SAURASHTRA UNIVERSITY, RAJKOT
SYLLABUS FOR MICROBIOLOGY SEMESTER - V
(With effect from June 2021)
MB-501:IMMUNOLOGY
(THEORY)

Unit 1: IMMUNITY AND IMMUNE SYSTEM
(Credit-1.2, Teaching Hours-12, Marks-14)

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, NKcell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cells.
1.3 Structure, functions and properties of Immune Organs: – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT.
1.4 Properties of immune system: Discrimination, Specificity, Memory, Transferability & Diversity.
1.5 Introduction to Immune response.

REFERENCE BOOKS

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
2. Atlas, R. M. (1997). Principles of microbiology. 2nd edition.Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology.7th -12th edition. New York: McGraw-Hill Higher Education.
4. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition.Hoboken: Taylor and Francis.
5. S. C.Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

Unit 2: ANTIGEN AND ANTIBODY
(Credit-1.2, Teaching Hours-12, Marks-14)

A. Antigen

2.1 Definition & types of microbial antigens.
2.2 Factors influencing Immunogenicity& Adjuvant, Epitopes and Haptens.

B. Antibody

2.3 Basic structure of Antibody& Immunoglobulin classes and their Biological functions.
2.4 Antibody Diversity and Clonal Selection Theory.
2.5 Overview of Monoclonal Antibody and polyclonal antibody.

REFERENCE BOOKS

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.

2. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology.7th -12th edition. New York: McGraw-Hill Higher Education.
4. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
5. S. C. Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

Unit 3: IMMUNE RESPONSE

(Credit-1.2, Teaching Hours-12, Marks-14)

3.1 Structure and properties of class I and II MHC.

3.2 Antigen processing and presentation. (Endogenous and Exogenous pathways)

3.3 Generation of Humoral Immune Response (Plasma and Memory cells).

3.4 Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co-stimulatory signals)

3.5 Cytokines, Phagocytosis, Inflammation, Opsonisationand Complement system: overview.

REFERENCE BOOKS

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
2. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology.7th -12th edition. New York: McGraw-Hill Higher Education.
4. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
5. S. C. Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

Unit 4: DYSFUNCTIONAL IMMUNITY

(Credit-1.2, Teaching Hours-12, Marks-14)

4.1Immunodeficiency Diseases

4.2 Hypersensitivity

4.3 Autoimmune diseases

4.4Overview of Tumor immunity

4.5 Overview of Transplantation immunity

REFERENCE BOOKS

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
2. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's

microbiology.7th -12thedition. New York: McGraw-Hill Higher Education.
4. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
5. S. C. Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

Unit 5: NORMAL FLORA AND INFECTION

(Credit-1.2, Teaching Hours-12, Marks-14)

5.1 Normal flora of healthy human host: Introduction & types.

5.2 Host –microbe interactions: Process of Infection, Pathogenicity and Virulence.

5.3 Microbial adherence: Penetration of epithelial cell layers and events in infection following penetration.

5.4 Microbial virulence factors.

5.5 Vaccines: Conventional and Modern approaches.

REFERENCE BOOKS

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
2. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology.7th -12thedition. New York: McGraw-Hill Higher Education.
4. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
5. S. C. Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

SAURASHTRA UNIVERSITY, RAJKOT
SYLLABUS FOR MICROBIOLOGY SEMESTER - V
(With effect from June 2021)
MB-501:IMMUNOLOGY
(PRACTICAL)

1. Microscopic observation and Identification of blood cells
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. Talwar, G. P., & Gupta, S. K. (1992). A Handbook of Practical and Clinical Immunology. New Delhi: CBS Publishers & Distributors.
2. Medical Laboratory Technology – Vol – I, II, III – MukherjiK.L.2nd edition.Tata McGraw-Hill Education.
3. Godkar, P. B., &Godkar, P. D. (2005). Text Book of Medical Laboratory Technology: Basic Histopathologic Techniques and the Laboratory Requirements.Bhalani Publishing House.
4. Cappuccino, J. G., & Welsh, C. Microbiology: A laboratory manual.5th -12th edition.Benjamin Cummings Black & White & Pearson.
5. Experimental Microbiology (volume 1 &2) by Rakesh Patel. 3rd Edition. AdityaPublishers.
6. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand& Company Ltd., New Delhi

SAURASHTRA UNIVERSITY, RAJKOT
SYLLABUS FOR MICROBIOLOGY SEMESTER - V
(With effect from June 2021)
MB-502:BACTERIAL METABOLISM
(THEORY)

UNIT 1: INTRODUCTION TO METABOLISM, BIOENERGETICS AND ENZYME KINETICS
(Credit- 1.2, Teaching Hours-12, Marks-14)

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

REFERENCE BOOKS

1. The physiology and Biochemistry of Prokaryotes by David white. 2nd edition.OUP USA.
2. Outlines of biochemistry byConn E.E. and Stumpt P.K. 5th edition. John Wiley and Sons, New York.
3. General microbiology by Stanier R.Y. 5th edition.McMillan.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.

UNIT 2:HETEROTROPHIC MODE OF METABOLISM
(Credit-1.2, Teaching Hours-12, Marks-14)

2.1 Glycolysis and its regulation
2.2The Pentose phosphate pathway &The Entner - Doudroff pathway
2.3The Citric acid cycle and its regulation &The Glyoxylate cycle
2.4Protein Catabolism: General reactions of amino acids catabolism, Stickland Reaction, Lipid Catabolism: Oxidation of Fatty Acids, Beta- Oxidation of Fatty Acids

REFERENCE BOOKS

1. The physiology and Biochemistry of Prokaryotes by David white. 2nd edition. OUP USA.
2. Outlines of biochemistry byConn E.E. and Stumpt P.K. 5th edition. John Wiley and Sons, New York.
3. General microbiology by Stanier R.Y. 5th edition. McMillan.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.

UNIT 3: ENERGY GENERATION AND ANABOLISM
(Credit-1.2, Teaching Hours-12, Marks-14)

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 Peptidoglycan Biosynthesis
3.5 Bacterial photosynthesis

REFERENCE BOOKS

1. The physiology and Biochemistry of Prokaryotes by David white. 2nd edition. OUP USA.
2. Outlines of biochemistry byConn E.E. and Stumpt P.K. 5th edition. John Wiley and Sons, New York.
3. General microbiology by Stanier R.Y. 5th edition. McMillan.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
5. Biochemistry by Jeremy M. Berg, LubertStryer, John Tymoczko, Gregory Gatto. 5th - 9th Edition. W.H. Freeman and Company, New York.
6. Biochemistry by Donald Voet & Judith G. Voet. 4th edition. John Wiley & Sons.

UNIT 4: SELECTED ASPECTS OF METABOLISM IN SPECIFIC MICROBIOAL SYSTEMS
(Credit-1.2, Teaching Hours-12, Marks-14)

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

REFERENCE BOOKS

1. The physiology and Biochemistry of Prokaryotes by David white. 2nd edition. OUP USA
2. General microbiology by Stanier R.Y. 5th edition. McMillan.
3. Bacterial Physiology and Metabolism by B. H. Kim & G. M. Gadd. 1st edition .Cambridge University Press.
4. Brock Biology of Microorganisms by Michael T. Madigan, John M. Martinko.11th – 15th edition. Pearson.
5. Microbial physiology by A. G. Moat, J. W. Foster & M. P. Spector. 4th edition. John Wiley & Sons.

UNIT 5: MEMBRANE BIOLOGY

(Credit-1.2, Teaching Hours-12, Marks-14)

5.1 Structure of cell membrane: Fluid Mosaic Model

5.2 Passive transport: Simple & Facilitated Diffusion

5.3 Active transport

5.4 Specific Transport Systems: Mechanosensitive channels, Chemiosmotic-driven transport, Iron transport, thephosphotransferase system

5.5 Overview of Quorum sensing & Signal Transduction

REFERENCE BOOKS

1. The physiology and Biochemistry of Prokaryotes by David white. 2nd edition. OUP USA
2. Outlines of biochemistry byConn E.E. and Stumpt P.K. 5th edition. John Wiley and Sons, New York.
3. General microbiology by Stanier R.Y. 5th edition. McMillan.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
5. Bacterial Physiology and Metabolism by B. H. Kim & G. M. Gadd. 1st edition.Cambridge University Press.

SAURASHTRA UNIVERSITY, RAJKOT
SYLLABUS FOR MICROBIOLOGY SEMESTER - V
(With effect from June 2021)
MB-502:BACTERIAL METABOLISM
(PRACTICAL)

1. Study effect of temperature on amylase activity
2. Study effect on amylase activity
3. Study effect of enzyme concentration on amylase activity
4. Determination of Vmax and Km for amylase enzyme by performing substrate concentration curve with M-M and line weaver Burk plot
5. Isolation and characterization of lactic acid bacteria from suitable sources.
6. Study of Diauxic growth curve in *E. coli*
7. Preparation of Winogradsky column (Demonstration)

REFERENCE BOOKS

1 Experimental Microbiology (volume 1 &2) by Rakesh Patel. 3rd Edition. AdityaPublishers.

SAURASHTRA UNIVERSITY, RAJKOT
SYLLABUS FOR MICROBIOLOGY SEMESTER - V
(With effect from June 2021)
MB-503:MOLECULAR BIOLOGY AND GENETIC ENGINEERING (THEORY)

UNIT 1: FUNDAMENTALS OF GENETICS
(Credit-1.2, Teaching Hours-12, Marks-14)

1.1 History of genetics and central dogma of life
1.2 Mendelian Laws of inheritance
1.3 DNA is the universal genetic material & experimental evidences
1.4 Gene structure and architecture in Prokaryotes and Eukaryotes
1.5 Prokaryotic DNA Replication: experiment, machineries, Mechanism & models

REFERENCE BOOKS

1. Twyman R. M., Advanced Molecular Biology – 1st Edition. Taylor &Fransis Group. UK.
2. Krebs, J. E.,Goldstein, E. S. et al., Lewin's Genes XII (any recent Edition), Jones and Bartlett Publishers, Inc., USA.
3. Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
5. Synder L., Champness, et al. Molecular Genetics of Bacteria –4th Edition. ASM Press, USA.
6. Verma P.S.&Agarwal V.K., Cell Biology, Genetics, Molecular Biology, Evolution & Ecology - Reprint Edn. 2006 edition. S Chand publications

UNIT 2: GENE EXPRESSION AND REGULATION
(Credit-1.2, Teaching Hours-12, Marks-14)

2.1 ProkaryoticTranscription: machineries and mechanism
2.2 Post transcriptional modifications of RNA: overview of splicing, capping, polyadenylation& editing
2.3 Genetic code, prokaryotic Translation (machineries and mechanism) and post translational modifications
2.4 An overview of Levels and modes of regulation of gene expression.
2.5 The Operon Models: Regulation of lactose utilization – The lac operon &Regulation of tryptophan biosynthesis – The trp operon

REFERENCE BOOKS

1. Malacinski G. M. & David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston : Jones and Bartlett Publishers, c1998.
2. Twyman R. M., Advanced Molecular Biology – 1stEdition. Taylor &Fransis Group. UK.
3. Synder L., Champness, et al. Molecular Genetics of Bacteria –4th Edition. ASM Press, USA.
4. Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
5. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
6. Prescott, Healey and Klein.,Microbiology - 5th - 10thEdition, Tata-McGraw Hill publications, Delhi.
7. Verma P.S.&Agarwal V.K., Cell Biology, Genetics, Molecular Biology, Evolution & Ecology - Reprint Edn. 2006 edition. S Chand publications

UNIT 3: GENE TRANSFER AND RECOMBINATION

(Credit-1.2, Teaching Hours-12, Marks-14)

3.1 Types of Recombination: Homologous recombination, Site specific recombination, illegitimate recombination

3.2 Transformation: 1. Natural transformation - competence, DNA uptake, role of natural transformation, 2. 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 Malacinski G. M. & David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston : Jones and Bartlett Publishers, c1998.
2 Twyman R. M., Advanced Molecular Biology – 1stEdition. Taylor &Fransis Group. UK.
3 Synder L., Champness, et al. Molecular Genetics of Bacteria –4th Edition. ASM Press, USA.
4 Gardner, M. J. Simmons, D. P. Snustad, PRINCIPLES OF GENETICS- 8th Edition. John Wiley & Sons.
5 Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
6 Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
7 Prescott, Healey and Klein.,Microbiology - 5th - 10thEdition, Tata-McGraw Hill publications, Delhi.

UNIT 4: MUTATION AND DNA REPAIR

(Credit-1.2, Teaching Hours-12, Marks-14)

4.1 Types of mutation- Spontaneous mutations and Induced mutations

4.2 Biochemical basis of mutation and mutation Reversion

4.3 Physical, Chemical and Biological Mutagenesis; Ames test

4.4 Experimental evidence of mutation: fluctuation analysis, mutation rate, Phenotypic and Phenomiclag

4.5 DNA repair mechanisms - Mismatch repair, Excision repair, Photo reactivation,

Recombinationalrepair and SOS repair

REFERENCE BOOKS

1. Malacinski G. M. & David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston : Jones and Bartlett Publishers, c1998.
2. Twyman R. M., Advanced Molecular Biology – 1stEdition. Taylor &Fransis Group. UK.
3. Synder L., Champness, et al. Molecular Genetics of Bacteria –4th Edition. ASM Press, USA.
4. Gardner, M. J. Simmons, D. P. Snustad, PRINCIPLES OF GENETICS- 8th Edition. John Wiley & Sons publication.
5. Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
6. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
7. Prescott, Healey and Klein.,Microbiology - 5th - 10thEdition, Tata-McGraw Hill publications, Delhi.

UNIT 5: GENETIC ENGINEERING AND PROTEIN ENGINEERING

(Credit-1.2, Teaching Hours-12, Marks-14)

5.1 Genetic engineering: aims and applications

5.2 Genetic manipulations of prokaryotes:

a. Isolation of DNA

b. Vectors of rDNA Technology – plasmid (pBR322 &pUC), Bacteriophage (lambda phage & M13), Cosmid, Phagmid, BACs, YACs

c. Insertion of DNA molecules into a vector

d. Transformation methods and Growth

e. Detection of Recombinant- Colony Hybridization

5.3 Genetic manipulations of eukaryotes: Genetic manipulation of plant cells (*Agrobacterium* mediated) and animal cells

5.4 Site directed mutagenesis

5.5 Molecular Chaperon

REFERENCE BOOKS

1 Trevan, M.D., et al., Biotechnology -The BiologiclPrinciples . Tata Mcgraw Hill Publishing Co Ltd.

2 Twyman R. M., Advanced Molecular Biology – 1stEdition. Taylor &Fransis Group. UK.

3 John Cronan, et al., Microbial Genetics - 2nd Edition. Narosa publications.

4 Malacinski G. M. &David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston: Jones and Bartlett Publishers, c1998.

5 T. A. Brown, Gene Cloning and DNA Analysis: An Introduction -7th Edition. Wiley-Blackwell publications.

6 S. B. Primrose, R.Twyman&B. Old, Principles of Gene Manipulation .6th Edition.Wiley-Blackwell publications

SYLLABUS FOR MICROBIOLOGY SEMESTER - V
(With effect from June 2021)
MB-503:MOLECULAR BIOLOGY AND GENETIC ENGINEERING (PRACTICAL)

1. Isolation of genomic DNAfrom bacteria (only demonstration experiment)
2. Estimation of DNA by DPA method
3. Conjugation in *E. coli* by plate method
4. Isolation of plasmid (Only demonstration experiment)
5. Transformation of plasmid in bacteria
6. Isolation of RNA (only demonstration experiment)
7. Estimation of RNA by Orcinol method
8. Isolation of Lactose non fermenter mutant of *E. coli* by physical mutagenesis
9. Isolation of antibiotic resistant bacteriaby 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. Trevan, M.D., et al., Biotechnology -The Biological Principles . Tata Mcgraw Hill Publishing Co Ltd.
2. Twyman R. M., Advanced Molecular Biology – 1st Edition. Taylor &Fransis Group. UK.
3. Prescott, Healey and Klein., Microbiology-9 or 10th Edition, Tata-McGraw Hill publications, Delhi
4. Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
5. John Cronan, et al., Microbial Genetics - 2nd Edition. Narosa publications.
6. Malacinski G. M. &David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston: Jones and Bartlett Publishers, c1998.
7. T. A. Brown, Gene Cloning and DNA Analysis: An Introduction -7th Edition. Wiley-Blackwell publications.
8. Sandy B. Primrose, Richard Twyman&Bob Old, Principles of Gene Manipulation – 6th Edition.Wiley-Blackwell publications