SEMESTER – I PRINCIPLES OF MICROBIOLOGY - PMB701

Unit - 1: (15 Hrs)
Scope of Microbiology - History - Microscopy - types - Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze-fracture methods for EM, image processing methods in microscopy - Stains and dyes – staining methods - Structure of bacterial cell - Structure and functions of cell organelles

Unit - 2: (15 Hrs)
Classification - Haeckel's, Whitaker's - Evolution of microorganisms - Outline of bacterial classification according to Bergey’s manual – Polyphasic taxonomy – 16s rRNA gene based phylogeny – Mol % G+C analysis – Chemotaxonomic markers – fatty acid methyl esters, peptidoglycans – Conventional and molecular methods of studying microbial diversity

Unit - 3: (15 Hrs)

Unit - 4: (15 Hrs)
Nutritional requirements of microorganisms - Growth factors - Nutritional types -Culture media - Sterilization - Physical agents - High temperature, Low temperature, Desiccation, Osmotic pressure, Radiation, Filtration - Chemical agents - Phenols and phenolic compounds, Alcohols, Halogens, Heavy metals and their compounds, Dyes, Synthetic detergents, Quaternary ammonium compounds, Aldehydes, Gaseous agents - Antibiotics - Classification, Mode of action – Antifungal and antiviral agents.

Unit - 5: (15 Hrs)
Text Books

Reference Books
SEMESTER – I IMMUNOLOGY AND IMMUNOTECHNOLOGY
- PMB702

Unit - 1: (15 Hrs)
History of Immunology – Overview of the immune system - Cells and organs of the immune system - Antigens - types, property, haptens, adjuvants, vaccines - Immunoglobulins - structure & classes

Unit - 2: (15 Hrs)
Immunohaematology - Blood groups, blood transfusion, Rh incompatibilities - Antigen-Antibody reactions - Agglutination, Precipitation, Complement fixation, Immunofluorescence, ELISA, RIA

Unit - 3: (15 Hrs)
Host-Parasitic relationships - Microbial infections - Virulence and host resistance - Innate and acquired immunity – vaccines – Definitions & Types - Brief account of MHC molecules – Antigen processing and presentation – T-cell receptors – T-cell maturation, activation and differentiation – B-cell generation, activation and differentiation - Cell mediated Immunity – Lymphokines and Cytokinins

Unit - 4: (15 Hrs)
Complement pathways - Classical and Alternate pathways - Hypersensitivity - Type I, II, III and IV - Basic concepts of Autoimmunity – Brief account of autoimmune diseases – Immunodeficiency – Transplantation immunology – immunological basis of graft rejection, Immunosuppressive therapy - Cancer and the immune system – oncogenes, tumors of the immune system, tumor antigens, immune response to tumors, cancer immunotherapy

Unit - 5: (15 Hrs)
Antibody production - Production of antisera – Haemagglutination titre and assay for antibody secreting cells – Separation and Identification of protein or antigen – Hybridoma technology: Monoclonal antibodies – Antibody engineering – Gene transfer technology – SCID Mice and SCID – human mice – Bone marrow transplantation – Tissue culture – Other techniques contributing to immunotechnology

Text Books

Reference Books
- Roitt, I. M. Essential Immunology, (8th Edition), Blackwell Science.
SEMESTER – I MOLECULAR BIOLOGY AND MICROBIAL GENETICS - PMB703

Unit - 1: (15 Hrs)

Unit - 2: (15 Hrs)

Unit - 3: (15 Hrs)

Unit - 4: (15 Hrs)

Unit - 5: (15 Hrs)
Textbooks
• Freifelder, D., Microbial Genetics. 1987, Narosa Publishing House, New Delhi.

Reference Books
SEMESTER – I ENVIRONMENTAL MICROBIOLOGY - PMB704

Objective:
To make the students understand the importance of microbes in ecology and bioremediation.

Unit - 1: (15 Hrs)
Microbiology of air - droplet nuclei, aerosols - enumeration of microorganisms in air- air sanitation - Laboratory hazards - airborne diseases - Aquatic microflora - lakes, ponds, rivers, ocean, estuary, ground water -significance – study of aquatic microflora – Eutrophication - Waterborne diseases

Unit - 2: (15 Hrs)
Waste water treatment - primary, secondary (anaerobic and aerobic - trickling, activated sludge, oxidation pond) - Sludge digestion - Disposal - Drinking water treatment - chlorination - Microbiological standards of water - Water pollution - indicators water pollution - BOD – COD - techniques for the study of water pollution

Unit - 3: (15 Hrs)
Role of microbes in soil fertility - methods used in soil microbiology – Deep subsurface Microbiology - Biodegradation of pesticides and pollutants in soil - Biogeochemical cycles - carbon, phosphorus, sulfur, iron, and nitrogen cycles – Green house effect and microorganisms

Unit - 4: (15 Hrs)
Interaction among microbial populations (Neutralism, commensalism, synergism, Mutualism, competition, parasitism, antagonism) – Microbial interaction with plants – rhizosphere, mycorrhizae, phyllosphere, nitrogen fixation - Microbial interaction with animals – microbial contribution to animal nutrition – symbiotic relationship

Unit - 5: (15 Hrs)
Bioleaching – recovery of metals – bioaccumulation of metals - acid-mine drainage - Biodeterioration – biofouling – Biofilms – Composting – Quantitative microbial ecology – sample collection, detection of microbial populations, determination of microbial numbers and biomass

Textbooks

Reference Books
- Grant W. D. and Long P.E., Environmental Microbiology, 1981 Blackie and Son Ltd., Glasgow
Objective:
To make the students familiar with techniques routinely used in bio sciences

Unit 1: (6 Hrs)
**Biophysical methods:** Analysis of biomolecules using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy

Unit 2: (6 Hrs)
**Biophysical methods:** structure determination using X-ray diffraction and NMR, analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods

Unit 3: (6 Hrs)
**Radiolabeling techniques:** Properties of different types of radioisotopes normally used in biology, their detection and measurement; incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines

Unit 4: (6 Hrs)
**Electrophysiological methods:** Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI, fMRI, CAT

Unit 5: (6 Hrs)
**Methods in field biology:** Methods of estimating population density of animals and plants, ranging patterns through direct, indirect and remote observations, sampling methods in the study of behavior, habitat characterization—ground and remote sensing methods.

Textbooks

Reference Books
SEMESTER – II FOOD AND AGRICULTURAL MICROBIOLOGY
- PMB806

Unit - 1: (15 Hrs)
Importance of studying food and dairy microbiology - Microorganisms important in food microbiology - Food as a substrate for microorganisms – Factors affecting the kinds and number of microorganisms in food - Contamination and spoilage - Food preservation methods with principles physical irradiation, drying, heat processing - high temperature - low temperature - chilling, freezing, high pressure, modification of atmosphere - food additives – chemical sodium chloride, sugar, vinegar, class I and class II preservatives

Unit - 2: (15 Hrs)
Food fermentations – therapeutic and nutritional value of fermented foods - Milk and milk products - fermented dairy products - butter, cheese, yogurt, acidophilus milk - Spoilage and defects of fermented dairy products - Milk-borne infection, intoxication - Milk preservation methods – pasteurization, sterilization

Unit - 3: (15 Hrs)
Food poisoning and food borne infections by bacteria such as Brucella, Bacillus, Clostridium, Escherichia, Salmonella, Shigella, Staphylococcus, Vibrio, fungi and viruses; bacterial and fungal exo- and endo- toxins - Food borne disease outbreaks - laboratory testing - preventing measures - Food sanitation – Plant sanitation - quality control – HACCP - Food control agencies and its regulations

Unit - 4: (15 Hrs)
Plant pathogenic microorganisms – Microbial Diseases of plants - disease symptoms, mode of entry of pathogens – Plant disease resistance – factors affecting disease incidence - control measures
Unit - 5:          (15 Hrs)

Text Books

Reference Books
Objective:
To make the students familiar with microbiological techniques in fermentation industry.
To make the students understand the application of microbes in fermentation industry.

Unit - 1: (15 Hrs)
Historical development of bioprocess technology, outline of an integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses, generalized process flow sheets - General requirements of fermentation processes, Basic design and construction of fermentor and ancillaries, Main parameters to be monitored and controlled in fermentation processes - asepsis and containment requirements - body construction and temperature control - aeration and agitation systems - sterilization of fermenter, Design of sterilization equipment - aseptic inoculation methods - sampling methods, valve systems - monitoring and control devices and types of fermenters - An overview of aerobic and anaerobic fermentation processes and their application in the biotechnology industry, solid-substrate fermentation and its applications.

Unit - 2: (15 Hrs)
screening and strain development strategies - preservation of industrially important microorganisms - Fermentation media - Desired qualities - Medium requirements for fermentation processes, Carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, media formulation strategies - formulation of optimal growth and product formation, examples of simple and complex media - role of buffers, precursors, inhibitors, inducers and antifoams - design and usage of various commercial media for industrial fermentations, heat, sterilization of liquid media - thermal death kinetics of microorganisms - filter sterilization of liquid media, Air.
Unit - 3: (15 Hrs)
Downstream process - Objectives and criteria - foam separation - precipitation methods - filtration devices and filter aids - industrial scale centrifugation and cell disruption methods - liquid-liquid extraction - solvent recovery – chromatography - two-phase aqueous extraction - super-critical fluid extraction - ultrafiltration, drying devices, crystallisation and whole broth processing - Fermentation economics

Unit – 4: (15 Hrs)
Stoichiometry of Cell growth and product formation, degrees of reduction of substrate and biomass, yield coefficients of biomass and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth - Phases of cell growth in batch cultures, product formation kinetics, substrate and product inhibition on cell growth and product formation.

Unit – 5: (15 Hrs)
Important industrial fermentations - production of enzymes (amylase, pectinases, cellulase) - Amino acid production (glutamic acid and lysine) - Production of antibiotics (penicillin, tetracycline) - Production of Vitamins (riboflavin, cyanocobalamin) - Production of alcohol (Ethanol) and beverages (beer and wine) - Organic acids - lactic acid, citric acid - Steroid transformations - Production of Vaccines, toxoids, antitoxin

Text Books

Reference Book
SEMESTER – II  CLINICAL MICROBIOLOGY - PMB808

Unit - 1: (15 Hrs)  
Background to infectious diseases – Host-parasite relationship – Types of transmission – Specimen collection - Specimen quality – Diagnosis of infection.

Unit - 2: (15 Hrs)  

Unit - 3: (15 Hrs)  
Gastrointestinal tract infections – Obstetric and perinatal infections – Central nervous system infections – Infections of the skin, muscle, joints, bone and hemopoietic system.

Unit - 4: (15 Hrs)  
World wide virus infections (Measles, Mumps, Rubella, Cytomegalovirus infection, EBV infection, other human herpes virus infections and small pox) – Vector borne infections (Rickettsial diseases, Malaria, Dengue as examples) – Multisystem Zoonoses – Pyrexia of unknown origin – Infections in the compromised host.

Unit - 5: (15 Hrs)  
Epidemiologic aspects of the control of infection and disease – Hospital acquired infection, sterilization and disinfection - Nucleic acid techniques in Diagnostic Microbiology.

Text Books

Reference Books
SEMESTER – II  BIOTECHNOLOGY - PMB809

Unit - 1:  \hspace{1cm} (15 Hrs)
History, Scope and Definitions of Biotechnology – Industrial Biotechnology – Enzyme technology - Enzyme immobilisation, Products, Applications - Biotechnological potentials of Seaweeds, Microalgae – Single cell protein – Mushroom - Spirulina cultivation - Biotransformation

Unit - 2:  \hspace{1cm} (15 Hrs)

Unit - 3:  \hspace{1cm} (15 Hrs)
Animal Biotechnology - animal cell culture – facilities and applications – culture media for animal cells – biology of cultured cells – primary culture and cell lines – scale-up – cell viability and cytotoxicity – cell transformation and cell cloning – organ and histotypic cultures – tissue engineering - Biohazards

Unit - 4:  \hspace{1cm} (15 Hrs)

Unit - 5:  \hspace{1cm} (15 Hrs)

Text Books
- Gupta, P.K., Elements of Biotechnology, 1996, Rastogi and company, Meerut.

Reference Books
SEMESTER – II  RESEARCH METHODOLOGY - EPMB810S

Unit 1:  
Research – Definition – Literature Collection – Literature Citation – Experimental designs - Major search engines - Major Websites, book and scientific information - Identification, Selection and formulation of research problem – Research questions.

Unit 2:  

Unit 3:  
Biological research - Institutional Ethical committee – Animal ethical committee – Use of laboratory animals in research - Laboratory animal management

Unit 4:  

Unit 5:  
Centrifugation – Principles and Instrumentation - Low-Speed centrifuges – High-Speed Centrifuges – Ultracentrifuges. Applications of Centrifugation: Preparative Techniques – Analytical Centrifugation (Differential and Density gradient)

Text Books
- Dr. N. Gurumani, Research Methodology: For Biological Sciences, 2006, MJP Publishers.

Reference Books
SEMESTER – II  LAB COURSE – II PMBP 202