K.T.S.P.MANDAL'S

SAHEBRAOJI BUTTEPATIL MAHAVIDYALAYA

RAJGURUNAGAR

Teaching Plan 2020-21

SEMESTER I

F.Y.B.Sc.

Subject –Introduction To Microbial World **Teacher Name –Prof. A.A.Indais**

Month	Unit	Topics
September 2020	**1**	**Amazing world of Microbiology** **Development of microbiology as a discipline -Discovery of microscope and Microorganisms (Anton von Leeuwenhoek and Robert Hooke), Abiogenesis v/s biogenesis (Aristotle's notion about spontaneous generation, Francesco Redi's experiment, Louis Pasteur's & Tyndall's experiments)** **Golden Era of Microbiology** **Contributions of - Louis Pasteur (Fermentation, Rabies, Pasteurization and Cholera vaccine-fowl cholera experiment) Robert Koch (Koch's Postulates, Germ theory of disease, Tuberculosis and Cholera-isolation and staining techniques of causative agent) Ferdinand Cohn (Endospore discovery), Discovery of viruses (TMV and Bacteriophages), River's Postulates** **Contribution of Joseph Lister (antiseptic surgery), Paul Ehrlich (Chemotherapy), Elie Metchnikoff (Phagocytosis), Edward Jenner (Vaccination) and Alexander Fleming (Penicillin) in establishment of fields of medical microbiology and immunology, Discovery of Streptomycin by Waksman** **Contribution of Martinus W. Beijerinck (Enrichment culture technique, Rhizobium), Sergei N. Winogradsky (Nitrogen fixation and Chemo-lithotrophy) in the development of the field of soil microbiology** **Modern Era of MicrobiologyCarl Woese classification based on 16S rRNA** **Signification and Application of Human Microbiome, Nano-biotechnology and Space Microbiology** **Nobel laureates in Life Sciences of 21st Century**

October 2020	**2**	**Types of Microorganism and their differentiating characters** **-- Prokaryotes, Eukaryotes, three domain and five domain system of classification** **--Bacteria (Eubacteria and Archaebacteria)** **--Protozoa** **--Fungi** **--Algae**
November 20202		**--Viruses, Viroids and Prions** **--Actinomycetes** **Beneficial and Harmful effects of microorganisms:** **Medical Microbiology (Enlist diseases caused by various microorganisms, vaccines and antibiotics)** **Environmental Microbiology (Eutrophication, red tide, Sewage treatment, bioremediation)** **Food and Dairy Microbiology (Food spoilage, food borne diseases, Probiotics and fermented food)** **Agriculture Microbiology (Plant diseases and Biofertilizers and Bio-control agents)** **Industrial Microbiology (Production of antibiotics, enzymes, solvents and contaminants-bacteria and phages)** **Immunology (Normal flora, Three lines of defence**
December 20202		**Revision And Assignment**

Prof. A.A.Indais

K.T.S.P.MANDAL'S

SAHEBRAOJI BUTTEPATIL MAHAVIDYALAYA

RAJGURUNAGAR

Teaching Plan 2020-21

SEMESTER I

F.Y.B.Sc.

Subject –Basic Technique In Microbiology (Paper II)

Teacher Name –Prof. K.D.Gokule

Month	Unit	Topics
September 2020	**1**	**I. Units of measurement – Introduction to Modern SI units** **Microscopy:** **1. Bright field microscopy:** **• • Electromagnetic spectrum of light** **• • Structure, working of and ray diagram of a compound light microscope; concepts of magnification, numerical aperture and resolving power.** **• • Types, ray diagram and functions of – condensers (Abbe and cardioid) eyepieces and objectives** **• • Concept of aberrations in lenses - spherical, chromatic, comma and astigmatism** **2. Principle, working and ray diagram of** **i. Phase contrast microscope** **ii. Fluorescence Microscopy** **iii. Electron Microscopy – TEM, SEM**
October 2020	**2**	**II. Staining Techniques:** **• Definition of Stain; Types of stains (Basic and Acidic), Properties and role of Fixatives, Mordants, Decolourisers and Accentuators** **• Monochrome staining and Negative (Relief) staining** **• Differential staining - Gram staining and Acid-fast staining** **• Special staining- Capsule, Cell wall, Spore, Flagella, Lipid granules, metachromatic granules**

November and December 2020	**3**	**Sterilization and Disinfection** **1. Sterilization** **• Physical Agents - Heat, Radiation, Filtration** **• Checking of efficiency of sterilization (Dry and Moist) – Biological and Chemical Indicators** **2. Disinfection:** **• Chemical agents and their mode of action - Aldehydes, Halogens, Quaternary ammonium compounds, Phenol and phenolic compounds,** **• Heavy metals, Alcohol, Dyes, Detergents and Ethylene oxide.** **• Characteristics of an ideal disinfectant** **• Checking of efficiency of disinfectant - Phenol Coefficient (Rideal–Walker method)**
December 2020		**Revision And Assignment**

Prof. K.D.Gokule

K.T.S.P.MANDAL'S

SAHEBRAOJI BUTTEPATIL MAHAVIDYALAYA

RAJGURUNAGAR

Teaching Plan 2020-21

SEMESTER I

S.Y.B.Sc.

Subject –
MB – 212: BACTERIAL PHYSIOLOGY AND FERMENTATION TECHNOLOGY

Teacher Name –Prof. A.A.Indais

Month	Unit	Topics
September 2020	**1**	**Enzyme-** apoenzymes, prosthetic group and cofactors. b. Nomenclature & classification as per IUB (up to class level). c. Models for catalysis – i. Lock and key ii. Induced fit iii Transition state. d. Effect of pH & temperature, substrate concentration & enzyme concentration, activators, and inhibitors of enzyme

October and November 2020	**2**	**Bacterial Physiology** a. Definitions of Metabolism, catabolism, anabolism, respiration, and fermentation b. Metabolic pathways (with structures) 1. Embden Meyerhof Parnas pathway (Glycolysis) 2. Hexose monophosphate pathway 3. Entner Doudoroff pathway 4. Phosphoketolase pathway (Pentose and hexose) 5. TCA cycle (with emphasis on amphibolism) and Glyoxylate bypass 6. Gluconeogenesis and its significa
November 2020	**3**	FERMENTATION TECHNOLOGY **Concept of fermentation technology** a. Microbial biomass- based fermentation (Biofertilizer, biopesticide, Probiotics) b. Production of Primary metabolites (Organic acids, amino acids, vitamins, enzymes) c. Production of Secondary metabolites (Antibiotics) d. Production of recombinant products (insulin and growth hormones) e. Production of Fermented food products (Cheese, yoghurt) f. Microbial bio transformation (Steroid transformation) **Design of a Fermenter (typical CSTR Continuous stirred Tank Reactor):** Different parts and their working **Monitoring of different fermentation parameters** (Temperature, pH, aeration, agitation, foam)
December 2020		**Strains of industrially important microorganisms:** i. Desirable characteristics of industrial strain ii. Principles and methods of primary and secondary screening iii. Master, working and seed culture; development of inoculum iv. Preservation and maintenance of industrial strains. **Types of fermentations: Batch, continuous, dual** **Media for industrial fermentations:** Constituents of media (Carbon source, nitrogen source, amino acids vitamins, minerals, water, buffers, antifoam agents, precursors, inhibitors, and inducers)

Janaury 2021		**Contamination: Sources, precautions, and consequences** **Revision and assignment**

Prof. A.A.Indais

K.T.S.P.MANDAL'S

SAHEBRAOJI BUTTEPATIL MAHAVIDYALAYA

RAJGURUNAGAR

Teaching Plan 2020-21

SEMESTER I

S.Y.B.Sc.

Subject –

MB – 211: MEDICAL MICROBIOLOGY AND IMMUNOLOGY

Teacher Name –Prof. K.D.gokule

Month	Unit	Topics
September 2020	**1**	**MEDICAL MICROBIOLOGY** **Defination** **Study of following pathogens with respect to – Classification, Morphological, Cultural and Biochemical characters, Antigenic structure, Viability characteristics, Pathogenicity, Pathogenesis, Symptoms, Laboratory diagnosis, Epidemiology, Prophylaxis and Chemotherapy:** **Bacteria: a) *Escherichia coli* b) *Staphylococcus aureus*** **Fungi: a) *Candida* b) *Dermatophytes***

October and November 2020	**2**	**Introduction to Chemotherapy** **i. Selective toxicity, Bioavailability MIC, MBC, LD 50** **ii. Antagonism and synergism in drug administration** **iii. Antibiotic sensitivity,** **iv. Antibiotic misuse/antibiotic overuse** **v. Concept of drug resistance (e.g. MRSA, ESBL**
November 2020	**3** **4** **5**	**IMMUNOLOGY** **Immunity: Definition, types (Innate and acquired, active and** **passive, humoral and cell mediated)** **Formation of blood cells (hematopoiesis)** **Myeloid and lymphoid lineages and differentiation process** **Lymphocytes types** **Antigens and antibodies: definition and concept** **Immunohematology** **a. ABO and Rh blood group systems** **b. Bombay blood group** **c. Biochemistry of blood group substances** **d. Inheritance of ABH antigens** **e. Medico legal applications of blood groups**
December 2020	**6**	**Active and Passive Immunization** **a. Active Immunization** **Whole organism vaccines** **i. Attenuated vaccines** **ii. Inactivated Vaccines** **b. Passive Immunization** **Transfer of preformed antibodies** **c. Latest Immunization schedule in India** **Revision And Assignment**

Prof. K.D.Gokule

K.T.S.P.MANDAL'S

SAHEBRAOJI BUTTEPATIL MAHAVIDYALAYA

RAJGURUNAGAR

Teaching Plan 2020-21

SEMESTER III

T.Y.B.Sc.

Subject – *MB – 331: MEDICAL MICROBIOLOGY*

Teacher Name –Prof. A.A.Indais

Month	Unit	Topics
September 2020	**1**	*Introduction to infectious diseases of following human body systems:* *(Brief anatomy and physiology, Diseases, Pathogens and Symptoms)* a. Respiratory system b. Gastrointestinal system c. Kidney and Liver d. Genital system e. Central nervous system
October and November 2020	**2**	*Epidemiology:* a. Definition, scope and applications b. Incidence and prevalence rates, mortality and morbidity rates c. Disease distribution based on time, place and person d. Case control and cohort studies – study design and application e. Principle and methods – Clinical trials of drugs and vaccines (Randomized control trials Concurrent parallel and cross-over trials) f. Epidemiology of infectious diseases i. Sources and reservoirs of infection ii. Modes of transmission of infections

		iii. Disease prevention and control measures
November and December 2020		-- Study of following groups of bacterial pathogens: (with respect to – Classification and Biochemical characters, Antigenic structure, Viability characteristics, Pathogenicity, Pathogenesis, Symptoms, Laboratory diagnosis, Epidemiology, Prophylaxis and Chemotherapy i. Enteric pathogens (*E. coli*, *Shigella*, *Salmonella*, *Campylobacter*, *Vibrio*) ii. Pneumococci and *Neiserria* iii. Pyogenic organisms – *Staphylococcus, Streptococcus, Pseudomonas* iv. Spirochetes – *Treponema, Leptospira* v. *Clostridium tetani* and *Clostridium perfringens* vi. *Bacillus anthracis* vii. *Acinetobacter* spp. viii. *Mycobacterium tuberculosis and Mycobacterium leprae* ix. Rickettsia

December and janaury 2020		**Revision And Assignment**

Prof. A.A.Indais

K.T.S.P.MANDAL'S

SAHEBRAOJI BUTTEPATIL MAHAVIDYALAYA

RAJGURUNAGAR

Teaching Plan 2020-21

SEMESTER III

T.Y.B.Sc.

Subject MB – 332: GENETICS AND MOLECULAR BIOLOGY

Teacher Name –Prof. A.A.Indais

Month	Unit	Topics
September 2020	**1**	Gene Linkage and crossing over: a. Mendelian laws, b. Recombination in eukaryotes Double Strand Break (DSB) model c. Gene linkage and cross over d. Chromosome mapping, Recombination frequency, Map unit e. Mapping Chromosome by Tetrad analysis f. Mapping Chromosome by Para sexual cycle
October and November 2020	**2**	DNA Replication: a. Single replicon b. Bidirectional movement of replication fork. Ori C, c. Prepriming and Priming reaction. d. DNA polymerases, DNA synthesis of leading, lagging strand e. Okazaki fragments. f. Termination- Ter sequence, Tus protein g. Mismatched repair

November and December 2020		-- **Prokaryotic and Eukaryotic Transcription:** a. Structure of Promotors b. Structure and role of RNA polymerases. c. Initiation, elongation and termination d. Post transcriptional modification e. Regulation of transcription f. Introduction to RNA splicing *Vibrio*) **Prokaryotic and Eukaryotic Translation:** a. Role of m-RNA, t-RNA and Ribosomes in translation b. Synthesis of amino acyl tRNA c. Initiation, elongation, translocation and termination of protein d. Regulation of translation
December and janaury 2020		**Guidelines for gene manipulation:** a. History of recombinant DNA technology - Potential uses and biohazards b. Safety guidelines for recombinant DNA technology laboratory **Techniques used in recombinant DNA technology:** a. Isolation and purification of genomic DNA b. Agarose gel electrophoresis c. Blotting- Southern, Northern and Western **Revision And Assignment**

Prof. A.A.Indais

K.T.S.P.MANDAL'S

SAHEBRAOJI BUTTEPATIL MAHAVIDYALAYA

RAJGURUNAGAR

Teaching Plan 2020-21

SEMESTER III

T.Y.B.Sc.

Subject –

MB – 336: FOOD AND DAIRY MICROBIOLOGY

Teacher Name –Prof. A.A.Indais

Month	Unit	Topics
September 2020	**1**	DAIRY MICROBIOLOGY **Dairy Development in India:** Role of National Dairy Development Board (NDDB), National Dairy Research Institute (NDRI), Military dairy farm, Indian Dairy Corporation (IDC), Dairy Co-operatives, Milk Grid, Operation **Milk Chemistry and Constituents:** a. Definition and Composition of milk b. Types of Milk (skimmed, toned and homogenized). c. Concept of clean milk d. Factors affecting quality and quantity of milk. e. Nutritive value of milk f. Physico-Chemical properties of milk.

October and November 2020		**Microbiology of milk:** a. Common micro-organisms found in milk b. Fermentation and spoilage of milk c. Milk borne diseases **Preservation of Milk by Pasteurization & its storage:** a. Methods of Pasteurization – LTH, HTST, UHT b. Storage specifications after pasteurization c. Phosphatase test and its significance
November 2020	**2**	**Microbial analysis of milk:** a. Dye reduction test (using methylene blue and resazurin) b. Total bacterial count. c. Brucella ring test and tests for mastitis. d. Somatic cell count **FOOD MICROBIOLOGY** **Classification of Foods based on stability:** Perishable, Semi-perishable & stable **Food spoilage:** a. Chemical and physical properties of food affecting microbial growth b. Sources of food spoilage micro-organisms c. Spoilage of i. Meat and Poultry products ii. Bread iii. Fruits and Vegetables iv. Eggs v. Sea foods vi. Canned foods **Food preservation:** a. Principles of food preservation b. Thermal destruction of bacteria - use of low temperature and high temperature. c. Determination of TDP, TDT, D, F, and Z values d. Use of chemicals and antibiotics in food preservation e. Canning
December and Janaury 2020		f. Dehydration g. Use of radiations h. Principles of Hazard Analysis and Critical Control Points (HACCP)-

		i. Introduction to Tetrapack technology **Microbial food poisoning and food infection:** a. Food poisoning by: i. *Staphylococcus aureus* ii. *Campylobacter* iii. *Clostridium botulinum* iv. *Aspergillus flavus* b. Food infection by : i. *Salmonella typhimurium* ii. *Vibrio parahemolyticus* **Fermented foods:** a. Definition and Types b. Significance of fermented foods (probiotic characteristics of lactic acid bacteria) c. Fermentation of *Idli* batter, butter **Applications of genetically modified microorganisms:** a. Starter cultures b. Genetically modified foods i. Food grade Bio-preservatives ii. Recombinant Dairy enzymes / Proteins **Food Sanitation and regulation** **Revision And Assignment**

Prof. A.A.Indais

K.T.S.P.MANDAL'S

SAHEBRAOJI BUTTEPATIL MAHAVIDYALAYA

RAJGURUNAGAR

Teaching Plan 2020-21

SEMESTER III

T.Y.B.Sc.

Subject –

MB – 335: FERMENTATION TECHNOLOGY

Teacher Name –Prof. K.D.Gokule

Month	Unit	Topics
September 2020	**1** **2**	**Strain Improvement:** a. Objective of strain improvement b. Methods for strain improvement: i. selection of different types of mutants ii. application of rDNA technologyk. **Media optimization:** a. Classical approach – One factor at a time, Full factorial design b. Placket & Burman design c. Response Surface Methodology (RSM)
October and November 2020	**3** **4**	**Sterilization of Media:** a. Methods of sterilization b. Batch sterilization and Continuous sterilization c. Concept and derivation of Del factor **Scale-up and Scale-down:** a. Objective of scale-up b. Levels of fermentation (laboratory, pilot-plant and production levels) c. Criteria of scale-up for critical parameters (aeration and

		agitation, broth rheology and sterilization) d. Scale-down
November 2020	**5**	***Principles and methods of downstream processing:*** a. Cell disruption b. Filtration c. Centrifugation d. Liquid-liquid extraction e. Distillation f. Ion exchange chromatography g. Drying
December and Janaury 2020	**6** **7**	***Quality assurance (QA) of fermentation product:*** a. Detection and Quantification of the product by physicochemical, biological and enzymatic methods b. Sterility testing c. Pyrogen testing – Endotoxin detection d. Ames test and modified Ames test e. Toxicity testing f. Shelf life determination ***Fermentation economics:*** Contribution of various expense heads to a process (Recurring and non recurring expenditures) citing any suitable example. Introduction to Intellectual Property Rights (IPR) - Types of IPR **Revision And Assignment**

Prof. K.D.Gokule

K.T.S.P.MANDAL'S

SAHEBRAOJI BUTTEPATIL MAHAVIDYALAYA

RAJGURUNAGAR

Teaching Plan 2020-21

SEMESTER III

T.Y.B.Sc.

Subject –

MB – 334: IMMUNOLOGY

Teacher Name –Prof. K.D.Gokule

Month	Unit	Topics
September 2020	**1**	**Immunity:** Definition and ClassificationRSM)
	2	**Formation of blood cells:** Erythrocytic, myelocytic, monocytic and lymphocytic lineages and differentiation process, lymphocyte types and subsets
October and November 2020	**3**	**Organs of immune system:** a. Primary lymphoid organs (Thymus and Bursa): Thymus – structure, thymic education (positive and negative selection) b. Secondary lymphoid organs – structure and function of spleen and lymph node, mucous associated lymphoid tissue; response of secondary lymphoid organs to antigen, lymphatic system and lymph circulation
	4	**Cell Mediated Immune Response** a. Activation and differentiation of T cells b. Mechanism of CTL mediated cytotoxicity, ADCC c. Significance of CMI

November 2020	**5** **6**	**Innate immunity: Non specific mechanisms of defense** a. **First line of defense** – Physical, chemical and biological barriers b. **Second line of defense**: i. Humoral components: Defensins, pattern recognition proteins (PRP) and pathogen associated molecular patterns (PAMPs), complement, kinins, acute phase reactants. ii. Cellular components: Phagocytic cells – PMNL, macrophages (reticulo-endothelial cell system) and dendritic cells iii. Functions: Phagocytosis (oxygen dependent and independent systems), Complement activation (Classical, Alternative and lectin pathway), Coagulation system, Inflammation (cardinal signs, mediators, vascular and cellular changes, role of Toll-like **Antigen:** a. Concepts and factors affecting immunogenecity b. Antigenic determinants, haptens and cross-reactivity, Carriers, Adjuvants c. Types of antigens: Thymus-dependent and thymus-independent antigens, Synthetic antigens, Soluble and particulate antigens, Autoantigens, Isoantigens
December and Janaury 2020	**7** **7**	**Immunoglobulins:** a. Structure of basic unit, chemical and biological properties b. Characteristic of domain structure, functions of light and heavy chain domains c. Antigenic nature of immunoglobulin molecules d. Molecular basis of antibody diversity (kappa chain, lambda chain and heavy chain diversity) **Adaptive / Acquired Immunity (Third line of defense):** **1. Humoral Immune Response** a. Primary and secondary response kinetics, significance in vaccination

		programs b. Antigen processing and presentation (MHC class I and class II restriction pathways), cell-cell interactions and adhesion molecules, response to super-antigens, role of cytokines in activation and differentiation of B-cells **Transplantation and Immunity** a. Types of Grafts, b. Allograft rejection mechanisms c. Prevention of allograft rejection **Revision And Assignment**

Prof. K.D.Gokule

K.T.S.P.MANDAL'S

SAHEBRAOJI BUTTEPATIL MAHAVIDYALAYA

RAJGURUNAGAR

Teaching Plan 2020-21

SEMESTER III

T.Y.B.Sc.

Subject –
MB – 333: ENZYMOLOGY

Teacher Name –Prof. K.D.Gokule

Month	Unit	Topics
September 2020	**1**	***Enzymes:*** a. Structure of enzymes: Methods to determine amino acid residues at active site (Physical and chemical methods b. Role of cofactors in metabolism: Occurrence, Structure and Biochemical functions of the following: i. Nicotinic Acid (Niacin) and the Pyrimidine nucleotides. ii. Riboflavin (Vitamin B_2) and the Flavin nucleotides iii. Thiamine (Vitamin B_1) and Thiamine Pyrophosphate iv. Pantothenic acid and coenzyme A v. Pyridoxal phosphate (Vitamin B_6) vi. Metal ions
	2	***II Enzyme assays:*** a. Principles of enzyme assays: Sampling b. Enzymes assays with examples by: i. Spectrophotometric methods ii. Spectroflurometric methods iii. Radioisotope assay

October and November 2020	**3**	**Principles and Methods of Enzyme purification:** a. Methods of cell fractionation b. Principles and methods of enzyme purification: i. Based on molecular size ii. Based on charge iii. Based on solubility differences iv. Based on specific binding property and selective adsorption c. Criteria for purity: SDS-PAGE, ultracentrifugation, and construction of purification chart d. Characterization of enzymes: i. Determination of Molecular weight based on: Ultracentrifugation, SDS-PAGE, gel filtration ii. Stability of enzyme activity at pH and temperature
November 2020	**4** **5**	**Enzyme Kinetics:** a. Concept and use of initial velocity b. Michaelis Menton equation for the initial velocity of single substrate enzyme catalyzed reaction. Brigg's Haldane modification of Michaelis Menton equation. Michaelis Menton plot. Definition with significance of Km, Ks, Vmax c. Different plots for plotting Kinetic data: i. Lineweaver and Burk plot ii. Hanes plot iii. Eadie Hofstee plot iv. Eisanthal, Cornish-Bowden plot d. Concepts and types of Enzyme Inhibitions **Metabolic Regulations:** i. Enzyme compartmentalization at cellular level ii. Allosteric enzymes iii. Feedback mechanisms

December and Janaury 2020	**6**	iv. Covalently modified regulatory enzymes (e.g. Glycogen phosphorylase) v. Proteolytic activation of zymogens vi. Isozymes - concept and examples vii. Multienzyme complex e.g. Pyruvate dehydrogenase complex(PDH) **Immobilization of enzymes:** Concept, methods of immobilization and applications **Revision And Assignment**

Prof. K.D.Gokule