



**GDCR**

**TEACHING PLAN**

**DEPARTMENT OF**

**MICROBIOLOGY**

**2022-23**

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

**Department of Microbiology**

**Teaching Plan**

**GUEST LECTURER-SHWETA VERMA**

**2022-2023**

<b>B.Sc. II Year Microbiology</b>	
<b>July</b>	History and scope of molecular biology, concept and mechanism of heredity, DNA as genetic material- experimental evidences, DNA replication-mechanism, process and enzymes/proteins involved in replication.
<b>Aug</b>	Simple and compound light microscope, bright Field, dark field, Phase Contrast and Electron microscope. Centrifugation-Principle and types of Centrifuge (Analytical and Preparatory), Types of Centrifugation-Differential and Rate zonal Centrifugation.
<b>Sept</b>	Transcription-initiation, elongation, termination, RNA polymerase and sigma factors, Transcription inhibitors (antibiotics, drugs), Translation initiation, elongation, termination. Factors involved in translation. Genetic code. Introduction and types of Gene mutation – Base substitution, frame shift mutation (insertion, deletion, miss-sense, nonsense mutation), mutagens - physical and chemical. Reverse mutation in bacteria.
<b>Oct</b>	DNA repair mechanism (mismatch repair, photoreactivation, excision repair and SOS repair ). Beneficial and harmful effects of mutation. Concept of Gene-Cistron, Recon, Muton, Operon concept -Lac operon, tryptophsn operon, His operon, Activators, co-activator and repressor. Introductio to Bioinformatics-Elementary genome database
<b>Nov</b>	Principle of pH meter, Types of electrodes, Factors affecting pH measurements and Application of pH meter. Chromatograpgy-Principle, types- Paper, TLC and column Chromatography, HPLC. Electromagnetic Spectrum, Beer- Lambert’s Law, Types (Principle, working and Application)- Colorimeter, UV- Vis Spectrophotometry and IR Spectrophotometry, Turbidometry.
<b>Dec</b>	Principle of electrophoresis, Instrumentation and Application, Types of Paper, gel Electrophoresis and Immunoelectrophoresis. X-ray diffraction -Principle and Application. Data-types, Characteristics, Presentation and distribution. Data analysis-Central tendency (Mean, Median and Mode), deviation (Variance, SD & SE). Concept of probability.
<b>Jan</b>	Basic concept of genetic engineering, DNA modifying enzymes, Restriction endonuclease, DNA ligase, Terminal transferase. Vectors- pBr322, pUC19, BAC and YAC. Phage based vectors, Expression of Vectors. Transformation-Physical & Chemical method. Bacterial Host. Screening of recombinant vector Blue white screening, Colony hybridization.

**B.Sc. III Year Microbiology**

<b>July</b>	Air borne diseases: Types – Tuberculosis, Pertussis, Diphtheria, Influenza, Small & Chicken pox, Mumps, Measles. Symptoms, treatment and prevention.
<b>Aug</b>	Concept and cause of water borne diseases; Types, Hepatitis, Dysentery, Diarrhea, Cholera, typhoid. Symptoms, treatment and prevention. Clinical diseases: Diabetes, Asthma, multiple sclerosis, rheumatoid arthritis, cancer. Symptoms, Treatment and prevention
<b>Sept</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>Oct</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>Nov</b>	Immune system: Structure and function of the cells, tissues and organs of immune system. Types of Immunity- humoral and cell-mediated, innate, acquired immunity. Antigen- Antibody: types, properties, Hapten, adjuvants, Immuno-globulin: Structure types, Properties and their function- Theory of antibody production. Methods based on Ag-Ab interaction-precipitation, agglutination, ELISA, RIA, Immunoelectrophoresis, PCR based diagnosis method for infectious diseases.
<b>Dec</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>Jan</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-Bacterial, azotobacter and vermiform compost. Soil microorganism- association with vascular plantsphyllosphere, Rhizobium, Rhizoplane associative nitrogen fixation. BiofertilizersCyanobacterial and Azoll

<b>Paper- III : Phycology and Mycology</b>	
<b>Aug</b>	General features of fungi: Classification, Structure and cell differentiation, Reproduction, Heterothallism, Sex hormones, Effect of environment on growth, Prevention of fungal growth. Salient features of Division Myxomycotina, Mastigomycotina and Zygomycotina. Life cycle and economic importance of representative members.
<b>Sept</b>	Salient features of Division Ascomycotina– Hemiascomycetes, Plectomycetes, Pyrenomycetes, Discomycetes. Life cycle and economic importance of representative members. Basidiomycotina– Teliomycetes, Hymenomycetes. Life cycle and economic importance of representative members. Deuteromycetes–Hypomycetes, Coelomycetes, Blastomycetes. Life cycle and economic importance of representative members.
<b>Oct</b>	Fungi and bioremediation, Industrial importance of fungi. Mycorrhiza – Ectomycorrhiza, Endomycorrhiza, Vesicular Arbuscular Mycorrhiza. Lichens – General account, classification, structure, reproduction and economic importance.
<b>Nov</b>	Algae – General Characteristics, Distribution, classification and thallus range. Reproduction and Nutrition in Algae Pigmentation in Algae. Diatoms and Euglenoids. Difference between Algae and Fungi.
<b>Paper- IV: : Fundamentals of Immunology</b>	
<b>Aug</b>	Immune System and Immunity: History of Immunology. Structures, composition and functions of cells and organs involved in immune system. Immune responses: innate immunity, acquired immunity. Antigens: Structure and Properties, types, iso and allo, haptens, adjuvants, antigen

	specificity.
<b>Sept</b>	Immunoglobulin: structure, heterogeneity, types and subtypes, properties (Physico-Chemical and biological). Complement: structure, components, properties and functions. in vitro Methods: agglutination, precipitation, complement fixation, immunofluorescence, ELISA, Radioimmunoassays. in vivo Method: Skin tests and immune complex tissue demonstrations, applications of these methods in diagnosis of microbial diseases.
<b>Oct</b>	Structure and functions of MHC and the HL-A system. Tissue transplantation, graft versus host reaction and rejection. Immunohaematology: blood groups, blood transfusion and Rh incompatibilities. Autoimmunity: Theories, mechanism and diseases with their diagnosis.
<b>Nov</b>	Hypersensitivity Reactions: Antibody mediated, Type I (Anaphylaxis), Type II (Antibody dependent cell cytotoxicity), Type III (Immune complex mediated reactions), Type IV (Cell mediated hypersensitivity reaction). Lymphokines and cytokines: properties, classification, biological functions, receptors and related diseases.

## **M.Sc. MICROBIOLOGY, SEMESTER III**

<b>Paper- II : Medical Microbiology</b>	
<b>Aug</b>	Normal microbial flora of human body: role of the resident flora. Host microbe interaction, Infection and Infectious Process-Routes of transmission of microbes in the body. Sources of infection for man, Vehicles or reservoirs of infection. Mode of spread of infection. Pathogenesis: infectivity and Virulence. Four lines of defense mechanism
<b>Sept</b>	Classification of pathogenic bacteria: Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Corynebacterium, Bacillus, Clostridium, Non-sporing Anaerobes. Organisms belonging to Enterobacteriaceae, Vibrios. Yersinia, Bordetella, Brucella, Mycobacteria, Spirochaetes, Actinomycetes, Rickettsiae, Chlamdiae.
<b>Oct</b>	General properties of viruses. viruses host interactions: pox viruses, herpes virus, adeno viruses, picarno viruses, orthomyxo viruses, paramyxo viruses, arbo viruses, rhabdo viruses. Hepatitis viruses, oncogenic viruses, human immunodeficiency viruses (AIDS). Protozoal diseases: Malaria andameabiosis.
<b>Nov</b>	Fungal infections: Dermatophytes, dimorphic fungi, opportunistic fungal pathogens, their description, Classification and Laboratory diagnosis. Fungal Diseases – Mycoses systemic and subcutaneous, Pneumocystis, Blastomycosis, Dermatophytosis, Aspergillosis. Nosocomial infection: common types of hospital infections, their diagnosis and control. Laboratory control and anti-microbial therapy.
<b>Paper- IV: INSTRUMENTATION AND TECHNIQUES</b>	
<b>Aug</b>	Microscopy- Phase contrast, Fluorescence microscopy, electron microscopy. Principle and working of pH meter, Laminar-air flow, trinocular microscope. Centrifugation: Types of centrifuge machines, preparative and analytical centrifuges, differential centrifugation, density gradient centrifugation.
<b>Sept</b>	Theory, principles and applications of paper chromatography, thin layer chromatography, gel filtration chromatography, ion exchange chromatography, affinity chromatography. Hydrophobic chromatography, gas liquid chromatography, high pressure/ performance liquid chromatography (HPLC).
<b>Oct</b>	Basic principles of electrophoresis, theory and application of paper electrophoresis, starch gel electrophoresis. Agarose gel electrophoresis, native and denaturing PAGE, SDS-PAGE, isoelectric

	focusing. Polymerase Chain Reaction, RT-PCR.
<b>Nov</b>	Spectroscopic techniques, theory and applications of UV Spectroscopy, Visible Spectroscopy, IR Spectroscopy. Radio isotopic techniques, principle and application of tracer techniques, Geiger-Muller and Scintillation counters, autoradiography and its applications.

## M.Sc. MICROBIOLOGY, SEMESTER II

<b>Paper- I: Molecular Biology</b>	
<b>Jan</b>	Nucleic acid as genetics information carriers: experimental evidence, structure of DNA, melting of DNA. DNA replication: general principle, various modes of replication, isolation, types and properties of DNA polymerases, proof reading, continuous and discontinuous synthesis. Exonuclease activity in eukaryotic DNA polymerases. Super helicity in DNA, mechanism of action of topoisomerases.
<b>Feb</b>	Relationship between replication and cell cycle. Inhibitors of DNA replication: blocking precursor synthesis, nucleotides polymerization, altering DNA structures. Structural and functional features of RNA (rRNA, tRNA and mRNA). Initiators and elongator class of tRNA, ribosome binding sites on mRNA and corresponding site on rRNA, peptidyl transferase activity of 23S rRNA.
<b>March</b>	Transcription: general principle, basic apparatus, types of RNA polymerases, steps (initiation, elongation and termination), inhibitors of RNA synthesis. Polycistronic and monocistronic RNAs. Maturation and processing of RNA: methylation, cutting and trimming of rRNA. Capping and Polyadenylation. Catalytic RNA, splicing of mRNA, group I and group II intron splicing RNAase P. Basic features of genetic codes. Protein synthesis: steps, details of initiation, elongation, termination, roles of various factors in above steps, inhibitors of proteins synthesis.
<b>April</b>	DNA binding proteins, enhancer sequences and controls of transcription. Use of alternate sigma factors, controlling termination, attenuation and anti-termination. Regulation of genes expression: Operon concept, catabolite repression instability of bacterial RNA, positive and negative regulation, inducers and co repressors. Negative regulation (E.coli lac operon), positive regulation (E. coli operon, regulation by attenuation – his and trp operons).
<b>Paper- II : Microbial Genetics</b>	
<b>Jan</b>	DNA damage: types of DNA damage (deamination, oxidation, alkylation, pyrimidine dimers). Repair pathways (methyl directed mismatch repair, very short patch repairs, nucleotide excision repairs, base excision repairs, recombination repairs, and SOS system). Gene as a unit of Mutation, types of mutagens, genetic analysis of mutants, types of mutations and their origin. Ame's test
<b>Feb</b>	Gene as a unit of recombination, molecular nature of recombination. Gene transfer mechanism: Transformation, Transduction, Conjugation, Transfection, Lysogeny and their applications. Genetic analyses of Bacteria and Yeast. DNA library.
<b>March</b>	Plasmids and phage vectors their types and uses in genetic analysis as vector for gene cloning, replication of selected plasmids, compatibility. 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. Transposons and their uses in genetic analysis. Molecular markers: RFLP and AFLP. Isolation of mutants.
<b>April</b>	Polymerase Chain Reaction. Genetics of phage: genetic recombination in phages, effect of parental ratio, reciprocity. T4 phage structure, life cycle, genetic map and DNA replication. $\lambda$ phageDNA structure, genetic organization and life cycle of $\lambda$ .

## M.Sc. MICROBIOLOGY, SEMESTER IV

<b>Paper- I: ENVIRONMENTAL MICROBIOLOGY</b>	
<b>Jan</b>	General concept of biotic and abiotic environment. Composition and structure of environment. Concept of biosphere, communities and ecosystems. Ecosystem characteristics, structure and function. Food chains, food webs and trophic structures. Ecological pyramids.
<b>Feb</b>	Microbiology of wastewater and solid waste treatment: - Waste-types-solid and liquid waste characterization, physical, chemical, biological, primary, secondary and tertiary treatments. Anaerobic processes: Anaerobic digestion, anaerobic filters and up flow anaerobic sludge. Bioconversion of Solid Waste and utilization as fertilizer. Bioaccumulation of heavy metal ions from industrial effluents.
<b>March</b>	Microbiology of degradation of xenobiotics in the environment, decay behaviour. Hydrocarbons, substituted hydrocarbons. Soil pollution, surfactants and pesticides. Genetically Modified Organisms. Environmental impact assessment and ethical issues.
<b>April</b>	Ozone depletion, Global warming, greenhouse effect, greenhouse gases. Acid rain, their impact and approaches for management. Biogeochemical cycles: carbon, nitrogen, phosphorus and Sulphur.
<b>Paper- II : ENZYME TECHNOLOGY</b>	
<b>Jan</b>	Enzyme classification, Co enzymes Extracellular and intracellular enzymes. Different sources of enzymes. Enzyme purification. Physical and Chemical methods. Enzyme fractionation by precipitation (using Temperature, salt, solvent, pH). Enzyme crystallization techniques. Criteria of purity of enzymes.
<b>Feb</b>	Enzyme kinetics: Michaelis Menten equation. Mechanism of enzyme action: Irreversible, reversible, competitive, non-competitive and uncompetitive inhibition. Allosteric inhibition, types of allosteric inhibition Vitamins and their co-enzymes: structure and functions with suitable examples. Metalloenzymes and Metal ions as co-factors and enzyme activators.
<b>March</b>	Methods viz. adsorption, covalent bonding, entrapment & membrane confinement and their analytical, therapeutic & industrial applications. Properties of immobilized enzymes.
<b>April</b>	Microbial enzymes in textile, leather, wood industries and detergents. Enzymes in clinical diagnostics. Enzyme sensors for clinical processes and environmental analyses. Enzymes as therapeutic agents.
<b>March</b>	Microbial contamination and spoilage of pharmaceutical products (sterile injectables, noninjectables, ophthalmic preparations and implants) and their sterilization. New vaccine technology, DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines. Vaccine clinical trials.
<b>April</b>	Financing R&D capital. Government regulatory practices and policies, FDA perspective. Reimbursement of drugs and biologicals, legislative perspective. Rational drug design. Immobilization procedures for pharmaceutical applications (liposomes). Biosensors in pharmaceuticals. Application of microbial enzymes in pharmaceuticals.



**HEAD**

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