



# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

T. Y. B.Sc. Microbiology

**ENGLISH (Higher Level)**

<b>Unit No.</b>	<b>Topic</b>
	<b>Text – The return of vaman</b>
<b>1</b>	<b>The Container</b>
	1.1 The Transfer 1.2 The Find 1.3 The Archaeologist 1.4 The New Hounds 1.5 The Task Force 1.6 The Expert 1.7 The Agent 1.8 The Opening 1.9 The Committee 1.10 The Fortress 1.11 The Suspect
<b>2</b>	<b>Guru</b>
	2.1 The Trojan House 2.2 The Machine 2.3 The Client 2.4 The Wiretapper 2.5 The Computer 2.6 The Rendezvous 2.7 The Challenge
<b>3</b>	<b>Vaman</b>
	3.1 The Monads 3.2 The Little One 3.3 The Precaution 3.4 The Decoy 3.5 The Watcher 3.6 The Kidnap 3.7 The Ransom 3.8 The Mole 3.9 The Document 3.10 Farewell
	<b>Text – English for competitive examination by Bhatnagar and Bhargav</b>
<b>1</b>	Basics of English
<b>2</b>	Errors and How to Avoid Them
<b>3</b>	Spotting Errors
<b>4</b>	Sentence Completion

<b>5</b>	Letter Writing
<b>6</b>	Spellings
<b>7</b>	Vocabulary

**Microbial Genomics and Bioinformatics (IDS)**

<b>Unit No.</b>	<b>Topic</b>
<b>1</b>	<b>Introduction and History of Genomics and Bioinformatics</b>
	1.1 Introduction to Genomics 1.1.1 Structural, Functional and comparative Genomics 1.2 Introduction to Bioinformatics 1.2.1 Definitions of Bioinformatics 1.2.2 Chronological History of Bioinformatics 1.2.3 Bioinformatics in India 1.2.4 Basic terminology of Bioinformatics
<b>2</b>	<b>DNA and Genome Sequencing</b>
	2.1 Determining DNA sequence 2.1.1 Maxam and Gilbert's method 2.1.2 Sanger's method 2.1.3 Automated DNA sequencing 2.1.4 Software for DNA sequencing 2.2 Whole Genome Shotgun sequencing 2.3 Polymorphism
<b>3</b>	<b>Microbial Genomics</b>
	3.1 General characteristics of microbial genomes 3.2 Comparative genomics 3.3 Functional genomics 3.4 Future of genomics
<b>4</b>	<b>Computers in Biology Laboratory</b>
	4.1 Role of computers in Science Laboratory 4.2 Brief History of Internet 4.3 Using computers for Biology research 4.4 Types of computers 4.5 Network computers 4.6 Working with Mainframe, Personal Computers and the Web
<b>5</b>	<b>Finding and Retrieving Sequences in Database - an overview</b>
	5.1 Public databases 5.2 Entrez 5.3 Sequence retrieval systems 5.4 GCG LOOKUP
<b>6</b>	<b>Similarity Searching</b>
	6.1 Introduction to sequence similarities 6.2 DOT PLOTS 6.3 DISTANCES 6.4 BLAST 6.5 FASTA and FASTA format
<b>7</b>	<b>Introduction to Alignments</b>
	7.1 Pair wise alignments Local and Global 7.2 Multiple alignments
<b>8</b>	<b>Protein Structure Analysis</b>
	8.1 Introduction to Protein structure 8.2 Protein database and PDB viewers 8.3 Protein composition and secondary structure 8.4 Protein tertiary structure 8.5 Motifs 8.6 Profiles

	8.7 Searching for new motifs
9	<b>Phylogenetic Trees</b>
	9.1 Introduction to taxonomy and phylogenetics 9.2 Cladistics 9.3 Calculating distances 9.4 Phylogenetic software - PAUP and PHYLIP
10	<b>Applications of Bioinformatics</b>
	10.1 Spotted DNA arrays 10.2 Protein microarrays

## Diagnostic Medical Laboratory Science (IDS)

Unit No.	Topic
<b>1</b>	<b>BIOSAFETY AND QUALITY MANAGEMENT</b>
	1.1 Biosafety 1.2 Health and safety in the clinical laboratory - Common hazards - Safety measures 1.3 Microbial hazards and its prevention 1.4 Containment and Biosafety levels 1.5 Decontamination and disposal of laboratory waste 1.6 Universal precautions for health care professionals 1.7 Emergency First Aid 1.8 Total Quality Management 1.9 Frame work of TQM 1.10 Quality Control-General approach
<b>2</b>	<b>LABORATORY INSTRUMENTS, OPERATION AND APPLICATIONS</b>
	2.1 Photoelectric Absorptimeters 2.2 pH meter 2.3 Electrophoresis 2.4 Chromatography-HPLC, GLC, Column Chromatography
<b>3</b>	<b>CLINICAL MICROBIOLOGY- I</b>
	3.1 Collection, Preservation, Aseptic Handling, Transport and Examination 3.2 Throat and Mouth specimens 3.3 Sputum
<b>4</b>	<b>CLINICAL MICROBIOLOGY- II</b>
	4.1 Collection, Preservation, Aseptic Handling, Transport and Examination 4.2 Pus, Ulcer material & skin specimen 4.3 C.S.F. (including clinical chemistry of C.S.F.) 4.4 Effusions 4.5 Blood
<b>5</b>	<b>CLINICAL MICROBIOLOGY- III</b>
	5.1 Collection, Preservation, Aseptic Handling, Transport and Examination 5.2 Urogenital Specimens 5.3 Semen
<b>6</b>	<b>ANTIMICROBIAL SUSCEPTIBILITY TEST</b>
	<b>Ref: Kolhatkar</b> 6.1 Dilution Tests 6.2 Diffusion Tests 6.2.1 Kirby Bauer technique 6.2.2 Strock technique 6.2.3 National Committee for Clinical Laboratory Standards (NCCLS) Technique 6.3 Antibiotic combinations 6.4 Determination of SBT 6.4.1 Serum antimicrobial levels (Antibiotic Assays) 6.5 Determination of serum antimicrobial Activity
<b>7</b>	<b>BIOCHEMICAL ANALYSIS</b>
	<b>Ref: M. Cheesbrough</b> 7.1 Measurement of serum creatine 7.2 Measurement of serum urea by DAM method

	<p>7.3 Measurement of serum glucose by Glucose oxidase- peroxidase method</p> <p>7.4 Measurement of GTT by WHO reference method</p> <p>7.5 Measurement of serum bilirubin by DMSO method</p> <p>7.6 Measurement of serum alpha-amylase by Iodometric method</p>
<b>8</b>	<p><b>ADVANCED DIAGNOSTIC TECHNIQUES</b></p> <p><b>Ref: Godkar</b></p>
	<p>8.1 Polymerase chain reaction</p> <p>8.2 Gene cloning</p> <p>8.3 Probe labeling</p> <p>8.4 Blot techniques</p> <p>8.5 Automation in diagnostic bacteriology</p>
<b>9</b>	<p><b>HAEMATOLOGY Ref: Mukherjee</b></p>
	<p>9.1 Blood : Definition, component and functions</p> <p>9.2 Haematopoiesis- An overview</p> <p>9.3 Blood coagulation and haemostasis</p> <p>9.4 Collection of blood and use and types of anticoagulants</p> <p>9.5 Determination of haemoglobin:</p> <p>    9.5.1 Sahli's method</p> <p>    9.5.2 Cyanmethaemoglobin method</p> <p>9.6 Blood cell counts</p> <p>9.7 Determination of PCV: Wintrobe's method</p> <p>9.8 Determination of Erythrocyte indices</p> <p>9.9 Determination of Bleeding, Clotting time and Prothrombin time</p>
<b>10</b>	<p><b>IMMUNOHAEMATOLOGY AND BLOOD BANKING Ref: Mukherjee</b></p>
	<p>10.1 Human blood group systems and their genetics</p> <p>10.2 Qualitative test for ABO and Rh groupings</p> <p>10.3 Coomb's Test: Direct and Indirect</p> <p>10.4 Selection of a donor</p> <p>10.5 Collection of blood</p> <p>10.6 Compatibility testing: Major and Minor crossmatch</p> <p>10.7 Methods of crossmatching – Coomb's crossmatch</p> <p>10.8 Separation and storage of blood components</p>

**Microbial Genetics and Metabolism**  
Paper VI

Unit No.	Topic
1	<b>HISTORY OF GENETICS</b>
	1.1 Mendel's principles of inheritance <b>Ref: Watson</b> 1.2 Chromosomal theory of heredity <b>Ref: Watson</b> 1.3 Gene linkage and crossing over <b>Ref: Watson</b> 1.4 Evidence of DNA and RNA as genetic material <b>Ref: Cummings &amp; Klug</b> 1.5 One gene – One polypeptide theory <b>Ref: Cummings &amp; Klug</b> 1.6 Terms used in genetics: Genotype, Phenotype, Alleles , Gene, Genome 1.7 Historical events in genetics- over view
2	<b>GENOME: STRUCTURE AND REPLICATION Ref: Watson and Lewin</b>
	2.1 Structure and organization of bacteria and phage genome ( <i>E. coli</i> and T <sub>4</sub> phage as case study) 2.2 Gene structure 2.2.1 Gene 2.2.2 Intron and exon 2.2.3 Cistrons 2.2.4 Open reading frame 2.2.5 Sequencing of DNA – Sanger method 2.3 Replication of DNA 2.3.1 Chemistry of DNA synthesis 2.3.2 Work of Messelson and Stahl 2.3.3 Models of DNA replication: Theta ( $\theta$ ) and Sigma ( $\sigma$ ) 2.3.4 Process and mechanism of DNA replication – Role of different enzymes and proteins 2.3.5 The replication fork 2.3.6 DNA replication at replication fork 2.3.7 RM system
3	<b>GENE EXPRESSION AND REGULATION Ref: Watson</b>
	3.1 Introduction and central dogma 3.2 Transcription 3.2.1 DNA dependent RNA polymerase 3.2.2 Stages of transcription 3.2.3 Post transcriptional modification of transcript in prokaryotes and eukaryotes 3.2.4 Role of ribozymes (Processing of RNA) 3.3 Genetic code 3.3.1 Deciphering the genetic code: Work of Holley, Nirenberg, Matthai and Khorana 3.3.2 Characteristics of Genetic code 3.4 Translation 3.4.1 Ribosome cycle

	<p>3.4.2 Charging of t-RNA</p> <p>3.4.3 Stages of translation</p> <p>3.4.4 Post translational modification <b>Ref: Prescott</b></p> <p>    3.4.4.1 Protein folding and molecular chaperons</p> <p>    3.4.4.2 Protein splicing</p> <p>3.5 Regulation of gene expression by operon model:</p> <p>    Negative control (lac operon)</p> <p>    Positive control (trp operon)</p>
4	<b>GENETIC RECOMBINATION AND EXTRACHROMOSOMAL INHERITENCE</b>
	<p>4.1 Recombination</p> <p>    4.1.1 Definition and Types – Homologous and site specific</p> <p>    4.1.2 Molecular events in homologous recombination – Holliday model</p> <p>4.2 Transformation – Process and mechanism <b>Ref: Prescott and Watson</b></p> <p>4.3 Transduction - Process and mechanism <b>Ref: Prescott and Watson</b></p> <p>4.4 Conjugation - Process and mechanism <b>Ref: Prescott and Watson</b></p> <p>4.5 Bacterial plasmids and Transposable elements</p>
5	<b>MUTATIONS AND THEIR REPAIR</b>
	<p>5.1 Mutation: Definition and Types</p> <p>5.2 Reversion and suppression</p> <p>5.3 Phenotypic classes of mutants <b>Ref: Davis</b></p> <p>5.4 Spontaneous mutation <b>Ref: Prescott</b></p> <p>    5.4.1 Fluctuation test</p> <p>    5.4.2 Biochemical basis</p> <p>5.5 Induced mutations</p> <p>    5.5.1 Mutagens: Physical, Chemical and Biological</p> <p>    5.5.2 AMES test</p> <p>5.6 DNA repair</p>
6	<b>GENETIC ENGINEERING</b>
	<p>6.1 Historical perspectives <b>Ref: Trevan</b></p> <p>6.2 Outline of gene cloning</p> <p>6.3 Tools of gene cloning</p> <p>    6.3.1 Restriction enzymes</p> <p>    6.3.2 Genomic libraries</p> <p>    6.3.3 cDNA</p> <p>    6.3.4 Synthetic DNA</p> <p>    6.3.5 Types of vector: bacterial plasmids, viral genomes, cosmid, artificial vectors – yeast and bacteria, shuttle vectors, expression vectors</p> <p>    6.3.6 Ligase</p> <p>    6.3.7 Alkaline phosphatase</p>

	6.3.8 Linkers and adaptors 6.4 Detection of recombinant clones 6.4.1 Colony hybridization method 6.4.2 Southern blotting <b>Ref: Prescott</b> 6.4.3 Reporter genes <b>Ref: Atlas</b> 6.5 Gene Amplification – PCR 6.6 Applications and socio-ethical impact of r-DNA technology <b>Ref: Prescott</b>
7	<b>METHODS OF ATP GENERATION AND CHEMOLITHOTROPHY</b>
	7.1 Overview of metabolism 7.2 Respiration – Oxidative phosphorylation and chemiosmotic theory <b>Ref: Prescott</b> 7.3 Photosynthesis - Photophosphorylation 7.4 Fermentation – Substrate level phosphorylation 7.5 Chemolithotrophy 7.6 Energy generation in Archea-Halobacteria (Bacteriorhodopsins)
8	<b>CARBOHYDRATE METABOLISM Ref: Lehninger</b>
	8.1 Major pathways – Glycolysis, Phosphoketolose, HMP and ED 8.2 Pyruvate and Acetyl CoA: Key metabolites 8.3 Tricarboxylic acid cycle (TCA) 8.4 Glyoxylate bypass 8.5 Calvin Benson cycle and Bassam cycle <b>Ref: Stryer</b> 8.6 Gluconeogenesis 8.7 Regulation of carbohydrate metabolism in prokaryotes
9	<b>PROTEIN METABOLISM</b>
	9.1 Amino acid and protein catabolism 9.1.1 Proteolysis 9.1.2 Deamination, Decarboxylation, Transamination and Stickland reaction 9.2 Biosynthesis of amino acids 9.3 Regulation of protein metabolism in prokaryotes
10	<b>LIPID METABOLISM Ref: Lehninger</b>
	10.1 $\beta$ -Oxidation of fatty acids 10.2 Biosynthesis of Fatty acid and Phospholipids 10.3 Regulation of lipid metabolism in prokaryotes

**IMMUNOLOGY AND MEDICAL MICROBIOLOGY**  
**Paper VII**

Unit No.	Topic
1	<b>PATHOGENICITY OF MICROORGANISMS AND NON-SPECIFIC HOST RESISTENCE Ref: Prescott</b>
	1.1 Host –Parasite relationships: Overview 1.2 Pathogenicity of Viral diseases 1.3 Pathogenicity of Bacterial diseases 1.4 Microbial mechanisms for escaping host defenses 1.5 Normal microbiota of the human body 1.5.1 Gnotobiotic life 1.5.2 Distribution 1.5.3 Relationship between normal microbiota and host 1.5.4 Probiotics and Prebiotics 1.6 Non-specific host resistance 1.6.1 Overview and pre-disposing factor <b>Ref: International Pelczar</b> 1.6.2 Physical, Chemical and Biological barriers
2	<b>SPECIFIC IMMUNITY Ref: Prescott , Kuby</b>
	2.1 Specific immunity 2.1.1 Overview 2.1.2 Types 2.2 Cells, Tissue and Organs of immune system 2.3 Antigen 2.3.1 Nature and types <b>Ref: Pelczar 5<sup>th</sup> ed.</b> 2.3.2 Composition - Hapten, carrier and determinants 2.3.3 Superantigens and CDs 2.3.4 Adjuvants 2.4 Antibody 2.4.1 Basic structure 2.4.2 Classes and Functions 2.4.3 Generation of antibody diversity <b>Ref: Prescott</b> 2.4.4 Monoclonal antibodies and applications 2.5 Biology of T cells and B cells 2.6 Action of antibodies 2.7 Vaccines 2.7.1 Types 2.7.2 Vaccination schedule for Travellers and children (Govt. of India)
3	<b>IN VITRO ANTIGEN-ANTIBODY REACTIONS AND APPLICATIONS Ref: Prescott and Pelczar 5<sup>th</sup> ed.</b>
	3.1 Precipitation reactions <b>Ref: Pelczar 5<sup>th</sup> ed.</b>

	<ul style="list-style-type: none"> <li>3.2 Flocculation and Agglutination reactions</li> <li>3.3 Complement Fixation Tests</li> <li>3.4 R.I.A.</li> <li>3.5 E.L.I.S.A.</li> <li>3.6 Immunofluorescence</li> <li>3.7 Immunoblotting</li> <li>3.8 Serotyping</li> <li>3.9 Introduction to in vivo antigen antibody reactions</li> </ul>
4	<b>IMMUNE DISORDERS Ref: Prescott and Kuby</b>
	<ul style="list-style-type: none"> <li>4.1 Hypersensitivity: Types</li> <li>4.2 Autoimmune disorders: Introductory aspects</li> <li>4.3 Transplant rejection and transplantation immunity <b>Ref: Roitt</b></li> <li>4.4 Immunodeficiency: Introduction to congenital and acquired</li> </ul>
5	<b>EPIDEMIOLOGY OF INFECTIOUS DISEASES</b>
	<ul style="list-style-type: none"> <li>5.1 Epidemiology <b>Ref: Atlas</b> <ul style="list-style-type: none"> <li>5.1.1 Concepts of epidemiology</li> <li>5.1.2 Collection of data</li> <li>5.1.3 Observational and experimental studies</li> </ul> </li> <li>5.2 Nosocomial infections <b>Ref: International Pelczar</b> <ul style="list-style-type: none"> <li>5.2.1 Sources, Equipment and procedures that contribute to infection, Susceptibility and transmission.</li> <li>5.2.2 Control and prevention of nosocomial infections <ul style="list-style-type: none"> <li>5.2.2.1 Breaking the cycle of infection</li> <li>5.2.2.2 Isolation</li> <li>5.2.2.3 Asepsis: Medical and surgical, Hospital disinfection and sterilization</li> <li>5.2.2.4 Surveillance: Of patients, health care personnel and hospital environment</li> <li>5.2.2.5 Infection control program in hospitals</li> </ul> </li> </ul> </li> <li>5.3 Emerging and re-emerging diseases- overview <b>Ref: Prescott</b></li> </ul>
6	<b>AIRBORNE DISEASES Ref: Prescott</b>
	<ul style="list-style-type: none"> <li>6.1 Anatomy and defenses of respiratory tract</li> <li>6.2 List of major airborne diseases</li> <li>6.3 Streptococcal diseases: Pharyngitis (Sore Throat) and Pneumonia</li> <li>6.4 Pulmonary Tuberculosis</li> <li>6.5 Influenza</li> </ul>
7	<b>ARTHROPOD BORNE DISEASES Ref: Prescott and Pelczar 5<sup>th</sup> ed.</b>
	<ul style="list-style-type: none"> <li>7.1 List of major arthropod borne diseases</li> <li>7.2 Plague</li> <li>7.3 Malaria</li> <li>7.4 Dengue Fever <b>Ref: Greenwood</b></li> </ul>
8	<b>DIRECT CONTACT DISEASES: S.T.D. AND SKIN DISEASES Ref: Prescott and Pelczar 5<sup>th</sup> ed.</b>
	<ul style="list-style-type: none"> <li>8.1 Anatomy and defenses of genitourinary tract and skin.</li> <li>8.2 List of major direct contact diseases</li> </ul>

	8.3 Syphilis 8.4 A.I.D.S. 8.5 Staphylococcal skin infections 8.6 Dermatomycoses (Not systemic)
9	<b>DIRECT CONTACT DISEASES: MISCELLANEOUS Ref: Prescott.</b>
	9.1 Leptospirosis <b>Ref: Greenwood</b> 9.2 Tetanus 9.3 Rabies 9.4 Serum hepatitis 9.5 Common cold 9.6 Urinary tract infections
10	<b>FOODBORNE AND WATERBORNE DISEASES Ref: Prescott</b>
	10.1 Anatomy and defenses of gastrointestinal tract 10.2 List of major foodborne and waterborne diseases 10.3 Typhoid and Paratyphoid fevers 10.4 Cholera 10.5 Dysentery: Bacillary and Amoebic 10.6 Paralytic Poliomyelitis

**MICROBIAL ECOLOGY AND ENVIRONMENTAL MICROBIOLOGY**  
**Paper VIII**

<b>Unit No.</b>	<b>Topic</b>
<b>1</b>	<b>MICROBIAL ECOLOGY AND MAJOR BIOGEOCHEMICAL CYCLES</b>
	1.1 Microbial ecology and Ecosystem: Introduction and Characteristics 1.2 Population interactions: Different types of Positive, Neutral and Negative interactions <b>Ref: Prescott</b> 1.3 Microbiology of Rumen ecosystem <b>Ref: Prescott</b> 1.4 Methods in microbial ecology <b>Ref : Brock</b> 1.5 Carbon cycle <b>Ref: Prescott</b> 1.6 Sulfur cycle <b>Ref: Prescott</b> 1.7 Nitrogen cycle <b>Ref: Prescott</b> 1.8 Phosphorus cycle <b>Ref: Prescott</b>
<b>2</b>	<b>AEROMICROBIOLOGY Ref: Daniel</b>
	2.1 Introduction to Aero microbiology 2.1 Origin and types of microorganisms in air 2.2 Microbiological analysis of air
<b>3</b>	<b>SOIL MICROBIOLOGY Ref: Mark Cohene</b>
	3.1 Physical and chemical properties of soil 3.2 Microorganisms in soil 3.3 Microbiological analysis of soil 3.4 Rhizosphere and Phyllosphere microflora 3.5 Soil microorganisms associations with vascular plants 3.6 Nitrogen fixation
<b>4</b>	<b>AGRICULTURAL MICROBIOLOGY</b>
	4.1 Plant pathology 4.1.1 Major symptoms of plant diseases <b>Ref: R.S. Singh</b> 4.1.2 Transmission of plant diseases <b>Ref: Atlas</b> 4.1.3 Control of plant diseases – Physical, Chemical and Biological 4.1.4 Plant quarantine 4.2 Biofertilizers <b>Ref: Ranga</b> 4.3 Biopesticides
<b>5</b>	<b>AQUATIC MICROBIOLOGY Ref: Maier</b>
	5.1 The aquatic environment 5.2 Freshwater ecosystems: Springs, Streams and rivers, Ponds, Lakes, Estuaries 5.3 Marine ecosystems: Mangroves, Deep seas and subterranean 5.4 Water zonations, Upwelling and Eutrophication
<b>6</b>	<b>MICROBIOLOGY OF DRINKING WATER Ref: Pelczar</b>
	6.1 Sources 6.2 Drinking water purification: Single-Dwelling supply and Municipal supply 6.3 Microbiological analysis of drinking water 6.4 Role of Indicator organisms <b>Ref: Maier</b> 6.5 W.H.O. microbiological standards for drinking water
<b>7</b>	<b>MICROBIOLOGY OF WASTE TREATMENT Ref: Maier and Arceiwala</b>

	7.1 Types of waste: Domestic and Industrial 7.2 Characterization of waste <b>Ref: Arceiwala</b> 7.3 Sludge processing: Landfills, Composting and Anaerobic sludge digesters 7.4 Waste water treatment: Primary, Secondary and Tertiary 7.5 Microbiological analysis of waste
<b>8</b>	<b>EXTREMOPHILES Ref: Desk Encyclopedia</b>
	8.1 Thermopiles and Hyperthermophiles 8.2 Psychrophiles 8.3 Halophiles 8.4 Xerophiles 8.5 Acidophiles and Alkalophiles 8.6 Barophiles
<b>9</b>	<b>MICROBIOLOGY OF BIOFUELS AND OIL RECOVERY Ref: Waites</b>
	9.1 Biogas – Production and applications 9.2 Bioethanol – Production and applications 9.3 Hydrogen as a fuel 9.4 Microbially Enhanced Oil Recovery
<b>10</b>	<b>ENVIRONMENTAL BIOTECHNOLOGY</b>
	10.1 Biohydrometallurgy: Recovery of Copper and Uranium 10.2 Biodegradation: Alkyl benzyl sulfonate, Herbicides and Pesticides 10.3 Bioremediation of oil spillage 10.4 Biodeterioration: Paper, Paint, Metal, Leather and Textiles

**FOOD MICROBIOLOGY AND FERMENTATION TECHNOLOGY**  
**Paper IX**

Unit No.	Topic
1	<b>MICROBIOLOGY OF FOOD Ref: Frazier and Adams</b>
	1.1 Food as a substrate for microorganisms 1.2 Important microorganisms in food: Molds, Yeasts and Bacteria 1.3 Microbiological analysis of food 1.4 Principles of food preservation: Asepsis, Removal of microorganisms, Maintenance of anaerobic conditions, High and low temperature, Drying, Food additives, Chemical preservatives and Radiation 1.5 Contamination and Spoilage of food: <b>Ref: Pelczar 5<sup>th</sup> ed.</b> 1.5.1 Overview of spoilage of Sugar products, Vegetables, Fruits, Meat and meat products, Fish, Seafood, Eggs and poultry 1.5.2 Spoilage of canned food and fresh food (In detail) 1.6 Food borne illness: Microbial and non-Microbial
2	<b>DAIRY MICROBIOLOGY Ref: Pelczar (5<sup>th</sup> ed.)</b>
	2.1 Nutritional value of milk 2.2 Sources of contamination in milk 2.3 Microbial flora of raw milk 2.4 Microbiological analysis of milk 2.5 Pasteurization and sterilization of milk and grading of milk <b>Ref: Mahanta</b> 2.6 Fermented dairy products: Fermented milk beverages, Cheese and Butter 2.7 Spoilage of milk, cheese and butter
3	<b>FERMENTED FOODS AND MICROORGANISMS AS FOOD Ref: Prescott and Dunn, Pepler</b>
	3.1 Fermented foods 3.1.1 Bread 3.1.2 Oriental fermented foods 3.1.3 Sauerkraut 3.1.4 Fermented olives 3.1.5 Pickles 3.1.6 Alcoholic beverages: Beer and Wine 3.2 Microorganisms as food: Production, Economics, Safety measures and Future 3.2.1 S.C.P. 3.2.2 Mushrooms
4	<b>HISTORY AND BASIS FOR THE DEVELOPMENT OF THE FERMENTATION PROCESSES Ref: A.H. Patel, Crueger</b>
	4.1 Historical developments in fermentation Technology 4.2 Screening for new metabolites -primary and secondary metabolites, Strains used in screening, Primary and secondary screening 4.3 Types of fermentation processes 4.3.1 Single, Dual and Multiple – An Overview 4.3.2 Batch and Continuous– An Overview 4.3.3 Surface and Submerged– An Overview 4.3.4 Solid state fermentation –

	In detail
5	<b>STRAIN IMPROVEMENT AND FERMENTATION MEDIA Ref: A.H. Patel, Crueger</b>
	5.1 Strategies of strain improvement: Mutation, Recombination, Regulation and Genetic engineering 5.2 Fermentation media 5.2.1 Characteristics of an ideal fermentation media 5.2.2 Designing a fermentation medium <b>Ref: Whittaker</b> 5.2.3 Raw materials 5.2.4 Screening for production media
6	<b>FERMENTATION EQUIPMENTS Ref: Crueger and Whitaker</b>
	6.1 Fermenter Design 6.2 Types of fermenters 6.3 Aeration and agitation devices 6.4 Scale up and scale down 6.5 Computer aided instrumentation and control – An overview
7	<b>INDUSTRIAL STERILIZATION Ref: Whittaker</b>
	7.1 Sterilization of equipments 7.2 Sterilization of media: Batch and Continuous 7.3 Sterilization of air 7.4 Radiation sterilization of pharmaceutical products (Ref: Talaro) 7.5 Sterility testing
8	<b>DOWNSTREAM PROCESSES Ref: Crueger and Whitaker</b>
	8.1 Separation of microbial cells and suspended solids 8.2 Intracellular product recovery: Cell disruption 8.3 Concentration of products : Solubilization, solvent extraction, precipitation and distillation 8.4 Purification of products : Crystallization, Chromatography, ultrafiltration, evaporation and drying
9	<b>TYPICAL FERMENTATION PROCESSES</b>
	9.1 List of industrially important microbial enzymes and Amylase fermentation 9.2 List of microbially produced Amino acids and production and regulation of Glutamic acid 9.3 List of microbially produced chemicals and production of Acetic acid (Vinegar) 9.4 List of microbially produced antibiotics and Penicillins and bioassay 9.5 List of microbially produced vitamins: Riboflavin and bioassay 9.6 List of microbially produced solvents: Production of Acetone-butanol
10	<b>MICROORGANISMS IN BIOTECHNOLOGY</b>
	10.1 Biosensors 10.2 Biopolymers 10.3 List of genetically engineered human therapeutic proteins and Insulin 10.4 Immobilization of enzymes and cells and their applications

## Microbiology Practical

Unit No.	Topic
	<b>MOLECULAR BIOLOGY, GENETIC ENGINEERING AND MICROBIAL METABOLISM</b>
<b>1</b>	Isolation of antibiotic resistant mutant by gradient plate technique
<b>2</b>	Isolation of auxotrophic mutant by Replica plate technique (Demonstration)
<b>3</b>	Isolation of inducible mutants by ultraviolet rays
<b>4</b>	Preparation of Phosphate buffer solution
<b>5</b>	Estimation of reducing sugars: Cole's method
<b>6</b>	Estimation of reducing sugars: Nelson Somagy
<b>7</b>	Estimation of protein: Folin – Lowry's method
<b>8</b>	Paper chromatography technique (For Amino Acid by ascending)
<b>9</b>	Isolation of inducible mutation of Chemical mutagen. (Acridine Orange)
	<b>IMMUNOLOGY AND CLINICAL MICROBIOLOGY</b>
<b>10</b>	Total count of blood cells
<b>11</b>	Haemoglobin estimation
<b>12</b>	Determination of blood groups
<b>13</b>	Differential count of Leucocytes
<b>14</b>	Widal test
<b>15</b>	RPR test – Qualitative
<b>16</b>	Urine analysis
<b>17</b>	Study of the microbial flora of oral cavity lining
<b>18</b>	Study of Nasal flora
<b>19</b>	Antibiotic susceptibility test – Combi disc- Gram positive, Gram negative
<b>20</b>	Bacteriological investigation of diagnostic problems from: blood
<b>21</b>	Bacteriological investigation of diagnostic problems from: urine
<b>22</b>	Bacteriological investigation of diagnostic problems from: stool
<b>23</b>	Bacteriological investigation of diagnostic problems from: purulent exudates, wound, abscess
<b>24</b>	Determination of MIC of antibiotics
<b>25</b>	Study of insect vectors (Flea, Culex-Anopheles-Aedes, Tick, Louse, Bed bug)
<b>26</b>	Study of permanent Slide of Parasites. (Malarial-P.v., P.f.; Leishmania, Tripanozoma cruzi)
	<b>Environmental and Agricultural Microbiology</b>
<b>27</b>	Assessment of Air-solid settling plate technique.
<b>28</b>	Isolation and enumeration of heterotrophic bacteria of soil.
<b>29</b>	Isolation and identification of soil fungi
<b>30</b>	Isolation and identification of actinomycetes from soil

31	Isolation of nonsymbiotic nitrogen fixing aerobic bacteria- <i>Azotobacter</i> spp.
32	Isolation of nonsymbiotic nitrogen fixing ectosymbiotant bacteria <i>Azospirillum</i> spp.
33	Isolation of nonsymbiotic nitrogen fixing anaerobic bacteria- <i>Clostridium</i> spp.
34	Isolation of <i>Rhizobium</i> spp. from root nodules of legume plants
35	Study of phylloplane microflora
36	Isolation of plant pathogenic bacteria from citrus canker.
37	Study of plant pathogenic fungi. (Permanent slides of various stages of life cycle of <i>Puccinia graminis</i> )
38	Bacteriological analysis of water. (Quantitative, Presence-Absence test, Detection & Enumerations of C.F.) (BGLB,Endo*)
39	Study of faecal indicator bacteria ( <i>Enterococcus faecalis</i> ) by membrane filter technique in water. (1 biochemical test)
40	Bacteriological examination of sewage
41	Isolation of coliphage from raw sewage
	<b>Food and Industrial Microbiology</b>
42	Bacteriological analysis of food.
43	Bacteriological analysis of milk (MBRT, qualitative, quantitative, AFB)
44	Phosphatase test of Pasteurized milk.
45	Isolation and identification of microorganisms from curd.
46	Sterility testing.
47	Screening of antibiotic producing microorganisms from soil-Wilkin's
48	Screening of organic acid producing bacteria from rotten fruit/soil
49	Fermentative production of amylase and its estimation
50	Bioassay of penicillin
51	Bioassay of Riboflavin.
52	Alcohol fermentation, its recovery & detection.
53	Turbidometric Enumeration of bacteria using McFarland scale. Ref: Kale