



**DEPARTMENT OF  
MICROBIOLOGY  
TEACHING PLAN  
GDCR  
2023-24**

# Govt. Digvijay Autonomous P.G. College, Rajnandgaon, C.G.

## Department of Microbiology

### Teaching Plans

#### ASSISTANT PROFESSOR – SAVITA CHANDRAWANSHI

2023-24

<b>B.Sc. I Semester(DSC) Microbial World and Principles of Microbiology</b>	
<b>July</b>	History of microbiology and introduction to the microbial world. Germ theory of disease, Development of various microbiological techniques and golden era of microbiology.
<b>Aug</b>	Contributions of Antony von Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Fleming, Selman A. Waksman and Edward Jenner. Characteristics of microorganisms, Baltimore classification. Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification systems and their utility.
<b>Sept</b>	General characteristics of Cellular microorganisms, wall-less forms - MLO (mycoplasma) with emphasis on distribution and occurrence, morphology, and economic importance.
<b>Oct</b>	Methods of studying microorganism; Staining techniques: simple staining, Gram staining, negative staining and acid-fast staining. Sterilization techniques (physical & chemical sterilization).
<b>Nov</b>	Culture media & conditions for microbial growth. Pure culture isolation: Streaking, serial dilution and plating methods; cultivation, maintenance and preservation of pure cultures
<b>Dec</b>	Beneficial and harmful microbes and their role in daily life. Concept of disease in plant and animal caused by microorganism.

<b>B.Sc. II Semester(DSC) Bacteriology and Virology</b>	
<b>Jan</b>	Morphology and ultrastructure of Bacteria: Cell size, shape and arrangement, capsule, flagella, fimbriae and pili. Cell-wall: Composition and detailed structure of Gram-positive and Gram-negative cell walls, Cell Membrane: Structure, function
<b>Feb</b>	Chemical composition of bacterial and archaeal cell membranes. Cytoplasm: Ribosomes, mesosomes, inclusion bodies, nucleoid. Endospore. Nutritional requirements in bacteria and nutritional categories. Physical methods of microbial control: heat, low temperature, high pressure, filtration, desiccation, osmotic pressure, radiation.
<b>March</b>	Brief outline of discovery of viruses, classification of viruses, distinctive properties of viruses, morphology and ultrastructure, capsids and their arrangements, types of envelopes and their composition, viral genome, their types and structures. Virus related agents (viroids, prions).
<b>April</b>	Multiplication and Economic importance of viruses (TMV, Influenza virus and T4 -Phage).

	reproduction of bacterial , Growth Phases of Bacteria.
--	--

## M.Sc. MICROBIOLOGY, SEMESTER I

<b>Paper- I : Bacteriology</b>	
<b>Aug</b>	Morphology and ultrastructure of bacteria, morphological types, archaebacteria, Gram negative and positive eubacteria, Actinomycetes and L-forms. Cell wall synthesis, antigenic properties. Capsule: types, composition and function. Cell membranes: structure, composition and properties.
<b>Sept</b>	Structure and functions of flagella, pili, gas vesicles, chromosomes, carboxysomes, magnetosomes, phycobilisomes, endospore. Cell division, Reserve food material, polyhydroxy butyrate, polyphosphate granules, oil droplets. Cyanophycean granules and Sulphur inclusions.
<b>Oct</b>	Structure and functions of flagella, pili, gas vesicles, chromosomes, carboxysomes, magnetosomes, phycobilisomes, endospore. Cell division, Reserve food material, polyhydroxy butyrate, polyphosphate granules, oil droplets. Cyanophycean granules and Sulphur inclusions.
<b>Nov</b>	Classification of microorganisms: Basis of microbial classification, Haeckel's three kingdoms concept, Whittaker's five kingdom concept, three domain concepts of Carl Woes. Salient feature of bacterial classification according to the Berge's manual of determinative bacteriology.

## M.Sc. MICROBIOLOGY, SEMESTER III

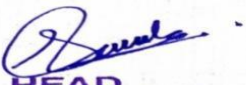
<b>Paper- I : CELLULAR MICROBIOLOGY</b>	
<b>July</b>	Emergence of cellular microbiology: Cellular biology underlying prokaryotic and eukaryotic interaction, ultrastructure, genome expression, pathogenicity islands.
<b>Aug</b>	Organization of chromosome: Structure of chromosome, centromere and Telomere, chromosome banding. DNA packaging, Genome evolution in microbes. Phylogenetic trees.
<b>Sept</b>	Eukaryotic signaling mechanisms: Signaling Via G protein, MAP Kinase pathway, insulin signaling, cyclins and cyclin dependent kinase. Prokaryotic signaling: quorum sensing and bacterial pheromones intracellular signaling.
<b>Oct</b>	Infection and cell:cell interaction Bacterial adherence: basic principle, effect of adhesion on bacteria, effect of adhesion on host cells. Bacterial invasion of host cells, Survival after invasion. Transport by vesicle formation Exocytosis, Endocytosis. Protein toxins: agents of diseases and examples.
<b>Nov</b>	Immune response to bacterial infection: Innate response, complement, acute phase protein. Macrophages: cytokines and interferon. Acquired immune response: cell mediated immune response, humoral response. Cell cycle, Apoptosis, Oncogenes.

## M.Sc. MICROBIOLOGY, SEMESTER II

<b>Paper – III: Microbial Physiology</b>	
<b>Jan</b>	Basic aspects of bioenergetics: entropy, enthalpy, electrons carrier. Artificial electron donors, inhibitors, energy bond, phosphorylation. Brief account of photosynthetic and accessory pigments: chlorophyll, bacteriochlorophyll, rhodopsin, carotenoids, phycobiliproteins.
<b>Feb</b>	Autotrophy: Carbohydrate anabolism, oxygenic and an-oxygenic photosynthesis, autotrophic generation of ATP, fixation of CO <sub>2</sub> , Calvin cycle, C <sub>3</sub> and C <sub>4</sub> pathway, Chemolithotrophy, oxidation of sulphur, iron, hydrogen and nitrogen. Methanogenesis, luminescence.
<b>March</b>	Respiratory metabolism: Embden Mayer Hoff Parnas pathway, Entner Doudroff pathway, Glyoxalate pathway. Krebs cycle, Oxidative and substrate level phosphorylation, Reverse TCA cycle, Gluconeogenesis, Pasteur effects. Fermentation of carbohydrates: homo and heterolactic fermentation.
<b>April</b>	Nitrogen metabolism: Biological nitrogen fixation, mechanism of nitrogen fixation, Ammonia assimilation. Synthesis and degradation of aromatic amino acids: Tryptophan, Tyrosine, Phenylalanine. Synthesis of polysaccharides: peptidoglycan, biopolymers as cell components.

## M.Sc. MICROBIOLOGY, SEMESTER IV

<b>Paper – III: FERMENTATION &amp; MICROBIAL TECHNOLOGY</b>	
<b>Jan</b>	Metabolic pathways and metabolic control mechanisms. Primary and secondary metabolites. Industrial production of citric acid, lactic acid, enzymes (alpha-amylase, lipase, proteases), acetone, butanol and glutamic acid.
<b>Feb</b>	Microbial production of therapeutic compounds ( $\beta$ -lactam, aminoglycosides, Ansamycins (Rifamycin). Biotransformation of steroids, vitamin B <sub>12</sub> and riboflavin fermentation. Bioreactors types, basic designs and uses. Bio fermenters uses.
<b>March</b>	Modern trends in microbial production of bioplastics (PHB, PHA), bioinsectices (thuricide). Biopolymer (dextran, alginate, xanthan). Bio-fuels. Biofertilizers (nitrogen fixer Azotobacter, Phosphate solubilizing microorganisms). Single Cell Protein and production of biological weapons with reference to anthrax.
<b>April</b>	Production of bioethanol from sugar, molasses, starch and cellulosic materials. Downstream processing: Removal of microbial cells and solid matter, precipitation, filtration, centrifugation, disintegration of cells, extraction methods, concentration methods, purification and resolution of mixtures, drying and crystallization. Intellectual Property Rights (IPR), Patents and Copyrights.

  
**HEAD**  
Deptt. of Microbiology  
Govt. Digvijay College  
Rajnandgaon (C.G.)

**Govt. Digvijay Autonomous P.G. College, Rajnandgaon (C.G.)**

**Department of Microbiology**

**Teaching Plan**

**GUEST LECTURER- PRAGATI NONHARE**

**SESSION- 2023-2024**

<b>B.SC. I SEM MICROBIOLOGY (G.E.)</b>	
<b>AUG</b>	Introduction to microbial world, Physiochemical and biological characteristics; Characteristics of Acellular microorganisms (Viruses); Baltimore classification, general structure with special reference to viroids and prions. Whittaker's five kingdom classification systems. Difference between prokaryotic and eukaryotic microorganism.
<b>SEPT</b>	General characteristics of Cellular microorganisms, types - archaeobacteria, eubacteria, wall-less forms - MLO (mycoplasma and spheroplasts) with emphasis on distribution and occurrence, morphology, mode of reproduction and economic importance. Structure, reproduction and economic importance of Mycoplasma.
<b>OCT</b>	Characteristics, occurrence, thallus organization and classification of Algae. Cyanobacteria - occurrence, thallus organization, cell ultra-structure, reproduction and economic importance.
<b>NOV</b>	General characteristics of fungi including habitat, distribution, nutritional requirements, fungal cell ultrastructure, thallus organization and aggregation, mode of reproduction and Economic importance of fungi .

<b>B.SC. III YEAR MICROBIOLOGY</b>	
<b>AUG</b>	<b>AIR MICROBIOLOGY</b> Basics of Aerobiology, Microbes in atmosphere, source of microorganism in air, droplet nuclei, infectious dust, and bio-aerosol. Factors affecting microbial survival in the air. Sampling, collection and isolation of microbes from air.
<b>SEPT</b>	<b>WATER MICROBIOLOGY</b> Basic concept, water zonation, eutrophication, microbial community in natural water. Determining the quality of water quality of water- bacteriological evidence for fecal pollution, indicator of fecal pollution. Water purification methods. Disinfection of potable water supply.
<b>OCT</b>	<b>SOIL MICROBIOLOGY</b> Soil as an environment culture medium, microbes of soil. Brief account of microbial interactions- symbiosis, mutualism, commensalism, competition, predation, parasitism. Microbiological examination of soil. Rhizosphere- concept and role of microbes, rhizosphere and non rhizosphere micro-flora. Mycorrhiza.
<b>JAN</b>	<b>INDUSTRIAL MICROBIOLOGY</b> Introduction and brief history and scope, important microbes in various industries. Fermentation- definition, types- Aerobic and anaerobic, Batch and SSF. Important products bread, cheese, vinegar, fermented food involving microbes. Microbial cells as food. SCP mushroom cultivation, production of alcohol and fermented beverages, beer and Wine.
<b>FEB</b>	<b>AGRICULTURE MICROBIOLOGY</b> History of Agricultural Microbiology; Microbes and their importance in maintenance of soil, Biogeochemical cycles, role of microbes in maintain the fertility of soil. Biofertilizers Cyanobacterial and Azolla
<b>MAR</b>	Biofertilizers- Bacterial, azotobacter and vermiform compost. Soil microorganism- association with

	vascular plants phyllosphere, Rhizobium, Rhizoplane associative nitrogen fixation.
--	--

<b>B.SC. II SEM MICROBIOLOGY (DSC)</b>	
<b>JAN</b>	Morphology and ultrastructure of Bacteria: Cell size, shape and arrangement, capsule, flagella, fimbriae and pili. Cell-wall: Composition and detailed structure of Gram-positive and Gram-negative cell walls, Cell Membrane: Structure, function and chemical composition of bacterial and archaeal cell membranes. Cytoplasm: Ribosomes, mesosomes, inclusion bodies, nucleoid. Endospore.
<b>FEB</b>	Nutritional requirements in bacteria and nutritional categories. Physical methods of microbial control: heat, low temperature, high pressure, filtration, desiccation, osmotic pressure, radiation.
<b>MAR</b>	Brief outline of discovery of viruses, classification of viruses, Distinctive properties of viruses, morphology and ultrastructure, capsids and their arrangements, types of envelopes and their composition, viral genome, their types and structures. Virus related agents (viroid's, prions).
<b>APR</b>	Multiplication and Economic importance of viruses (TMV, Influenza virus and T4 –Phage). reproduction of bacterial , Growth Phases of Bacteria.

<b>B.SC. II SEM MICROBIOLOGY (G.E.)</b>	
<b>JAN</b>	Soil Microbiology: Soil as Microbial Habitat, Soil profile and properties, Soil formation, Diversity and distribution of microorganisms in soil. Microbial Activity in Soil and Green House Gases- Carbon dioxide, methane, nitrous oxide, nitric oxide – production and control.

<b>FEB</b>	Microbial Control of Soil Borne Plant Pathogens: Biocontrol mechanisms and ways, Microorganisms used as biocontrol agents against Microbial plant pathogens, Insects, Weeds
<b>MAR</b>	Biofertilization,Phytostimulation,Bioinsecticides: Plant growth promoting bacteria,biofertilizers– symbiotic (Bradyrhizobium, Rhizobium, Frankia), Non Symbiotic (Azospirillum,Azotobacter,Mycorrhizae,MHBs, Phosphatesolubilizers,algae).
<b>APR</b>	biogas, biofuels – advantages and processing parameters. GM crops: Advantages, social and environmental aspects, Bt crops, golden rice.

### **B.SC. IV SEM MICROBIOLOGY (SEC)**

<b>JAN</b>	Fermented Foods: Definition, types, advantages and health benefits, fermented foods used by Common public, domestication.
<b>FEB</b>	Milk Based Fermented Foods: Dahi, Yogurt, Buttermilk (Chach) and cheese: Preparation of inoculums, types of microorganisms and production process.
<b>MAR</b>	Grain Based Fermented Foods: Soy sauce, Bread, Idli and Dosa: Microorganisms and production process, Preparation and preservation.
<b>APR</b>	Fermented Meat and Fish:Types, microorganisms involved, fermentation process, Probiotic Foods: Definition, types, microorganisms and health benefits

### **M.SC. I SEM MICROBIOLOGY (VIROLOGY)**

<b>AUG</b>	Brief outline of discovery of viruses, classification and nomenclature of viruses.  Distinctive properties of viruses, morphology and ultra-structure, capsids and their arrangements, types of envelopes and their composition, viral genome, their types and structures.
------------	--



	Virus related agents (viroid's, prions).
<b>SEPT</b>	<p>Cultivation of viruses: embryonated eggs, experimental animals</p> <p>Cell culture: primary and secondary cultures, suspension cultures and monolayer cultures and transgenic system</p> <p>Assay of viruses: physical and chemical methods (protein, nucleic acid, radioactive tracers, electron microscopy), infectivity assay (plaque method, end point method).</p>
<b>OCT</b>	<p>Bacteriophages: structural organization, life cycle:one step growth curve, eclipse phase, phage production, lysogenic cycle, application in bacterial genetics.</p> <p>Brief details of MI3, Mu, T3 &amp; T4.</p> <p>Plant Viruses: structural organization, life cycle, (TMV, CMV and PVX), pathogenicity, symptoms, transmission and prevention of plant viral diseases, control of vectors.</p>
<b>NOV</b>	<p>Animal viruses: structural organization, lifecycle, pathogenicity, diagnosis, prevention and treatment of RNA viruses Orthomyxo, Paramyxo, Rota and HIV virus.</p> <p>DNA viruses; Pox, Adeno and Hepatitis virus.</p> <p>Viral vaccines (conventional, genetic recombinant, new generation vaccines including DNA vaccines, interferon and antiviral drug.</p>

### **M.SC. III SEM MICROBIOLOGY (MEDICAL MICROBIOLOGY)**

<b>AUG</b>	<p>Normal microbial flora of human body: role of the resident flora.</p> <p>Host microbe interaction, Infection and Infectious Process-Routes of transmission of microbes in the body.</p> <p>Sources of infection for man, Vehicles or reservoirs of infection .Mode of spread of infection. Pathogenesis: infectivity and Virulence. Four lines of defense mechanism</p>
------------	--

<b>SEPT</b>	<p>Classification of pathogenic bacteria: Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Corynebacterium, Bacillus, Clostridium, Non-sporing Anaerobes.</p> <p>Organisms belonging to Enterobacteriace, Vibrios ,Yersinia, Bordetella, Brucella, Mycobacteria, Spirochaetes, Actinomycetes, Rickettsiae, Chlamdiae.</p>
<b>OCT</b>	<p>General properties of viruses. viruses host interactions: pox viruses, herpes virus, adeno viruses, picarno viruses, orthomyxo viruses, paramyxo viruses, arbo viruses, rhabdo viruses.</p> <p>Hepatitis viruses, oncogenic viruses, human immunodeficiency viruses (AIDS).</p> <p>Protozoal diseases: Malaria and ameabiosis.</p>
<b>NOV</b>	<p>Fungal infections: Dermatophytes, dimorphic fungi, opportunistic fungal pathogens, their description, Classification and Laboratory diagnosis.</p> <p>Fungal Diseases – Mycoses systemic and subcutaneous, Pneumocystis, Blastomycosis, Dermatophytosis, Aspergillosis.</p> <p>Nosocomial infection: common types of hospital infections, their diagnosis and control.</p> <p>Laboratory control and anti-microbial therapy.</p>

### **M.SC. III SEM MICROBIOLOGY (FOOD MICROBIOLOGY)**

<b>AUG</b>	<p>Food as substrate for microorganisms: Important micro-organisms in food microbiology - Molds, Yeasts and Bacteria (General characteristics and importance).</p> <p>Principles of food preservation: Asepsis (anaerobic conditions, high temperatures, low temperature, drying).</p> <p>Factors influencing microbial growth in food: Extrinsic and intrinsic factors; Chemical preservatives and food additives, Canning, processing for Heat treatment - D, Z, and F values.</p>
------------	--

<b>SEPT</b>	<p>Contamination and Spoilage: Cereals, sugar products, vegetables, fruits, meat and meat products, Milk and Milk products, Fish and sea foods, poultry-spoilage of canned foods.</p> <p>Detection of spoilage and characterization.</p> <p>Food control agencies and its regulations.</p>
<b>OCT</b>	<p>Food-borne infections and intoxications: Bacterial and non-bacterial with examples of infective and toxic types (Brucella, Bacillus, Clostridium, Escherichia, Salmonella, Staphylococcus, Vibrio, Yersinia; Nematodes, Protozoa, algae, fungi and viruses).</p> <p>Application of Microbial enzymes in food industry.</p>
<b>NOV</b>	<p>Food Produced by Microbes: Fermented foods, microbial cells as food (single cell proteins) Bioconversions: Mushroom cultivation, Production of alcohol. Fermented beverages (beer and wine).</p> <p>Microbiology of fermented milk products (acidophilus milk, yoghurt).</p> <p>Role of microorganisms in beverages– tea and coffee fermentations. Vinegar Fermentation.</p>

### **M.SC. II SEM MICROBIOLOGY (GENETICS)**

<b>JAN</b>	<p>DNA damage: types of DNA damage (deamination, oxidation, alkylation, pyrimidine dimers).</p> <p>Repair pathways (methyl directed mismatch repair, very short patch repairs, nucleotide excision repairs, base excision repairs, recombination repairs, and SOS system).</p> <p>Gene as a unit of Mutation, types of mutagens, genetic analysis of mutants, types of mutations and their origin. Ame's test</p>
<b>FEB</b>	<p>Gene as a unit of recombination, molecular nature of recombination.</p> <p>Gene transfer mechanism: Transformation, Transduction, Conjugation, Transfection, Lysogeny and their applications. Genetic analyses of Bacteria and Yeast. DNA Library</p>

<b>MAR</b>	<p>Plasmids and phage vectors their types and uses in genetic analysis as vector for gene cloning, replication of selected plasmids, compatibility.</p> <p>Recombinant DNA Technology: foreign DNA, Enzymes needed, selection of vectors, Transfer of foreign DNA in to vector, Transfer of recombinant DNA to host cell (Tail ligation and linker used method), selection and screening of recombinant DNA.</p> <p>Transposons and their uses in genetic analysis. Molecular markers: RFLP, RAPD, SNP and AFLP. Isolation of mutants.</p>
<b>APR</b>	<p>Polymerase Chain Reaction.</p> <p>Genetics of phage: genetic recombination in phages, effect of parental ratio, reciprocity.</p> <p>T4 phage structure, life cycle, genetic map and DNA replication. <math>\lambda</math> phage DNA structure, genetic organization and life cycle of <math>\lambda</math>.</p>

<b>M.SC. II SEM MICROBIOLOGY (BIOSTASTICS)</b>	
<b>JAN</b>	<p>Introduction: Definition, Basic concepts, sample and population, measurement scales, statistical inferences and parameters.</p> <p>Presentation of data: Tabulation, Frequency distribution, Graphical presentation of data and interpretation.</p> <p>Measures of central tendency (mean, median, mode), Measures of dispersion (range, mean deviation, standard deviation and error).</p>
<b>FEB</b>	<p>Correlation: Types and Methods, correlation coefficient and its significance.</p> <p>Regression analysis: linear regression, regression coefficient, uses of regression analysis, difference between correlation and regression.</p> <p>Experimental designs: Basic concepts, principles, types and significance</p>
<b>MAR</b>	<p>Tests of significance: Chi-Square, characteristics, applications.</p> <p>Student's t Test, properties and applications.</p>

	<p>Analysis of Variance (ANOVA): Introduction, procedure, multiple comparisons.</p> <p>Statistical quality control: introduction, types and advantages.</p>
<b>APR</b>	<p>Introduction to computer: computer applications, basics, organization, PC, Mainframes and Super Computers.</p> <p>Hardware and Software, MS office, Word processing. Working in Power point, creating presentations.</p> <p>Introduction to Internet: Basics of internet, e-mailing, search engines- Google and Yahoo.</p>

### **M.SC. IV SEM MICROBIOLOGY (FERMENTATION TECHNOLOGY)**

<b>JAN</b>	<p>Metabolic pathways and metabolic control mechanisms.</p> <p>Primary and secondary metabolites.</p> <p>Industrial production of citric acid, lactic acid, enzymes (alpha-amylase, lipase, proteases), acetone, butanol and glutamic acid.</p>
<b>FEB</b>	<p>Microbial production of therapeutic compounds (<math>\beta</math>-lactam, aminoglycosides, Ansamycins (Rifamycin).</p> <p>Biotransformation of steroids, vitamin B<sub>12</sub> and riboflavin fermentation.</p> <p>Bioreactors types, basic designs and uses. Bio fermenters uses.</p>
<b>MAR</b>	<p>Modern trends in microbial production of bioplastics (PHB, PHA), bioinsectices (thuricide).</p> <p>Biopolymer (dextran, alginate, xanthan). Bio-fuels.</p> <p>Biofertilizers (nitrogen fixer Azotobacter, Phosphate solubilizing microorganisms).</p> <p>Single Cell Protein and production of biological weapons with reference to anthrax.</p>
<b>APR</b>	<p>Production of bioethanol from sugar, molasses, starch and cellulosic materials.</p>

	<p>Downstream processing: Removal of microbial cells and solid matter, precipitation, filtration, centrifugation, disintegration of cells, extraction methods, concentration methods, purification and resolution of mixtures, drying and crystallization.</p>
--	--

Intellectual Property Rights (IPR), Patents and Copyrights.