



BHAKTA KAVI NARSINH MEHTA UNIVERSITY JUNAGADH

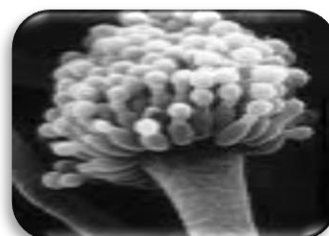
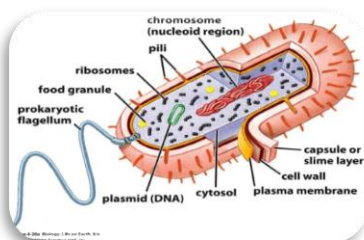
COURSE STRUCTURE & SYLLABUS

FOR

UNDERGRADUATE PROGRAMME

IN

MICROBIOLOGY



(CORE COURSE FOR SEMESTER V & VI)

(As per Choice Based Credit System as recommended by UGC)

Effective from June – 2018

PREFACE



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COURSE STRUCTURE FOR UG PROGRAM AND CREDIT SYSTEM

SKELETON OF COMPLETE COURSE CONTENT OF UNDER GRADUATE MICROBIOLOGY (SEMESTER I TO VI)

SEMESTER	PAPER NO. & CODE	TITLE OF THE PAPER	CREDIT
I	MB-101 (Theory)	Basic Aspects of Microbiology	4
	MB-101 (Practical)	-do-	3
II	MB-201 (Theory)	Microbial Chemistry and Microbial Control	4
	MB-201 (Practical)	-do-	3
III	MB-301 (Theory)	Microbial Systematics and Environmental Microbiology	4
	MB-301 (Practical)	-do-	3
IV	MB-401 (Theory)	Applied Microbiology	4
	MB-401 (Practical)	-do-	3
V	MB-501 (Theory)	Immunology and Medical Microbiology	4
	MB-501 (Practical)	-do-	3
	MB-502 (Theory)	Prokaryotic Metabolism	4
	MB-502 (Practical)	-do-	3
	MB-503 (Theory)	Molecular Biology and Genetic Engineering	4
	MB-503 (Practical)	-do-	3
VI	MB-601 (Theory)	Bioprocess Technology	4
	MB-601 (Practical)	-do-	3
	MB-602 (Theory)	Analytical Techniques and Bioinformatics	4
	MB-602 (Practical)	-do-	3
	MB-603 (Theory)	Clinical and Diagnostic Microbiology	4
	MB-603 (Practical)	-do-	3

GENERAL INSTRUCTIONS

- 1) The Medium of Instruction will be English for Theory and practical course
- 2) There will be 6 Lectures / Week / Theory Paper / Semester.
- 3) Each Lecture (Period) will be of 55 Mins. (1 Period = 55 Mins).
- 4) There will be 2 Practical / Week / Paper / Batch. Each Practical will be of 3 Periods (1 Period 55 Mins.).
- 5) Each Semester Theory Paper will be of FIVE Units. There will be 60 Hrs. of Theory teaching / Paper / Semester.
- 6) Each Theory Paper / Semester will be of 100 Marks. There will be 30 marks for internal evaluation and 70 marks for external evaluation. Each Practical Paper / Semester will be of 50 Marks. So, Total Marks of Theory and Practical for each Paper will be 150. (100+50 = 150)

Instructions to the Candidates for Practical Examination:

- 1) The practical examination will be conducted for THREE (3) days.
- 2) The Time duration of practical examination will be of FOUR (4) hrs on all the days.
- 3) All the students have to remain present at the examination centre 15 minutes before the scheduled time for examination.
- 4) Students have to carry with them Certified journal, I-card or examination receipt, Slide box, Apron and all other necessary requirements for examination.
- 5) Candidate should not leave the laboratory without the permission of examiner.
- 6) Use of calculator is allowed but the use of Mobile phones is strictly prohibited.
- 7) The candidate has to leave the laboratory only after the submission of all the answer sheets of the exercises performed.

**SKELETON OF THEORY EXAMINATION
(SEMESTER – I to VI)**

Paper Style for All Semester

1. The syllabus consists of five Units.
2. All Units carry equal marks.
3. There should be five questions in a question paper.
4. One question is to be asked from each Unit.
5. Each question carries 14 marks.
6. Time duration of 70 marks question paper is 2:30 hours.
7. Each question should be divided into a, b and c as shown below.
 - a. Answer the following. (Any one out of Two)----- (07 marks)
(Theory Question)
 - b. Attempt any one. (Out of Two)----- (04 Marks)
(Application/Example/Problem/Theory)
 - c. Attempt any three. (Out of Five) ----- (03 Marks)
(short answer/one word/one line/true or false/fill up the blanks)

**INTERNAL EVALUATION FOR MB : 501,502,503,601,602 AND 603
(THEORY)**

No.	Pattern of Internal Evaluation	Marks
1	Assignment	10
	MCQ Test	10
	Seminar/Presentation	10
OR		
2	MCQ Test	30
OR		
3	Assignment	10
	MCQ Test	20
OR		
4	Seminar/Presentation	10
	MCQ Test	20

**INTERNAL EVALUATION FOR MB MB : 501,502,503,601,602 AND 603
(PRACTICAL)**

No.	Pattern of Internal Evaluation	Marks
1	Reagent Preparation/Calculation	05
2	Practical Performance/Test	05
3	Viva	05

SYLLABUS FOR MICROBIOLOGY SEMESTER - V

(With effect from June 2018)

MB-501- : Immunology and Medical Microbiology

(THEORY)

UNIT 1 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

IMMUNITY AND IMMUNE SYSTEM

- 1.1 Types of immunity : Natural, Acquired, herd, Innate, specific
- 1.2 Structure, functions and properties of Immune Cells: – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell
- 1.3 Structure, functions and properties of Immune Organs: – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT
- 1.4 Characters of immune system

REFERENCE BOOKS

- 1 Immunology – 5th edition – J.Kuby, R. A. Goldsby , .J.Kindt , B.A. Osborne – W.H. Freeman and Company , New York
- 2 Principles of Microbiology- 2nd edition – R.M.Atlas – Wm.C.Brown Publishers
- 3 Microbiology – 5th edition – Prescott , Harley , Klein – McGraw-Hill Publishers
- 4 Instant Notes in Microbiology – P.M. Lyolyard , A. Whelan, M.W. Fanger

UNIT 2(CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

IMMUNE RESPONSE

- 2.1 Primary and Secondary Immune Response
- 2.2 Generation of Humoral Immune Response (Plasma and Memory cells)
- 2.3 Structure and properties of class I and II MHC
- 2.4 Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co- stimulatory signals)
- 2.5 Killing Mechanisms by CTL and NK cells
- 2.6 Cytokines (overview of Interleukin, interferon and Tumour necrosis factors and Chemokines)
- 2.7 Phagocytosis, Inflammation, Opsonisation, Complement system,: an overview
- 2.8 Antigen processing and presentation

REFERENCE BOOKS

- 1 Immunology – 5th edition – J.Kuby, R. A. Goldsby, T.J.Kindt , B.A. Osborne – W.H. Freeman and Company , New York
- 2 Principles of Microbiology- 2nd edition – R.M.Atlas – Wm.C.Brown Publishers
- 3 Microbiology – 5th edition – Prescott , Harley , Klein – McGraw-Hill Publishers
- 4 Instant Notes in Microbiology – P.M. Lyolyard , A. Whelan, M.W. Fanger
- 5 Immunology – Raj Khanna – Oxford University Press

UNIT 3(CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

ANTIGEN AND ANTIBODY

3.1 Antigen

- a. Immunogenicity versus antigenicity
- b. Factors influencing Immunogenicity
- c. Adjuvant, Epitopes and Haptens

3.2 Antibody

- a. Basic structure of Antibody
- b. Immunoglobulin classes and their Biological activities
- c. Epitopes and Receptors on immunoglobulin molecule
- d. Antibody Diversity and Clonal Selection Theory
- e. Overview of Monoclonal Antibody and polyclonal antibody

REFERENCE BOOKS

- 1 Immunology – 5th edition – J.Kuby, R. A. Goldsby , T.J.Kindt , B.A. Osborne – W.H. Freeman and Company , New York
- 2 Principles of Microbiology- 2nd edition – R.M.Atlas – Wm.C.Brown Publishers
- 3 Microbiology – 5th edition – Prescott , Harley , Klein – McGraw-Hill Publishers
- 4 Instant Notes in Microbiology – P.M. Lyolyard , A. Whelan, M.W. Fanger

UNIT 4(CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

DYSFUNCTIONAL IMMUNITY

- 3.1 Immunodeficiency Diseases
- 3.2 Hypersensitivity

- 3.3 Autoimmune diseases
- 3.4 Overview of Tumor immunity
- 3.5 Overview of Transplantation immunity

REFERENCE BOOKS

- 1 Immunology – 5th edition – J.Kuby, R. A. Goldsby , T.J.Kindt
B.A. Osborne – W.H. Freeman and Company , New York
- 2 Principles of Microbiology- 2nd edition – R.M.Atlas –
Wm.C.Brown Publishers
- 3 Microbiology – 5th edition – Prescott , Harley , Klein – McGraw-
Hill Publishers
- 4 Instant Notes in Microbiology – P.M. Lyolyard , A. Whelan,
M.W. Fanger

UNIT 5(CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

NORMAL FLORA AND INFECTION

- 4.1 Introduction to the normal flora of healthy human host
- 4.2 Host –microbe interactions
 - a. Process of Infection
 - b. Pathogenicity
 - c. Virulence and infection
 - d. Microbial adherence
 - e. Penetration of epithelial cell layers
 - f. Events in infection following penetration
 - g. Microbial virulence factors
- 4.3 Natural Resistance: Species, Racial, Individual, External and Internal
defence

REFERENCE BOOKS

- 1 Immunology – 5th edition – J.Kuby, R. A. Goldsby , T.J.Kindt
B.A. Osborne – W.H. Freeman and Company , New York
- 2 Principles of Microbiology- 2nd edition – R.M.Atlas –
Wm.C.Brown Publishers
- 3 Microbiology – 5th edition – Prescott , Harley , Klein – McGraw-
Hill Publishers
- 4 Instant Notes in Microbiology – P.M. Lyolyard , A. Whelan, M.W.
Fanger

MB-501- : Immunology and Clinical Microbiology (PRACTICAL)

1. Identification of blood cells through microscopy
2. Total count of RBC
3. Total count of WBC
4. Differential count of WBC
5. Isolation of normal flora of skin
6. Isolation of normal flora of mouth
7. Understanding of the medical problems (Case Study)

REFERENCE BOOKS

- 1 Medical Laboratory Technology – Vol – I , II , III – Mukherji K.L.
- 2 A Text Book in Medical Laboratory Technology – P.B.Godkar
- 3 Medical Bacteriology, Mycology and AIDS – N.C. Dey, T.K. Dey, D.Sinha

MB-502- Prokaryotic Metabolism (THEORY)

UNIT 1 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

INTRODUCTION TO METABOLISM, BIOENERGETICS AND ENZYME KINETICS

- 1.1 Bioenergetics : The concept of free energy, Determination of ΔG & Energy rich compounds
- 1.2 Energy metabolism: Role of ATP in metabolism, Role of reducing power in metabolism, Role of precursor metabolites in metabolism
- 1.3 Non Regulatory Enzymes : Derivation of the Michaelis - Menten Equation
- 1.4 Regulatory Enzymes : Conformational changes in Regulatory Enzymes

REFERENCE BOOKS

1. The physiology and Biochemistry of Prokaryotes, 2nd edition By. David white
2. Outlines of biochemistry By- Conn E.E. and Stumpp P.K.: 4th Ed.
3. General microbiology by Stanier R.Y.: 5th Ed
4. Principles of Biochemistry By Lehninger

UNIT 2 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

HETEROTROPHIC MODE OF METABOLISM

A. Catabolism of Carbohydrates :

- 2.1 Glycolysis and its regulation
- 2.2 The Pentose phosphate pathway
- 2.3 The Entner - Doudroff pathway
- 2.4 The Citric acid cycle and its regulation
- 2.5 The Glyoxylate cycle

B. Catabolism of protein and amino acids:

- 2.6 General reactions of amino acids catabolism, Stickland Reactions

C. Catabolism of lipids:

- 2.7 Oxidation of Fatty Acids, Beta- Oxidation of Fatty Acids

REFERENCE BOOKS

1. The physiology and Biochemistry of prokaryotes, 2nd edition By. David white
2. Outlines of biochemistry by Conn E. E. and Stumpf P. K. 4th Ed.
3. General microbiology by Stanier R.Y.: 5th Ed.
4. General microbiology by Powar and Daginawala Vol-1
5. Principles of Biochemistry By Lehninger

UNIT 3 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

ENERGY GENERATION AND ANABOLISM

- 3.1 Different modes of ATP generation
- 3.2 Electron transport chain : Introduction, Components of ETC and energy yield
- 3.3 Anaerobic Respiration
- 3.4 Methods of studying biosynthesis : Strategy of Biosynthesis, Use of Biochemical Mutants, Use of Isotopic Labeling
- 3.5 Bacterial photosynthesis

REFERENCE BOOKS

1. The physiology and Biochemistry of prokaryotes, 2nd edition By. David White
2. Outlines of biochemistry by Conn E.E. and Stumpt P.K. 4th Ed.
3. General microbiology by Stanier R.Y.: 5th Ed.
4. General microbiology by Powar and Daginawala Vol-1

UNIT 4 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

SELECTED ASPECTS OF METABOLISM IN SPECIFIC MICROBIOAL SYSTEMS

- 4.1 Chemo - autotrophs : Nitrifying Bacteria, Sulfur Oxidizers, Iron bacteria, Hydrogen Bacteria
- 4.2 The lactic acid bacteria: Patterns of carbohydrate fermentation in lactic acid bacteria
- 4.3 The Enteric group and related Eubacteria : Fermentative patterns of Gram negative Eubacteria
- 4.4 Archaeobacteria: Energy metabolism and Carbon- Assimilation in Methanogens, photophosphorylation in *Halobacterium*

REFERENCE BOOKS

1. General Microbiology By Stanier R.Y.: 5th Ed.
2. The physiology and Biochemistry of prokaryotes, 2nd edition by David

UNIT 5 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

MEMBRANE BIOLOGY

- 5.1 Structure of membrane and membrane components: Membrane lipids, Membrane carbohydrates, Membrane proteins, Membrane transport of small molecules
- 5.2 Active transport and passive transport
- 5.3 Specific Transport Systems : Mechanosensitive channels, Chemiosmotic-driven transport, Establishing Ion gradients, Iron transport, The phosphotransferase system
- 5.4 Quorum sensing
- 5.5 Signal Transduction

REFERENCE BOOKS

1. General Microbiology By Stanier R.Y.: 5th Ed.
2. The physiology and Biochemistry of prokaryotes, 2nd edition by David

MB-502 : Prokaryotic Metabolism (PRACTICAL)

1. Determination of V_{max} and K_m for amylase enzyme by performing substrate curve with line weaver Burk plot.
2. Determination of V_{max} and K_m for phosphatase by performing substrate curve with line weaver Burk plot.
3. Effect of temperature on amylase activity
4. Effect of pH on amylase activity
5. Study of Diauxic growth curve in *E. coli*
6. Determination of amino acid decarboxylase activity
7. Preparation of winogradsky column (Demonstration)

REFERENCE BOOKS

- 1 International student edition: Microbiology- A laboratory Manual 4th edition. By James G. Chappuccino & Natalie Sherman
- 2 Bacteriological Techniques By F.J. Baker
- 3 Introduction to Microbial Techniques By Gunasekaran

MB-503: Molecular Biology and Bio-engineering (THEORY)

UNIT 1 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

THE HISTORY AND CONCEPT OF GENETICS

- 1.1 History of genetics and molecular biology
- 1.2 Mendelian Laws of inheritance

The Gene Concept

- 1.3 Units of genetic structure and genetic function
- 1.4 Gene Cistron relationship in Prokaryotes and Eukaryotes
- 1.5 Gene structure and architecture
- 1.6 DNA is the universal genetic material
- 1.7 DNA Replication – Mechanism and models

REFERENCE BOOKS

- 1 Advanced Molecular Biology, Twyman R. M.
- 2 Genes VII, Benjamin Lewin
- 3 Microbiology, Atlas R. M.

UNIT 2 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

GENE EXPRESSION AND REGULATION

- 2.1 Transcription and post transcriptional modifications
- 2.2 Genetic code and Ribosome
- 2.3 Translation and post translational modifications
- 2.4 Levels of gene expression and regulation
- 2.5 Types and principles of gene regulation
- 2.6 Transcriptional regulation
- 2.7 The Operon Model :Regulation of lactose utilization – The lac operon
- 2.8 The Operon Model :Regulation of arabinose utilization – The ara operon
- 2.9 The Operon Model :Regulation of tryptophan biosynthesis – The trp operon
- 2.10 Post transcription control

REFERENCE BOOKS

- 1 Essential of Molecular Biology – Malacinski G. M.
- 2 *Advanced Molecular Biology* – Twyman R. M.
- 3 Molecular Genetics of Bacteria – Synder L. & Champness

- 4 Microbial Genetics – R. Maloy
- 5 Microbiology – Prescott L. M.
- 6 Microbiology – Atlas R. M.

UNIT 3 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

GENE TRANSFER AND RECOMBINATION

- 3.1 Types of Recombination : Homologous recombination, Site specific recombination, Illegitimate recombination,
- 3.2 Transformation: Natural transformation, competence, DNA uptake, role of natural transformation, Artificial induced competence, electroporation
- 3.3 Transduction: Generalized transduction, Specialized transduction and Abortive transduction
- 3.4 Conjugation: Mechanism of DNA transfer in Gram positive and Gram negative bacteria
- 3.5 Transposable genetic elements

REFERENCE BOOKS

- 1 Essential of Molecular biology – Malacinski.G.M.
- 2 Advanced Molecular Biology – Twyman R.M.
- 3 Molecular genetics of bacteria – Synder L. & Champness
- 4 Microbial Genetics – R. Maloy
- 5 Microbiology – Prescott L.M.
- 6 Microbiology – Atlas R.M.

UNIT 4 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

MUTATION AND DNA REPAIR

- 4.1 Mutation and Mutation rate
- 4.2 Types of mutation :Spontaneous mutations and Induced mutations
- 4.3 Mutation at Chromosome, gene and DNA level
- 4.4 Phenotypic effects of mutation, Phenotypic and Phenomic lag
- 4.5 Biochemical basis of mutation
- 4.6 Physical, Chemical and Biological Mutagenesis
- 4.7 Reversion and Ames test
- 4.8 DNA repair mechanisms - Mismatch repair, Excision repair, Photo reactivation, Recombinational repair and SOS repair

REFERENCE BOOKS

- 1 Essential of Molecular biology – Malacinski.G.M.
- 2 Advanced Molecular Biology – Twyman R.M.
- 3 Molecular genetics of bacteria – Synder L. & Champness
- 4 Microbial Genetics – R. Maloy
- 5 Microbiology – Prescott L.M.
- 6 Principals of Genetics by Gardner M J
- 6 Microbiology – Atlas R.M.

UNIT 5 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

GENETIC ENGINEERING AND PROTEIN ENGINEERING

- 5.1 Genetic engineering: aims and applications
- 5.2 Genetic manipulations of prokaryotes:
 - a. Isolation of DNA
 - b. Vectors of Recombinant-DNA Technology – pBR322, pUC, Bacteriophages, Cosmid, Phagmid, BACs, YACs
 - c. Insertion of DNA molecules into a vector
 - d. Transformation and Growth
 - e. Detection of Recombinant molecules – Colony Hybridization
 - f. Expression of foreign DNA
- 5.3 Genetic manipulations of eukaryotes: Genetic manipulation of plant cells, animal cells and yeasts
- 5.4 Site directed mutagenesis
- 5.5 Molecular Chaperon

REFERENCE BOOKS

- 1 Biotechnology – Trevan M.D.
- 2 Advanced Molecular Biology – Twyman R.M.
- 3 Microbiology – Atlas R.M.
- 4 Microbiology – Prescott L.M.
- 5 Microbial Genetics – Freifilder. D
6. Principles of Gene Manipulation – Old and Primrose

MB-503: Molecular Biology and Bio-engineering (PRACTICAL)

1. Isolation of DNA (only demonstration experiment)
2. Estimation of DNA
3. Conjugation in *E. coli* by plate method
4. Isolation of plasmid (Only demonstration experiment)
5. Transformation of plasmid
6. Isolation of RNA (only demonstration experiment)
7. Estimation of RNA
8. Isolation of Lactose non fermenter mutant of *E. coli* by physical mutagenesis
9. Isolation of antibiotic resistant bacterial population by gradient-plate method.
10. Isolation of streptomycin resistant mutants by Replica plating technique.
11. The Ames test: For detecting potential carcinogen (only demonstration experiment)

REFERENCE BOOKS

- 1 Biotechnology – Trevan M.D.
- 2 Advanced Molecular Biology – Twyman R.M.
- 3 Microbiology – Atlas R.M.
- 4 Microbiology – Prescott L.M.
- 5 Microbial Genetics – Freifilder. D
- 6 Principles of Gene Manipulation – Old and Primrose

MB-601: Bioprocess Technology (THEORY)

UNIT 1 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

FERMENTATION TECHNOLOGY & INDUSTRIALLY IMPORTANT MICROORGANISMS

A. Historical perspective and concept

- 1.1 General Concept and historical development of industrial microbiology
- 1.2 Range of Fermentation Processes
- 1.3 Component parts fermentation process
- 1.4 Economic aspects of fermentation industry

B. Isolation & improvement of industrially important microorganisms

- 1.5 Primary & Secondary Screening
- 1.6 Isolation methods using selection of desired characters
- 1.7 Improvement of industrially important microbes: Application of protoplast fusion and recombinant DNA technology

REFERENCE BOOKS

- 1. Principles of Fermentation Technology by Stanbury & Whittaker: 2nd edition
- 2. Industrial Microbiology by Casida L.E.
- 3. A text book of Industrial Microbiology, 2nd edition by Wulf Crueger & Anneliese Crueger
- 4. Industrial Microbiology by A.H. Patel
- 5. Biotechnology: Food Fermentation Microbiology, Biochemistry & Technology vol. 1 & 2 by V.K. Joshi & Ashok Pandey

UNIT 2 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

FORMULATION OF FERMENTATION MEDIA

- 2.1 Introduction to Media and its Types
- 2.2 Media formulation
- 2.3 Raw materials: Crude Carbon and Nitrogen sources, Minerals, Precursors, Growth Regulators, Buffers, Antifoam agents
- 2.4 Inoculum and Production medium
- 2.5 Media Optimization

REFERENCE BOOKS

- 1. Principles of Fermentation Technology by Stanbury & Whittaker: 2nd edition

2. Industrial Microbiology by Casida L.E.
3. A text book of Industrial Microbiology, 2nd edition by Wulf Crueger & Anneliese Crueger
4. Industrial Microbiology by A.H. Patel
5. Introduction to Bioinformatics by Institute of Bioinformatics, India

UNIT 3 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

DESIGN AND ASEPTIC OPERATION

- 3.1 Introduction and basic functions of fermentor
- 3.2 Criteria for design of a fermentor
- 3.3 Types of bioreactors
- 3.4 Aeration and Agitation
- 3.5 Fermentation process: Batch Fermentation, Continuous fermentation and their comparative advantages and disadvantages
- 3.6 Sterilization process in fermentation industries:
 - a. Introduction of Del factor
 - b. Fermentor sterilization
 - c. Medium sterilization
 - d. Sterilization of air and feed
- 3.7 Aseptic operation, Containment and its categorization

REFERENCE BOOKS

1. Principles of Fermentation Technology by Stanbury & Whittaker: 2nd edition
2. A text book of Industrial Microbiology, 2nd edition by Wulf Crueger & Anneliese
3. Industrial Microbiology by A.H. Patel

UNIT 4 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

DOWNSTREAM PROCESSES

- 4.1 Methods of Cell separation: Broth conditioning, Precipitation, Sedimentation, Centrifugation, Filtration
- 4.2 Techniques of Cell Disruption: Mechanical and Non mechanical methods
- 4.3 Product Recovery: Liquid liquid extraction, Solvent recovery, Two Phase aqueous extraction, Super critical fluid extraction
- 4.4 Physical, Chemical and Biological assay of fermentation products

REFERENCE BOOKS

1. Principles of Fermentation Technology by Stanbury & Whittaker: 2nd edition
2. Industrial Microbiology by Casida L.E.
3. A text book of Industrial Microbiology, 2nd edition by Wulf Crueger & Anneliese Crueger
4. Industrial Microbiology by A.H. Patel

UNIT 5 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

STUDIES OF SELECTIVE FERMENTATION PROCESSES

- 5.1 Production of organic solvents: Ethyl alcohol
- 5.2 Production of enzymes: Amylases and Proteases
- 5.3 Production of antibiotics: Penicillin and Streptomycin
- 5.4 Production of amino acids: Lysine
- 5.5 Production of organic acids: Citric acid
- 5.6 Production of vitamins: Riboflavin
- 5.7 Overview of Immobilization in fermentation process

REFERENCE BOOKS

1. Industrial Microbiology by Casida L.E.
2. A text book of Industrial Microbiology, 2nd edition by Wulf Crueger & Anneliese Crueger
3. Industrial Microbiology By A.H. Patel
4. Biotechnology: Food Fermentation Microbiology, Biochemistry & Technology Vol. 1 & 2 By V.K. Joshi & Ashok Pandey
5. Biotechnology By M.D.Treva

MB-601: Bioprocess Technology (PRACTICAL)

- 1 Primary screening of industrially important microorganisms capable of producing: Antibiotics, Organic acids, amylases
- 2 Bioassay of penicillin using *Bacillus. spp.*
- 3 Laboratory fermentation & estimation of Ethyl Alcohol by *Saccharomyces*
- 4 Laboratory fermentation & estimation of amylase by *Bacillus spp.*
- 5 Sterility testing of fermentation products (Demo)
- 6 Immobilization of yeast cells by Ca- alginate entrapment method & Determination of viability of immobilized cells by invertase activity

REFERENCE BOOKS

- 1 International student edition: Microbiology- A laboratory Manual 4th edition. By James G. Chappuccino & Natalie Sherman
- 2 Bacteriological Techniques By F.J. Baker
- 3 Introduction to Microbial Techniques By Gunasekaran

MB-602: Analytical Techniques and Bioinformatics (THEORY)

UNIT 1 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

BASIC ANALYTICAL TECHNIQUES IN BIOSCIENCES

- 1.1 Concept Of Good Laboratory Practices and Quality Management
- 1.2 Colorimetry and Spectrophotometry
- 1.3 Introduction to Mass spectroscopy
- 1.4 Introduction to IR And NMR and Their Applications
- 1.5 Applications of Radioisotopes in Biosciences
- 1.6 Atomic Spectroscopy: Principles and Applications of Atomic Absorption/Emission Spectrometer

REFERENCE BOOKS

1. Microbiology-Fundamentals and Applications - Purohit, S.S., - 6 Edition, Agrobios Publications, Delhi
2. Principles and Techniques of biochemistry and molecular biology - Wilson and Walker – Cambridge University Press
3. Bioanalytical Techniques - Srivastava - Narsa Publication
4. Analytical biochemistry and separation techniques – 4th edition – P Palanivelu - 21st Century Publication
5. Biophysical techniques - A Upadhyay, K Upadhyay and N Nath – Himalaya Publishing House

UNIT 2 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

PRINCIPLES AND THEORIES OF CHROMATOGRAPHY

- 2.1 Chromatography: Theory and Principle
- 2.2 Paper and Thin Layer Chromatography
- 2.3 Affinity and Ion Exchange Chromatography
- 2.4 Partition and Size Exclusion Chromatography
- 2.5 Gas Chromatography, GC-MS, LC-MS
- 2.6 High Performance Liquid Chromatography (HPLC) and FPLC

REFERENCE BOOKS

1. Microbiology-Fundamentals and Applications - Purohit, S.S., - 6 Edition, Agrobios Publications, Delhi

2. Principles and Techniques of biochemistry and molecular biology - Wilson and Walker – Cambridge University Press
3. Bioanalytical Techniques - Srivastava - Narsa Publication
4. Analytical biochemistry and separation techniques – 4th edition – P Palanivelu - 21st Century Publication
5. Biophysical techniques - A Upadhyay, K Upadhyay and N Nath – Himalaya Publishing House

UNIT 3 (CREDIT-0.8, TEACHINGHOURS-12, MARKS-14)

MOLECULAR TECHNIQUES AND BIOSENSOR TECHNOLOGY

- 3.1 Basic principle of electrophoresis
 - a. Paper electrophoresis
 - b. Agarose gel electrophoresis
 - c. SDS-PAGE
 - d. Native gel electrophoresis
 - e. PFGE
 - f. 2D-PAGEs
 - g. Capillary electrophoresis
- 3.2 Introduction to Flow cytometry
- 3.3 Introduction to Autoradiography
- 3.4 Overview of Biosensor Technology

REFERENCE BOOKS

1. Microbiology-Fundamentals and Applications - Purohit, S.S., - 6 Edition, Agrobios Publications, Delhi
2. Principles and Techniques of biochemistry and molecular biology - Wilson and Walker – Cambridge University Press
3. Bioanalytical Techniques - Srivastava - Narsa Publication
4. Analytical biochemistry and separation techniques – 4th edition – P Palanivelu - 21st Century Publication
5. Biophysical techniques - A Upadhyay, K Upadhyay and N Nath – Himalaya Publishing House

UNIT 4 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

MODERN ANALYTICAL TECHNIQUES

- 4.1 DNA sequencing: Principles and Methods, Automated DNA sequence Analyzer
- 4.2 Blotting techniques and FISH
- 4.3 RFLP, RAPD, VNTR, STR and SNP analysis
- 4.4 Chemical synthesis of DNA
- 4.5 PCR Technology: Principle, Methods and Applications
- 4.6 Overview of Primer design for PCR

REFERENCE BOOKS

- 1. Microbiology-Fundamentals and Applications - Purohit, S.S., - 6 Edition, Agrobios Publications, Delhi
- 2. Principles and Techniques of biochemistry and molecular biology - Wilson and Walker – Cambridge University Press
- 3. Bioanalytical Techniques - Srivastava - Narsa Publication
- 4. Analytical biochemistry and separation techniques – 4th edition – P Palanivelu - 21st Century Publication
- 5. Biophysical techniques - A Upadhyay, K Upadhyay and N Nath – Himalaya Publishing House

UNIT 5 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

BIOINFORMATICS

- 5.1 Introduction and Importance of Bioinformatics
- 5.2 Database and DBMS: Primary and Secondary Biological Databases, Structure Databases, Miscellaneous Database
- 5.3 Information Retrieval from Biological Database: ENTREZ, SRS AND DBGET
- 5.4 Sequence Alignment: BLAST and FASTA
- 5.5 Construction of Phylogenetic tree using computer

REFERENCE BOOKS

- 1. Introduction to Bioinformatics Attwood & Parry. D.J.
- 2. Instant notes in Bioinformatics - Westhead, Parish and Twyman
- 3. Bioinformatics - Andreas. D., & Baxevanis

MB-602: Analytical Techniques and Bioinformatics (PRACTICAL)

1. Determination of absorbance maxima of KMnO_4
2. Separation of carbohydrates by ascending paper chromatography
3. Separation of amino acids by circular paper chromatography
4. Separation of amino acids by Thin layer chromatography
5. Separation of nucleic acid by agarose gel electrophoresis
6. Separation of proteins by SDS PAGE (Demonstration)
7. Retrieval of 16S r DNA sequence of bacterial species from NCBI
8. Demonstration of BLAST analysis

REFERENCE BOOKS

1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India
3. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
4. Konika Sharma, Manual of Microbiology – Tools and Techniques , Ane Books, Delhi

MB-603: Clinical Diagnostic Microbiology (THEORY)

UNIT 1 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

HEMATOLOGY

- 1.1. Hematopoiesis
- 1.2. Discovery of human blood group system, ABO and Rh system
- 1.3. Hemostasis
- 1.4. Introduction to blood banking
- 1.5. Cross matching
- 1.6. Principle, significance and procedure of blood transfusion
- 1.7. Separation and storage of blood components

REFERENCE BOOKS

1. Immunology – 5th edition – J.Kuby, R. A. Goldsby , .J.Kindt , B.A. Osborne – W.H. Freeman and Company , New York
2. Principles of Microbiology- 2nd edition – R.M.Atlas – Wm.C.Brown Publishers
3. Microbiology – 5th edition – Prescott , Harley , Klein – McGraw-Hill Publishers
4. Instant Notes in Microbiology – P.M. Lyolyard , A. Whelan, M.W. Fanger
5. Medical laboratory Technology A Procedure manual for Routine Diagnostic test Vol I – K L Mukherjee – Tata McGraw Hill Publishing company New Delhi

UNIT 2 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

SEROLOGY

- 2.1 In vitro antigen: antibody reaction
 - a. Precipitin test (in fluid and gel)
 - b. Agglutination test (Hemagglutination, Bacterial Agglutination, Passive Agglutination and agglutination inhibition)
 - c. Complement fixation test
- 2.2 Special Serological test
 - a. Fluorescent antibody technique
 - b. Nuefeld Quellung reaction
 - c. Detection of heterophile antibody
 - d. Virus neutralizing antibody
- 2.3 Evaluation of Virulence
 - a. Antifibrinolysin
 - b. Antistreptolysin

2.4 Overview of Intracutaneous diagnostic test

REFERENCE BOOKS

1. Microbiology – Pelczar – McGraw Hill
2. Immunology – 5th edition – J.Kuby, R. A. Goldsby , J.Kindt , B.A. Osborne – W.H. Freeman and Company , New York
3. Principles of Microbiology- 2nd edition – R.M.Atlas – Wm.C.Brown Publishers
4. Microbiology – 5th edition – Prescott , Harley , Klein – McGraw-Hill Publishers
5. Instant Notes in Microbiology – P.M. Lyolyard , A. Whelan, M.W. Fanger
6. Medical laboratory Technology A Procedure manual for Routine Diagnostic test Vol I – K L Mukherjee – Tata McGraw Hill Publishing company New Delhi

UNIT 3 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

CONVENTIONAL AND ADVANCED DIAGNOSTIC TECHNIQUES

- 3.1 Conventional techniques
 - a. Methods of specimen collection
 - b. Identification of microbes from specimen
 1. Microscopy
 2. Rapid methods of identification
 3. Molecular methods
- 3.2 Advanced techniques
 - a. Immunoelectrophoresis
 - b. Immunofluorescence
 - c. Radioimmunoassay
 - d. ELISA
 - e. Western Blot
 - f. Detection of pathogen by PCR
 - g. Immunohistochemistry
 - h. Immunotherapy

REFERENCE BOOKS

1. Microbiology – Pelczar – McGraw Hill
2. Immunology – 5th edition – J.Kuby, R. A. Goldsby , J.Kindt , B.A. Osborne – W.H. Freeman and Company , New York
3. Principles of Microbiology- 2nd edition – R.M.Atlas – Wm.C.Brown Publishers
4. Microbiology – 5th edition – Prescott , Harley , Klein – McGraw-Hill Publishers
5. Instant Notes in Microbiology – P.M. Lyolyard , A. Whelan, M.W. Fanger
6. Medical laboratory Technology A Procedure manual for Routine Diagnostic test Vol I – K L Mukherjee – Tata McGraw Hill Publishing company New Delhi

UNIT 4 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

EPIDEMIOLOGY AND MICROBIAL AGENTS OF DISEASE

4.1 Epidemiology of infectious disease: Markers, concepts and tools

4.2 Microbial agents of disease: Bacteria – Pathogenicity, diagnosis, treatment and prevention

- a. Gram negative Bacteria – *Treponema*, *Salmonella*, *Shigella*, *Neisseria*, *Vibrio*
- b. Gram positive Bacteria – *Clostridium*, *Mycobacterium*, *Streptococci*, *Corynebacterium*

4.3 Fungi - Pathogenicity, diagnosis, treatment and prevention

- a. Superficial mycoses – *Piedra* and *Malassezia furfur*
- b. Cutaneous mycoses – *Tinea pedis*
- c. Subcutaneous mycoses – *Sporocotrichum schenckii*
- d. Systemic mycoses - *Cryptococcus neoformans* and *Histoplasma capsulatum*
- e. Opportunistic fungi – *Candida albicans*, *Aspergillus fumigatus*, and *Cladosporium*

REFERENCE BOOKS

1. Microbiology – Pelczar – McGraw Hill
2. Immunology – 5th edition – J.Kuby, R. A. Goldsby, J. Kindt, B.A. Osborne – W.H. Freeman and Company, New York
3. Principles of Microbiology- 2nd edition – R.M. Atlas – Wm.C. Brown Publishers
4. Microbiology – 5th edition – Prescott, Harley, Klein – McGraw-Hill Publishers
5. Instant Notes in Microbiology – P.M. Lyolyard, A. Whelan, M.W. Fanger
6. Medical Bacteriology including Medical Mycology and AIDS – N C Dey, T K Dey and D Sinha – New Central Book Agency Calcutta
7. Textbook of Microbiology – A Panikar

UNIT 5 (CREDIT-0.8, TEACHING HOURS-12, MARKS-14)

MICROBIAL AGENTS OF DISEASE AND PROPHYLAXIS

5.1 Protozoa - Pathogenicity, diagnosis, treatment and prevention

- a. *Entamoeba histolytica*
- b. *Plasmodium spp.*
- c. *Giardia lamblia*
- d. *Leishmania donovani*
- e. *Trypanosoma spp.*

5.2 Viruses – - Pathogenicity, diagnosis, treatment and prevention

Mumps, Measles (*Morbillivirus*), Rubella, Polio virus, Rotavirus, Pox virus, Rabies virus, Herpes virus and Hepatitis virus, HIV, Influenza with brief description of swine flu, Ebola, Chikungunya, Japanese Encephalitis.

5.3 Vaccines: Conventional and Modern approaches

REFERENCE BOOKS

1. Microbiology – Pelczar – McGraw Hill
2. Immunology – 5th edition – J.Kuby, R. A. Goldsby , J.Kindt , B.A. Osborne – W.H. Freeman and Company , New York
3. Principles of Microbiology- 2nd edition – R.M.Atlas – Wm.C.Brown Publishers
4. Microbiology – 5th edition – Prescott , Harley , Klein – McGraw-Hill Publishers
5. Instant Notes in Microbiology – P.M. Lyolyard , A. Whelan, M.W. Fanger
6. Medical Bacteriology including Medical Mycology and AIDS – N C Dey, T K Dey and D Sinha – New Central Book Agency Calcutta
7. Textbook of Microbiology – A Panikar

MB-603: Clinical Diagnostic Microbiology (PRACTICAL)

1. Antibiotic susceptibility of the pathogens isolated from the clinical specimen
2. Study of Agglutination by
 - a Blood grouping
 - b Serodiagnosis of enteric fever by Widal test
 - c Serodiagnosis of syphilis by RPR Test
3. Haemoglobin estimation by Drabkin's method
4. Bleeding time by filter paper technique and clotting time by capillary method
5. Erythrocyte Sedimentation Rate (ESR-demonstration)
6. Blood sugar estimation by GOD / POD method
7. Determination of Serum bilirubin
8. Determination of Serum Cholesterol
9. Physical, chemical and microscopic analysis of urine
10. Screening of Thalassemia by NESTROFT
11. Total count of platelets

REFERENCE BOOKS

- 1 A Handbook of Practical and Clinical Immunology – G.P.Talwar and S. K. Gupta – CBS Publication
- 2 Medical Laboratory Technology – Vol – I , II , III – Mukherji K.L.
- 3 A Text Book in Medical Laboratory Technology – P.B.Godkar
- 4 Medical Bacteriology, Mycology and AIDS – N.C. Dey, T.K. Dey, D.Sinha