(Bachelor of Science)
(B.Sc) (Biotechnology) Semester V

Course Code	US05MABTE01	Title of the Course	Enzymology & Metabolism
Total Credits Of the Course	04	Hours per Week	04

Course Objectives:	1. To understand mechanism of enzyme catalysis, enzyme kinetics 2. To understand enzyme immobilization and industrial application of enzymes. 3. To understand the concept of the metabolic reaction of cells that is essential for the sustenance of life. 4. To make them able to understand to ATP synthesis, electron transport chain and photosynthesis. 5. To understand the pathways for degradation and biosynthesis of carbohydrate, lipid & nucleic acids.

Course Content

Unit	Description	Weightage* (%)
1.	Enzymology—General characteristics, classification of enzymes Structure of active site of enzymes, specificity of enzyme action-Types and factors affecting enzyme activity. Brief introduction of allosteric enzymes. Enzyme kinetics—Derivation of Michaelis and Menten equation and its modifications (Line-weaver Burk plots).	25%
2.	Mechanism of action of enzymes, Catalytic mechanism (Proximity and orientation, strain and distortion, acid-base and covalent catalysis) (chymotrypsin, lysozyme). Enzyme inhibition: Mechanism and types (Reversible & Irreversible) Immobilization: Definition, techniques and applications. Industrial application of amylase, protease & lipase.	25%
3.	Metabolism- Introduction, Definition of Anabolism & Catabolism. Glycolysis, Pentose phosphate pathway, Gluconeogenesis, Glycogenolysis and glycogen synthesis. TCA cycle. Electron Transport Chain, Oxidative phosphorylation, Chemiosmotic theory, ATP synthase	25%
4.	FAS complex enzyme. Synthesis of saturated fatty acids, β oxidation of saturated fatty acid, Ketone-body metabolism. Nucleotide biosynthesis. Denovo and salvage pathway, Photosynthesis, Urea cycle. Inborn errors of metabolisim.	25%

Teaching-Learning Methodology	Classroom interaction,Use of blackboard and chalk ICT tools involving smartboards, powerpoint presentation,videos, animations & models. Assignments Seminar, unit test,andquiz

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written/Practical Examination(As per CBCS R.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Explain enzyme characteristics, enzyme specificity and enzyme kinetics
2.	Understand the different techniques of enzyme immobilization and industrial applications of enzymes
3.	Students will get an understanding of how living organisms get energy at molecular level through metabolic activities.
4.	Make them able to understand to ATP synthesis, electron transport chain and photosynthesis.
5.	Understand the pathways for degradation and biosynthesis of carbohydrate, lipid & nucleic acids

SuggestedReferences:	
Sr.No.	References
1.	Biochemistry–Zubay
2.	Enzymology- Palmer;
3	Fundamentals of Enzymology–Nicolas Price &Lewis Stevens
4	Biochemistry–Stryer
5	Textbook of biochemistry-Vasudevan &Shreekumari
6	Principle of Biochemistry–Lehninger
7	Fundamentals of Biochemistry- Voet & Voet
8	Biochemistry- U Satyanarayan

On-line resources to be used if available as reference material
On-line Resources
Nptel.ac.in
SANDHAN BISAG

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(Bachelor of Science)
(B.Sc) (Biotechnology) Semester V

Course Code	US05MABTE02	Title of the Course	Fundamentals of Immunology
Total Credits Of the Course	4	Hours/ Week	4

Course Objectives:	1. To study basic concepts of Infection, Immunology& epidemiology 2. To study the concepts of antigen, antibody,complement and antibody reaction. 3. To study various cells, organs, and receptors of immune system and their effect. 4. To have an idea about various immune disorders and immune-prophylaxis.

Course Content

Unit	Description	Weightage* (%)
1.	Concept of Infection (source, method of transmission, types of infection, factors predisposing infection). Immunity: Innate immunity- Innate Immunity- mechanism of Innate immunity (anatomical barrier, phagocytosis, cellular innate response and Inflammation) Acquired Immunity (Active and Passive) Primary and secondary immune response, Introduction to Primary lymphoid organs and secondary lymphoid (spleen and lymph nodes) organs. Epidemiology: Concept, Epidemiology markers, carrier, Epidemic disease (Plague and Influenza), Herd immunity.	25
2.	Antigen and Immunogen, Hapten Epitope, adjuvant, Properties of Antigen. Antibodies - structure of IgG, classes of Ig (physiochemical and biological properties and function). Complement – function and Complement pathways. Properties and Mechanism of Ag-Ab reaction (Zone phenomenon, Lattice formation,), Principle application of Ag-Ab reaction (agglutination reaction, Precipitation reaction immune- diffusion, Immunoelectrophoresis, immuno-fluroscence, ELISA, CFT, RIA).	25
3.	Introduction to Hematopoesis and Immune cell (B cell, T cell, APC), Concepts of Humoral and cell mediated immune response. MHC molecules- structure and function. Receptor and signaling- introduction to B-cell and T cell receptor cytokines (general properties and attributes), overview of chemokine. Effectors response- Cell and antibody mediated. NK cell mechanism. Immunodeficiency disorder (Primary(SCID) and secondary (HIV))	25

4.	Immune Disorder: Hypersensitivity (gel and Coomb's classification), introduction to tolerance system, Mechanism and disorder of Autoimmunity (Hashimotos thyroiditis, antibody stimulating and blocking-gravis and Myasthenia gravis, Systemic reaction (SLE, Rheumatoid arthritis),Introduction to transplantation immunology (types of graft, mechanism andtypesofrejection. infectious disease(influenza and TB) vaccine: Introduction and types of vaccine.	25

Teaching-Learning Methodology	Chalk board, PowerPoint presentation, quizzes, Video available on NPTEL and BISAG

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written/Practical Examination (As per CBCSR.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical ,Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Examination	50%

CourseOutcomes:Havingcompleted thiscourse,thelearnerwill beable to	
1.	Understand infection, types ofimmunityandepidemiology
2.	UnderstandAntigen, Antibody, Complement and Ag-Abreaction
3.	Understand hematopoiesis MHC and immune effectors response and immunodeficiency diseases.
4.	Understand Immune disorderandImmuno-prophylaxis.

SuggestedReferences:	
Sr. No.	References
1.	Immunology,Kuby
2.	Textbook of Microbiology ,Ananthanarayan and Panikar
3.	Immunology: Roitt's
4.	Basic Immunology ,Abul K Abbas, Andrew h Lichtman, shiv pillai
5.	Immunology: a textbook, Rao. C. vaman

On-line Resources
Nptel.ac.in
SANDHAN,BISAG

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SARDARPATELUNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC)
Syllabus with effect from the Academic Year 2025-2026

(Bachelor of Science)
(B.Sc) (Biotechnology) Semester V

Course Code	US05MABTE03	Title of the Course	Biotechnology Practical
Total Credits Of the Course	4	Hours/ Week	8

Course Objectives:	5. The student will have a practical approach on enzyme activity and various factors affecting enzyme activity 6. The student will study various clinical analysis of in born error of metabolism 7. The student will study various clinical diagnosis blood and urine test.

Course Content		
	Section-I	Weightage* (%)
	1. To study effect of substrate concentration 2. To stud effect of pH /temperature and time on enzyme activity. 3. Immobilization by Calcium alginate and check its activity. 4. To estimate reducing sugar by Nelson –Somogyi method 5. Qualitative analysis of Protein. 6. SGPT/SGOT 7. Estimation of creatinine by Jaff's method. 8. TLC 9. Extraction of amylase from the germinating seeds. 10. Study of competitive and non competitive inhibition of amylase enzyme.	50
.	**Section –II**	
	1. Total count of WBC/RBC 2. DC of WBC 3. RID 4. QPA 5. Medical microbiological case study of (any organism) 6. Estimation of blood sugar by GOD-POD method 7. Estimation of blood urea by DAMs method 8. Urine analysis 9. Estimation of Bilirubin test 10. Widal test. 11. Dot Elisa 12. Repot/presentation analysis of Disease.	50

Teaching-Learning Methodology	Chalkboard, PowerPoint presentation, quizzes, Video available on NPTEL and BISAG

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written/Practical Examination (As per CBCS R.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical,Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	To understand enzyme activity and various factors affecting enzyme activity
2.	To understand estimate and understand various inborn errors of metabolism.
3.	To understand clinical diagnosis of disease.
4.	To understand various antigen-antibody interaction.

Suggested References:	
Sr. No.	References
1.	Experimental Microbiology- Rakesh J patel
2.	Histology techniques by KLaxminarayan
3.	On-line resources

On-lineResources
Nptel.ac.in
SANDHAN, BISAG

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SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar, Gujarat (Reaccredited with 'A' Grade by NAAC)

Syllabus with effect from the Academic Year 2025-26

(Bachelor of Science)

(B.Sc) (Biotechnology) Semester V

Course Code	US05MIBTE01	Title of the Course	Clinical Diagnosis
Total Credits of the Course	02	Hours per Week	02

Course Objectives	1. To understand the blood components and its separation and storage in blood banks. 2. To understand various diseases and its diagnosis.

Course Content		
Unit 1	Introduction and scope of Clinical diagnosis, Introduction to haematology, Blood (Normal constituents of blood, functions, HB structure), blood bank (Collection, storage, plasma, anticoagulation factors), body fluids (CSF), preparation of serum and overview of serodiagnosis.	Weightage*(%) 50%
Unit 2	Clinical biochemistry: Blood sugar regulation (Hormonal) and abnormalities, HB abnormalities (Sickle cell anaemia/Thalassemia), Inborn error of metabolism (bilirubin), Lipoprotein metabolism disorder (Cholesterol), Urine formation and examination (Physical, chemical, microscopic)	50%

Teaching-Assignments, Learning	Lecture, Recitation, Group discussion, Guest speaker, Debate, Seminar, Quizzes.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written/Practical Examination (As per CBCS R.6.8.3)	25%
2.	CEE: Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance, etc	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	The students will be able to understand blood as a diagnosis tool and components.
2.	Students will be able to understand the various disorder pertaining to human body.

Suggested References:	
Sr No	References 1. Histology techniques by K Laxminarayan 2. Introduction to genetic analysis by Griffith 3. Human genetics by Vogel
On-line resources to be used if available as reference material	
On-line Resources	
Relevant entries on Nptel.ac.in, Sandhan, Bisag, Encyclopaedia Britannica	

(Bachelor of Science)
(B.Sc) (Biotechnology) Semester V

Course Code	US05MIBTE02	Title of the Course	Practicals
Total Credits of the Course	02	Hours per Week	04

Course Objectives	1. To understand the various aseptic and safety practices used in a medical laboratory. 2. To introduce blood and urine to understand various disorders.

Course Content
1. Aseptic practice in laboratory and safety precautions 2. Preparation of serum 3. Estimation of haemoglobin by Sahli's method 4. Total count of blood cells (WBC/RBC) 5. Differential count of WBC 6. Urine analysis- (Physical/chemical /microscopic) 7. Estimation of Bilirubin. 8. Estimation of blood sugar: GOD-POD method

Teaching-Assignments, Learning	Lecture, Recitation, Group discussion, Guest speaker, Debate, Seminar, Quizzes.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	CEE: Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance, etc	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	The students will be able to use various laboratory tools with clean and safely approach.
2.	The students will be able to perform various blood and urine analysis.

Suggested References:	
Sr No	References 4. Experimental microbiology by Rakesh J. Patel 5. Histology techniques by K Laxminarayan
On-line resources to be used if available as reference material	
On-line Resources	
Relevant entries on Wikipedia and Encyclopaedia Britannica	

(BachelorofScience)
(B.Sc)(Biotechnology)SemesterV

Course Code	US05MIBTE03	Title of the Course	Food and Dairy Biotechnology
Total Credits Of the Course	2	Hours per Week	2

Course Objectives:	1. To understand the role of biotechnology in food and dairy industry . 2. To aquaint students to the various fermented products. 3. To understand microbiology of food and milk 4. To familiarize students to microbiological examination of food and milk.

Course Content

Unit	Description	Weightage* (%)
1.	Scope of food and dairy biotechnology, Potential areas in food processing for Biotechnological applications, Impact of Biotechnology in Food Industry, Target Areas for Biotechnological Applications in Dairying. Microbial flora of fresh foods, Spoilage of food, Preservation of foods, Food borne diseases, Fermented food -Tempeh,Yogurt, Kafir,SCP(Mushroom)	50%
2.	Sources of microorganisms in milk, types of microorganism in milk, Pasteurization of milk,Biotechnology based strategies for altering the Properties of Milk, Important Enzymes Used in Dairy Industry, Manufactured dairy products (Cheese), Biotechnological approaches for Accelerating Cheese Ripening Methods for the microbiological examination of foods and milk.	50%

Teaching-Learning Methodology	Classroom interaction,Use of blackboard andchalk ICT tools involving smartboards, powerpoint presentation, videos, animations & models. Assignments Seminar,unit test,and quiz

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	50%
2.	Internal Continuous Assessment in the form of Practical,Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	
3.	University Examination	50%

CourseOutcomes:Having completed this course, the learner will be able to	
1.	Gain an in-depth understanding of microbiology of food and milk
2.	Explain the role of biotechnology in food and dairy industry
3.	Explain the fermented foods and milk products.
4.	Understand the microbiological examination of food& Dairy

Suggested References:	
Sr. No.	References
1	Industrial Microbiology-Prescott & Dunn,CBS Publishers
2	Dairy biotechnology;SunitaGrover,V.KBatish,VPadmanabha Reddy
3	Food Microbiology-WilliamCFrazer.
4	General Microbiology-Powar & Daginawala, HimalayaPublishers
5	Microbiology– Michael J Pelczar

On-line resources to be used if available as reference material

On-lineResources
https://agrimoon.com/wp-content/uploads/Dairy-Biotechnology.pdf

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(Bachelor of Science)
(B.Sc)(Biotechnology)SemesterV

Course Code	US05MIBTE04	Title of the Course	Food and Dairy Biotechnology Practical
Total Credits Of the Course	2	Hours per Week	4

Course Objectives:	1. To acquaint students with qualitative test of food and milk. 2. To familiarize students to test microbiological examination of food and milk.

Course Content		
1.	Qualitative & Quantitative analysis of the given food sample.	
2.	MBRT Test	
3.	To find out the moisture content from a given food sample by lab oven method.	
4.	Detection of adulterants in different food product. (Powdered sugar, honey, milk & paneer)	
5	To demonstrate the use of microorganisms in food processing by using yogurt as an example	
6	To detect the fat in the given milk sample.	
7	To isolate spoilage microorganism from the given food sample.	
8	To isolate food born bacteria from the given food sample.	

Teaching-Learning Methodology	Classroom interaction, Use of blackboard and chalk ICT tools involving smart boards, PowerPoint presentation, videos, animations & models.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written/Practical Examination (As per CBCS R.6.8.3)	50%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Check the quality of food and milk.
2.	Perform microbiological examination of food & Dairy

Suggested References:

Sr. No.	References
1	Industrial Microbiology-Prescott & Dunn, CBS Publishers
2	Dairy biotechnology; Sunita Grover, V. K. Batish, V Padmanabha Reddy
3	Food Microbiology-William C Frazer.
4	General Microbiology, Powar & Daginawala, Himalaya Publishers
5	Microbiology– Michael J Pelczar

On-line resources to be used if available as reference material

On-lineResources
https://agrimoon.com/wp-content/uploads/Dairy-Biotechnology.pdf

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B.Sc.-Biotechnology---Semester-V

Course Code	US05SEBTE01	Title of the Course	Molecular Techniques
Total Credits Of the Course	2	Hours per Week	2

Course Objectives:	To understand about different techniques used in Molecular Biology.

Course Content		
Unit	Description	Weightage* (%)
1.	Agarose gel electrophoresis and SDS PAGE- Principle, methodology & applications). PCR- Introduction, Principle, basic methodology and applications, Molecular Markers (RFLP,RAPD & AFLP)	50%
2.	DNA sequencing—Sanger's method, Maxam Gilbert's method, DNA foot printing., Blotting techniques (Southern, Northern & Western) DNA fingerprinting	50%

Teaching-Learning Methodology	Class room lectures and uses of chalk and blackboard. ICT tools involving smartboards, powerpoint presentations, videos, animations, and models.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage* (%)

1.	Internal Written/Practical Examination (As per CBCS R.6.8.3)	50%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Through this paper the understanding of various techniques using biomolecules for various purposes will be made clear to students.

Suggested References:	
Sr. No.	References
1.	Biotechnology-Expanding Horizons byB.D.Singh
2.	Biophysical Chemistry-principles and techniques;Upadhyay andUpadhyay,Nath
3.	Genetic engineering-Old & Primrose
4.	Genes and cloning –T A Brown
5.	A text book of biotechnology-R C Dubey

On-line resources to be used if available as reference material
On-line Resources
Nptel.ac.in
SANDHAN, BISAG, youtube

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