• Mutations – spontaneous and induced, base pair changes, frame shifts, deletions, inversions,
tandem duplications, insertions.
• Mutagens - Physical and Chemical mutagens.
• Outlines of DNA damage and repair mechanisms.
• Genetic recombination in bacteria – Conjugation, Transformation and Transduction.
UNIT-III: **:** Skill & Employability
• Types of RNA and their functions.
• Genetic code. Structure of ribosomes.

UNIT-IV

• Types of genes – structural, constitutive, regulatory
• Protein synthesis – Transcription and translation, regulation of gene expression in bacteria – lac operon.

UNIT-V: : Skill & Employability

• Basic principles of genetic engineering.
Restriction endonucleases, DNA ligases.
Vectors – plasmids (pBR322), Cosmids, Phagemids, lambda phage vector, M 13 vectors.
Outlines of gene cloning methods.
Polymerase chain reaction. Genomic and cDNA libraries.
General account on application of genetic engineering in industry, agriculture, and medicine.

MBP – III: MICROBIAL GENETICS AND MOLECULAR BIOLOGY

Enterpreneurship Skill & Employability

1. Study of different types of DNA and RNA using micrographs and model / schematic representations.
2. Study of semi-conservative replication of DNA through micrographs / schematic representations
3. Isolation of genomic DNA from *E. coli*
4. Estimation of DNA using UV spectrophotometer.
5. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
6. Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis (SDS - PAGE).
7. Problems related to DNA and RNA characteristics, Transcription and Translation.
8. Induction of mutations in bacteria by UV light.
9. Instrumentation in molecular biology - Ultra centrifuge, Transilluminator, PCR

A.S.D Govt. Degree College for Women (A), Kakinada

MICROBIOLOGY (Semester: IV)
Immunology And Medical Microbiology

UNIT-I Skill & Employability

Types of immunity – innate and acquired; active and passive; humoral and cell-mediated immunity.
Primary and secondary organs of immune system - thymus, bursa fabricus, bone marrow, spleen, lymph nodes.
Cells of immune system- Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils

UNIT-II Skill & Employability

Antigens – types, chemical nature, antigenic determinants, haptens.
Factors affecting antigenicity.
• Antibodies – basic structure, types, properties and functions of immunoglobulins.
• Types of antigen-antibody reactions - Agglutinations, Precipitation, Neutralization, complement fixation, blood groups.
• Labeled antibody based techniques – ELISA, RIA and Immunofluroscence.
• Monoclonal antibodies – production and applications.
• Concept of hypersensitivity and Autoimmunity.

UNIT- III: Skill & Employability

Normal flora of human body.
• Host pathogen interactions: infection, invasion, pathogen, pathogenicity, virulence and opportunistic infection, General account on nosocomial infection.
• General principles of diagnostic microbiology- collection, transport and processing of clinical samples.
• General methods of laboratory diagnosis - cultural, biochemical, serological and molecular methods.

UNIT- IV: Principles of Diagnosis Enterpreneurship Skill & Employability

Antibacterial Agents- Penicillin, Streptomycin and Tetracycline.
• Antifungal agents – Amphotericin B, Griseofulvin
• Antiviral substances - Amantadine and Acyclovir
• Tests for antimicrobial susceptibility.
• Brief account on antibiotic resistance in bacteria - Methicillin-resistant Staphylococcus aureus (MRSA).
• Vaccines – Natural and recombinant

UNIT- V: Prevention and Treatment Skill oriented& Employability, Enterpreneurship

General account on microbial diseases – causal organism, pathogenesis, epidemiology, diagnosis, prevention and control
• Bacterial diseases – Tuberculosis and Typhoid.
• Fungal diseases – Candidiasis.

• Protozoal diseases – Malaria.
• Viral Diseases - Hepatitis- A and AIDS.

MBP -V: IMMUNOLOGY AND MEDICAL MICROBIOLOGY

Skill & Employability

1. Identification of human blood groups.
2. Separate serum from the blood sample (demonstration).
3. Immunodiffusion by Ouchterlony method.
4. Total Leukocyte count of blood
5. Differential Leucocyte Count
6. Immuno diffusion by Ouchterlony method
7. Identification of any of the bacteria (*E. coli, Pseudomonas, Staphylococcus, Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, urease production and catalase tests
8. Isolation of Normal flora of human body by swab method.
9. Antibacterial sensitivity by Kirby-Bauer method
10. Study symptoms of the diseases with the help of photographs: Anthrax, Polio, Herpes, chicken pox, HPV warts, Dermatomycoses (ring worms)
11. Study of various stages of malarial parasite in RBCs using permanent mounts.

A.S.D Govt. Degree College for Women (A), Kakinada

MICROBIOLOGY (Semester: 5)

ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY

UNIT – I

• Terrestrial Environment: Soil profile and soil micro flora

• Aquatic Environment: Micro flora of fresh water and marine Habitats

• Atmosphere: Aeromicroflora and dispersal of microbes

UNIT – II

• Role of microorganisms in nutrient cycling (Carbon, nitrogen, phosphorus).

• Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for fecalcoli forms (b) Membrane filter technique. Microbial interactions – mutualism, commensalism, antagonism, competition, parasitism, predation.

UNIT – III

• Outlines of Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill).

• Liquid waste management: Composition and strength of sewage (BOD and COD), Primary,

secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary sewage treatment.

UNIT – IV

• Plant Growth Promoting Microorganisms - Mycorrhizae, Rhizobia, Azospirillum, Azotobacter, Frankie, • Phosphate-solubilizers and Cyanobacteria.

• Outlines of biological nitrogen fixation (symbiotic, non-symbiotic). Biofertilizers - Rhizobium.

UNIT – V

• Concept of disease in plants. Symptoms of plant diseases caused by fungi, bacteria, and viruses. Plant diseases - groundnut rust, Citrus canker and tomato leafcurl.

• Principles of plant disease control.

Additional input: Determination of water quality by MPN

A.S.D Govt. Degree College for Women (A), Kakinada
FOOD AND INDUSTRIAL MICROBIOLOGY
MICROBIOLOGY (Semester: 5)

UNIT – 1 Skill, Employability

Intrinsic and extrinsic parameters that affect microbial growth in food
Microbial spoilage of food - fruits, vegetables, milk, meat, egg, bread and canned foods
Food intoxication (botulism).
Food-borne diseases (salmonellosis) and their detection.

UNIT – II Skill, Employability & Enterpreneurship

Principles of food preservation - Physical and chemical methods.
Fermented Dairy foods – cheese and yogurt.
Microorganisms as food – SCP, edible mushrooms (white button, oyster and paddy straw).
Probiotics and their benefits.

UNIT – III Skill, Employability & Enterpreneurship **No. of Hours: 8**

Microorganisms of industrial importance – yeasts, (Saccharomyces cerevisiae) moulds, (Aspergillusniger) Bacteria (E.coli), Actinomycetes (Streptomyces griseous).
• Outlines of Isolation and Screening and strain improvement of industrially-important microorganisms.

UNIT - IV **No. of Hours: 8**

Types of fermentation processes – solid state, liquid state, batch, fed-batch, continuous. Basic concepts of Design of Fermentor.
• Ingredients of Fermentation media

UNIT – V Skill, Employability **No. of Hours: 12**

Microbial production of Industrial products - Citric acid, Ethanol, amylases, penicillin, glutamic acid and vitamin B12.

Additional input: Mushroom cultivation

MBP – FOOD AND INDUSTRIAL MICROBIOLOGY

1. Isolation of bacteria and fungi spoiled bread / fruits / vegetables
2. Preparation of yogurt / dahi
3. Determination of microbiological quality of milk sample by MBRT
4. Isolation of antagonistic microorganisms by crowded platetechnique
5. Design of Fermenter(identification of diagrams of various types of Fermentors and labeling of parts)
6. Microbial fermentation for the production and estimation of ethanol fromGrapes.
7. Microbial fermentation for the production and estimation of citricacid.

A.S.D Govt. Degree College for Women (A), Kakinada

III B.Sc Microbiology Syllabus

Semester: V: Microbial Biotechnology

UNIT- I

• Microbial biotechnology: Scope and its applications in human therapeutics, agriculture (Biofertilizers, PGPR, Mycorrhizae), environmental, and food technology.

• Genetically engineered microbes for industrial application: Bacteria and yeast

UNIT- II No. of Hours: 10

• Recombinant microbial production processes in pharmaceutical industries - Streptokinase, recombinant vaccines (Hepatitis B vaccine).

• Over view of production and applications of Microbial polysaccharides, Bioplastics and Microbial biosensors

UNIT- III No. of Hours: 10

• Microbial based transformation of steroids and sterols.

• Bio-catalytic processes and their industrial applications: Production of high fructose syrup and production of cocoa butter substitute.

• Immobilization methods and their application: Whole cell immobilization

UNIT- IV No. of Hours: 7

• Bio-ethanol and bio-diesel production: commercial production from lignocellulosic waste and algal biomass.

• Biogas production: Methane and hydrogen production using microbial culture. Microorganisms in bioremediation: Degradation of xenobiotics.

• Mineral recovery, removal of heavy metals from aqueous effluents.

UNIT- V No. of Hours: 4

• Outlines of Intellectual Property Rights: Patents, Copyrights, Trademarks

MICROBIAL BIOTECHNOLOGY

Practical Syllabus (2019-20)

Skill, Employability

1. Yeast cell immobilization in calcium alginate gels
2. Enzyme immobilization by sodium alginate method
3. Pigment production from fungi (Trichoderma / Aspergillus / Penicillium)
4. Isolation of xylanase or lipase producing bacteria
5. Study of algal Single Cell Proteins

A.S.D Govt. Degree College for Women (A), Kakinada

BSc Microbiology Semester: VI

Paper 8A1: Microbial Diagnosis in Health Clinics

UNIT- I

• Study of Bacteria (Tuberculosis and Typhoid) Viral (Influenza and HIV) Fungal (Aspergillosis and Candidiasis) and Protozoan Malaria and Amebiasis)Diseases affecting humans.

UNIT- II Skill, Employability

• Collection of clinical samples (oral cavity, throat, skin, blood, CSF, urine and faeces) and precautions required.

• Method of transport of clinical samples to laboratory and storage.

UNIT- III Skill, Employability

• Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa-stained thin blood film for malaria

• Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, distinct colony properties of various bacterial pathogens.

UNIT- IV : Skill, Employability,Entrepreneurship

• Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid based methods - PCR, Nucleic acid probes.

• Typhoid, Dengue and HIV, Swine flu.

UNIT- V Skill, Employability

• Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method

Practical syllabus: Microbial Diagnosis in Health Clinics

1. Collection transport and processing of any one of the following clinical specimens (Blood/ Urine/ Stool/Sputum). Receipts, Labeling, recording and dispatching clinical specimens.
2. Isolation of bacteria in pure culture and Antibiotic sensitivity.
3. Identification of common bacteria (E.coli, Staphylococcus aureus and Streptococcus sps) by studying their morphology, cultural character, Biochemical reactions, and other tests.
4. Maintenance and preservation of stock culture.

A.S.D Govt. Degree College for Women (A), Kakinada

BSc Microbiology Syllabus

Sem VI: 8A2: Microbial Quality Control in Food and Pharmaceutical Industries

Skill, Employability & Enterpreneurship

UNIT – I No of Hours: 8

• Good laboratory practices - Good microbiological practices.

• Biosafety cabinets – Working of biosafety cabinets, using protective clothing, specification

for BSL-1, BSL-2, BSL-3.

• Discarding biohazardous waste – Methodology of Disinfection, Autoclaving & Incineration

UNIT – II No. of Hours: 8

• Culture and microscopic methods - Standard plate count, Most probable numbers, Direct microscopic counts,

• Biochemical and immunological methods: Limulus lysate test for endotoxin, gel diffusion, sterility testing for pharmaceutical products

UNIT – III No. of Hours: 8

• Molecular methods - Nucleic acid probes, PCR based detection, biosensors.

UNIT – IV No. of Hours: 8 Skill, Employability

• Enrichment culture technique, Detection of specific microorganisms - on XLD agar, SalmonellaShigellaAgar, Manitol salt agar, EMB agar, McConkey Agar, Saboraud Agar

• Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centres (COB, 10 min Resazurin assay).

UNIT – V No. of Hours: 4 Skill, Employability & Enterpreneurship

• Hazard analysis of critical control point (HACCP) - Principles, flow diagrams, limitations.

• Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water.

Practical: Microbial Quality Control in Food and Pharmaceutical Industries

PRACTICALS: Skill, Employability & Enterpreneurship

TOTAL HOURS: 36 CREDITS: 2

1. Microbiological laboratory safety- General rules & Regulations.
2. Sterility tests for Instruments – Autoclave & Hot Air Oven
3. Disinfection of selected instruments &Equipments
4. Sterility of Air and its relationship to Laboratory & Hospital sepsis.
5. Sterility testing of Microbiological media
6. Sterility testing of any one Pharmaceutical product
7. Standard qualitative analysis of water.
8. Microbiological analysis of homogenized food samples by direct microscopic count

A.S.D Govt. Degree College for Women (A), Kakinada

BSc Microbiology Syllabus

Semester VI: 8A3 -BIOFERTILIZERS AND BIOPESTICIDES

Skill, Employability & Enterpreneurship

UNIT – I:

• General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers.
• Symbiotic N2 fixers: Rhizobium - Isolation, characteristics, types, innoculum production and field application, legume/pulses plants
• Frankia from non-legumes and characterization.
• Cyanobacteria and Azolla, characterization, mass multiplication, Role in rice cultivation, Crop response, field application.

UNIT – II

• Free living Azospirillum, Azotobacter - isolation, characteristics, mass innoculum production and field application.

UNIT – III

• Phosphate solubilizing microbes - Isolation, characterization, mass innoculum production, field application

UNIT – IV

• Importance of mycorrizal innoculum, types of Mycorrhizae and associated plants, Mass innoculum production of VAM, field applications of Ectomycorrhizae and VAM.

UNIT – V

• General account of microbes used as bioinsecticides and their advantages over synthetic pesticides. Bacillusthuringiensis- production, Field applications.
• Viruses – NPV cultivation and field applications.