

B. Sc. Biotechnology Course
Veer Narmad South Gujarat University, Surat

Semester	Semester III & IV (24+24 Credits)						Total Credits
	Theory			Laboratory Work			
	Course	Credit	hours	Course	Credit	Hours	
Foundation Compulsory	1	2	2	-	-	-	2
Generic Elective	1	2	2	-	-	-	2
Core 1	3	6	6	1	3	6	9
Core 2	3	6	6	1	3	6	9
Foundation Elective	1	2	2	-	-	-	2
Total	9	18	18	2	6	12	24+24

Semester-III

[Academic Year of Implementation: 2019-2020]

Core 1: Biotechnology

Course 1: BT 05: Instrumentation and Techniques

Course 2: BT 06: Mammalian Anatomy and Physiology

Course 3: BT 07: Plant Morphology and Physiology

Practical Core 1: BTP 03: Biotechnology Practical

Semester-IV

[Academic Year of Implementation: 2019-2020]

Core 1: Biotechnology

Course 1: BT 08: Fundamentals of Mycology

Course 2: BT 09: Fundamentals of Immunology

Course 3: BT 10: Introduction to Molecular Biology-I

Practical Core 1: BTP 04: Biotechnology Practical

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B. Sc. Biotechnology Semester-III

BT-05: INSTRUMENTATION & TECHNIQUES

UNIT-1: POTENTIOMETRY

- 1.1 pH Electrode: Reference electrode, Glass electrode, Combine electrode
- 1.2 Construction, operation and use of pH meter
- 1.3 Maintenance of electrodes
- 1.4 Ion selective meter and electrode for Ca^{+2} , F^- , Biomembrane electrode

UNIT-2: SEPARATION & MEASUREMENT TECHNIQUES

- 2.1 Classification of chromatography & general principles
- 2.2 Principles of Paper chromatography and Thin Layer Chromatography
- 2.3 Development methods
- 2.4 Detection, measurement and use of radioactivity in Biology:
 - 2.4.1 Geiger-Muller counter: working principle and application
 - 2.4.2 Scintillation counter: working principle and application
 - 2.4.3 Autoradiography: Techniques and applications

UNIT-3: CENTRIFUGATION

- 3.1 Basic principles of sedimentation, Types of centrifuges and rotors
- 3.2 Separation methods in preparative ultracentrifuges:
 - 3.2.1 Differential centrifugation
 - 3.2.2 Density gradient centrifugation
 - 3.2.3 Analysis of sub cellular fractions
- 3.3 Application of analytical ultracentrifuge:
 - 3.3.1 Determination of relative molecular mass
 - 3.3.2 Estimation of purity of macromolecules
 - 3.3.3 Conformational changes in macromolecules
- 3.4 Safety aspects in use of centrifuge

UNIT-4: SPECTROPHOTOMETRY

- 4.1 Molecular absorption spectroscopy and Laws of photometry
- 4.2 Colorimeter : Components of the instrument and applications
- 4.3 Spectrophotometer: Single beam and double beam instrument and applications
- 4.4 Quantitative analysis by spectrophotometer-manual and automated

REFERENCES:

1. Keith Wilson & John Walker (ED) (2000): Practical biochemistry-principle & Techniques. Cambridge university press.
2. Skoog, Holler and Nieman, Industrial analysis-Saunders college publication
3. Skoog, West and Holler, fundamentals of analytical chemistry- Saunders college publication
4. James S. Fritz & George H. Schenk, Jr. (1969): Quantitative analytical chemistry (2nd edition). Allyn & Bacon, Inc., Boston.
5. Brown S.B (1980): An Introduction to spectroscopy for biochemists. Academic press London.
6. E.D.P. De Robertis & E.M.F. De Robertis Jr. (2001): Cell and Molecular Biology (8th edn) Lippincott Williams & Wilkins, London
7. Roberts K. Haddad P. R. & Jackson P.E. (1994): Principles and Practice of modern chromatographic methods. Academic press London

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B. Sc. Biotechnology Semester-III

BT-06: MAMMALIAN ANATOMY AND PHYSIOLOGY

UNIT-1: MUSCLE PHYSIOLOGY & CARDIO-VASCULAR SYSTEM

- 1.1 Structure & Types of Muscles
- 1.2 Structure & Internal Anatomy of Heart
- 1.3 Organization & Microscopic anatomy of Skeletal Muscle Fiber
- 1.4 Sliding Filament Mechanism of Skeletal Muscle Fibers
- 1.5 Cardiac cycle & Cardiac Output

UNIT-2: NEUROPHYSIOLOGY

- 2.1 Structure & types of Neurons & Nerve Fibers
- 2.2 Neurotransmitters
- 2.3 Reflex Activities
- 2.4 Electrical Signals in Neurons
- 2.5 Synapse & Signal transmission at Synapse

UNIT-3: EMBRYOLOGY & REPRODUCTIVE SYSTEM

- 3.1 Structure of Testis & Ovary with role of their hormones
- 3.2 Spermatogenesis & Oogenesis
- 3.3 Fertilization
- 3.4 Characteristics, Planes, Physiology & Products (Morula, Blastula & Gastrula) Of Cleavage
- 3.5 Female Reproductive Cycle

UNIT-4: ENDOCRINOLOGY

- 4.1 Introduction to Endocrine Glands & Hormones
- 4.2 Pituitary Gland – Structure, Hormones & their functions
- 4.3 Thyroid & Parathyroid Glands - Structure, Hormones & their functions
- 4.4 Adrenal Gland – Structure, Hormones & their functions
- 4.5 Pancreas – Structure, Hormones & their functions

REFERENCES:

1. Anatomy & Physiology – G. J. Tortora & B. Derrickson, Wiley Pub.
2. Medical Physiology – Guyton & Hall, Saunders Elsevier Pub.
3. Essentials of Medical Physiology – K. Sembulingam & P. Sembulingam, Jaypee Brothers Medical Pub.
4. Chordate Embryology - P. S. Verma & V. K. Agarwal, S. Chand Pub.
5. Developmental Biology – S. F. Gilbert, Palgrave Macmillan Pub.

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B. Sc. Biotechnology Semester-III

BT-07: PLANT MORPHOLOGY AND PHYSIOLOGY

UNIT-1: PLANT MORPHOLOGY

- 1.1 Shoot system - Parts and functions
- 1.2 Root system- types, functions and modifications
- 1.3 Flower- Parts, functions, types of fertilizations, fruit formation.
- 1.4 Seed-Types, basic structure. Germination- types, factors necessary for germination.

UNIT-2: PLANT-WATER RELATIONS

- 2.1 Water relations- Diffusion, Osmosis, water potential and its components
- 2.2 Turgor pressure, Wall pressure and interrelationship.
- 2.3 Ascent of sap-Theories
- 2.4 Transpiration - types, Mechanism of opening and closing of stomata, factors influencing transpiration rate.

UNIT-3: METABOLIC PROCESSES

- 3.1 Structure of chloroplast; Action spectra, Photophosphorylation.
- 3.2 Pathways of carbon fixation- C₃, C₄, CAM pathway; Significance of Carbon fixation.
- 3.3 Photorespiration and its significance
- 3.4 Mineral salt absorption- Passive absorption and active absorption.

UNIT-4: GROWTH AND REGULATION

- 4.1 Mineral nutrition: Macro, and micronutrients, their role, deficiency symptoms.
- 4.2 Growth pattern and kinetics, Physiological role of Phytohormones- Auxins, Kinetin, Gibberellins, ABA and Ethylene: Their applications.
- 4.3 Concept of photomorphogenesis -Phytochrome system, Photoperiodism.
- 4.4 Vernalization, Florigen concept.

REFERENCES:

1. A. C. Dutta 6th Edition, Botany for Degree Students *Publisher: Oxford.*
2. Frank B. Salisbury and Cleon W. Ross (2010), Plant Physiology, Cengage learning products, India Edition.
3. S. K. Verma and Mohit Verma (1999) Plant Physiology Biochemistry and Biotechnology, S. Chand.
4. Lincoln Taiz and Eduardo Zaiger (4th Edition), Plant Physiology, Sinaur Associates Inc. Publishers.
5. S. N. Pandey and K. K. Singh, Plant physiology, Vikas Pub.

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B. Sc. Biotechnology Semester-III

BTP-03: Biotechnology Practical

1. Preparation of working solutions as well as different buffers and calibration of pH meter.
2. Study of Binocular Microscope and cell count by Haemocytometer.
3. To study the working of Centrifuge.
4. To study the working of Spectrophotometer.
5. Paper chromatography for separation of amino acids.
6. To study use & working of Electrocardiogram (ECG), Electroencephalogram (EEG), Sphygmomanometer, Electromyogram & Kymograph Apparatus.
7. To study Reaction Time & Reflex Action.
8. To study planes of cleavage, morula, blastula & gastrula with the help of permanent slides/charts/photographs.
9. Determination of osmotic potential of cell sap by plasmolytic method.
10. Comparatively anatomical studies of C₃ and C₄ plants.
11. Experiment to show that oxygen is evolved during photosynthesis.
12. To compare the loss of water from two surfaces of leaf by:
 - a) CoCl₂ method
 - b) Four leaf method

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B. Sc. Biotechnology Semester-IV

BT-08: FUNDAMENTALS OF MYCOLOGY

UNIT-1: INTRODUCTION

- 1.1 Place of fungi in 'tree of life'.
- 1.2 Characteristics of fungi.
- 1.3 Morphology of yeasts and filamentous fungi.
- 1.4 Classification of fungi.
- 1.5 Life cycle of the yeast *Saccharomyces* and filamentous Ascomycete.

UNIT-2: FUNGAL PHYSIOLOGY & DIFFERENTIATION

- 2.1 Physical & Chemical requirements for growth.
- 2.2 Fungal cultivation media.
- 2.3 Cellular reproduction.
- 2.4 Mould-yeast dimorphism.
- 2.5 Sclerotia & Nutrient –translocating organs.

UNIT-3: CONTROL OF FUNGAL GROWTH

- 3.1 Management of environmental and biological factors.
- 3.2 Biological and chemical control.
- 3.3 Cellular targets of antifungal agents.
- 3.4 Fungicides for plant disease control.
- 3.5 Control of fungal infections of humans.

UNIT-4: APPLIED MYCOLOGY

- 4.1 Fungal parasites and symbionts of plants.
- 4.2 Fungal pathogens of humans.
- 4.3 Fungal parasites as biological control.
- 4.4 Fungal saprotrophs.
- 4.5 Fungi in Biotechnology and Case study-Hepatitis B vaccine.

REFERENCES:

1. Deacon, J. (2007). *Fungal Biology*. 4th Ed., Blackwell Publishing.
2. Kavanagh, K. Ed. (2006). *Fungi: Biology and Applications*. Wiley.
3. Wiley, J., & Sherwood, L. (2011). *Prescott's Microbiology*, 8th Ed., McGraw-Hill Science/Engineering/Math.

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B. Sc. Biotechnology Semester-IV

BT-09: FUNDAMENTALS OF IMMUNOLOGY

UNIT 1: INTRODUCTION TO IMMUNE SYSTEM

- 1.1 Overview of host resistance
- 1.2 Cells of the immune system
- 1.3 Organs and Tissues of the immune system
- 1.4 Physical barriers in non-specific resistance

UNIT 2: NON-SPECIFIC HOST RESISTANCE

- 2.1 Phagocytosis
- 2.2 Inflammation
- 2.3 Chemical mediators in non-specific (Innate) resistance
 - 2.3.1 Antimicrobial peptides
 - 2.3.2 Complement
 - 2.3.3 Cytokines
 - 2.3.4 Acute-Phase proteins

UNIT 3: SPECIFIC HOST RESISTANCE-I

- 3.1 Overview of specific immunity
- 3.2 Antigens
- 3.3 Types of specific immunity
- 3.4 Recognition of Foreignness
- 3.5 T Cell Biology

UNIT 4: SPECIFIC HOST RESISTANCE-II

- 4.1 B cell Biology
- 4.2 Immunoglobulin Structure, Function and Classes
- 4.3 Generation of Antibody Diversity
- 4.4 Antibody kinetics
- 4.5 Action of Antibodies

REFERENCES:

1. Willey, J. M., Sherwood, L. M., & Woolverton, C. J., (2008). *Prescott, Harley & Klein's Microbiology, 7Ed*, The McGraw-Hill Companies, Inc.

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B. Sc. Biotechnology Semester-IV

BT-10: INTRODUCTION TO MOLECULAR BIOLOGY

UNIT-1: DNA REPLICATION

- 1.1 General features of DNA replication
- 1.2 Replication in prokaryotes
- 1.3 Replication in eukaryotes
- 1.4 Termination of replication
- 1.5 Regulation of replication

UNIT-2: DNA MUTATIONS AND REPAIR

- 2.1 Chemical basis of mutations
- 2.2 Spontaneous and Induced mutations
- 2.3 Effect of mutations
- 2.4 Detection and Isolation of mutants
- 2.5 DNA repair

UNIT-3: MOLECULAR RECOMBINATION AND GENE TRANSFER-I

- 3.1 Introduction to recombination and recombination in eukaryotes
- 3.2 Horizontal gene transfer in prokaryotes
- 3.3 Recombination at molecular level
- 3.4 Transposable elements
- 3.5 Bacterial plasmids

UNIT-4: MOLECULAR RECOMBINATION AND GENE TRANSFER-II

- 4.1 Bacterial Conjugation
- 4.2 Bacterial Transformation
- 4.3 Transduction
- 4.4 Development of antibiotic resistance in bacteria
- 4.5 Mapping the genome

REFERENCES:

1. Willey, J. M., Sherwood, L. M. and Woolverton, C. J. (2008). Prescott, Harley and Klein's Microbiology, 7th Edition, McGraw Hill International Edition.
2. Pal, J. K. and Ghaskadbi, S. S. (2009). Fundamentals of Molecular Biology, Oxford University Press.

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
B. Sc. Biotechnology Semester-IV

BTP-04: Biotechnology Practical

1. Cultivation and identification of moulds on different mycological media.
2. Isolation and cultivation of yeast.
3. Study of different spores produced by *Puccinia graminis* using permanent slides.
4. Isolation of plant pathogenic fungi from the Red Rot of Sugarcane.
5. Differential Count of blood leucocytes.
6. Diagnosis of Syphilis by Rapid Plasma Reagin (RPR) Test.
7. Study of Haemagglutination in blood grouping.
8. Extraction of bacterial plasmid by alkaline lysis method.
9. Isolation of Prokaryotic DNA.
10. Estimation of DNA by DPA method.
11. Estimation of RNA by Orcinol method.
12. Study of pigmentation mutation in *Serratia marcescens*.

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