HSNC Board's
Smt. Chandibai Himathmal Mansukhani College
(Autonomous)
(Affiliated to the University of Mumbai)
University College Code : 217-JD Office : T14
HYDERABAD (SIND) NATIONAL COLLEGIATE BOARD
Estd. 1965

Principal : Dr. Manju Lalwani Pathak

Ref No: CHM (A) AC/C/01/2025
Date: 18th June 2025

CIRCULAR

The immediate attention of all concerned is invited to this office Circular No. CHM (A) AC 05/2025 dated 19th May, 2025 regarding the Choice Based and Credit Based Syllabus (CBCS) for all subjects of F.Y.B.Sc. & T.Y.B.Sc. in Microbiology SEM - I & SEM – V respectively.

It is hereby communicated that the recommendations of the syllabus made by the Ad-hoc Board of Studies in Microbiology coordinated by the Dean, Faculty of Pure Sciences in the meeting of Academic Council held on 23rd May, 2025 vide item No. 5.6, have been accepted and subsequently passed.

In accordance, therewith, the syllabus as per the CBCS has been brought into force with effect from the academic year 2025 – 2026 and accordingly the same is attached for reference and is available on the College's website www.chmcollege.in

Ulhasnagar - 421 003
18th June, 2025

Dr. Manju Lalwani Pathak
Principal & Chairperson, Academic Council

Copy forwarded for information to:-

1) The Dean, Faculty of Humanities.
2) The Chairperson, Ad-hoc Board of Studies.
3) The Controller of Examination.
4) The Registrar

HSNC Board's

Smt. Chandibai Himathmal Mansukhani College, Ulhasnagar

(Autonomous)

Affiliated to the University of Mumbai

Bachelor of Science
(Microbiology)
(Aided Course)

Semester– V

Choice Based and Credit Based syllabus
with effect from the
Academic Year 2025-2026

PREAMBLE

The syllabus is as per the Credit Based Semester and Grading System (CBSGS) and continuous evaluation consisting of components of Internal Assessment and External Assessment. The study of the microscopic world is known as microbiology. It is an essential component of our daily existence. The study of microorganisms with a focus on their morphology, biochemistry, and industrial uses in various domains is the focus of this scientific field. The goal of the B.Sc. (Microbiology) program is to give students a hands-on understanding of the concepts, abilities, and scope of the field in both industry and research as well as in daily life. The program's primary goals are to foster a scientific temper, enhance students' creativity, logical reasoning, and analytical thinking abilities, and foster a deeper interest in the subject so they can advance to higher education. Additionally, to develop the skill sets necessary to become autonomous researchers and industry-ready. Students who successfully complete this program will be able to apply their knowledge to interdisciplinary sciences in higher education and work well in both research labs and industry. Students can raise awareness of the value of microbiology to society both locally and globally.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Master fundamental principles and practical applications across key microbiological disciplines including Microbial Genetics, Medical Microbiology, Immunology, and Microbial Biochemistry.

PSO2: Develop comprehensive understanding of applied microbiological fields such as Bioprocess technology and tissue culture techniques, while analyzing the critical functions of microorganisms in industrial fermentation processes.

PSO3: Acquire specialized knowledge and technical proficiency in safe handling, cultivation, and characterization of both pathogenic and non-pathogenic microorganisms under controlled laboratory conditions.

PSO4: Explore and comprehend complementary fields including Bioinformatics, Intellectual Property Rights (IPR), and recombinant DNA technology applications.

PSO5: Develop analytical and research capabilities to design and conduct, microbiological experiments while interpreting results for real-world problem-solving in healthcare, industry, and environmental applications.

Smt. Chandibai Himathmal Mansukhani College
(Autonomous)

Third Year B.Sc.
(Microbiology)

Semester- V

Title: Microbial Genetics
Paper I

With effect from
Academic Year 2025-2026

Title: Microbial Genetics

Course Code: CHM(A)USMB501

Sr. No.	Heading	Particulars
1	**Description of the Course**	This course covers DNA replication mechanisms, including key enzymes and processes in both prokaryotes and eukaryotes. It explores transcription, the genetic code, and translation, emphasizing RNA synthesis, protein formation, and ribosomal function. Mutation types, causes, and DNA repair mechanisms are discussed, alongside the use of mutagens and the Ames test. Additionally, bacterial genetic exchange methods—transformation, conjugation, and transduction—are covered, highlighting gene transfer processes and their historical significance.
2	**Vertical**	--
3	**Type** **Teaching Method**	Theory Lectures/ Discussion / Presentation/ Case Studies/Industrial visit Flipped classroom etc.
4	**Credit**	2.5 Credits
5	**Hours allotted**	48 Hours
6	**Marks allotted**	100 Marks
7	**Course Objectives**: 1. The course comprehensively discusses key aspects like microbial replication, transcription and translation with special attention to different enzymes and proteins required during these processes. 2. The course is also formulated to develop understanding among learners regarding mutations, repair and genetic exchange. For each of these mechanisms detailed pathway, and role of enzymes and proteins are discussed elaborately. 3. The course is outlined with the intention to enable the understanding of gene variation, horizontal gene transfer and their role in microbial evolution. 4. The course intends to develop critical thinking among learners pertaining to investigating, analysing, and interpreting microbial experimental data. 5. Lastly the course will enable learners to apply the knowledge procured during the course towards fields like biotechnology, genetic engineering, recombinant DNA technology, drug discovery and environmental sciences.	
8	**Learning Outcomes**: Upon completion of the course, student will be able to: **LO1** understand the process of DNA replication in prokaryotes and eukaryotes. **LO2** understand the concepts of transcription, genetic code and translation. **LO3** describe types of mutation and DNA repair. **LO4** understand the various mechanisms of bacterial gene transfer like transformation, conjugation and transduction **LO5** apply basic bacterial genetics knowledge in solving problems related to genetics.	

9	**Syllabus**

UNIT I: DNA Replication

- Historical perspective - Historical perspective - Conservative, dispersive, semi-conservative, bidirectional and semi-discontinuous, Rolling circle mode of DNA replication.
- Enzymes and proteins associated with DNA replication- Primase, Helicase, Topoisomerase, SSB, DNA polymerases, Ligases, Ter and Tus proteins.
- Prokaryotic DNA replication - Details of molecular mechanisms involved in Initiation, Elongation and Termination.
- Eukaryotic DNA replication - Molecular details of DNA synthesis, replicating the ends of the chromosomes.

UNIT II: Transcription, Genetic Code and Translation

- Introduction to Central Dogma
- Transcription: The transcription Unit, Substrates for Transcription, Types of RNA, Role of RNA Polymerases, Structure of RNA polymerase, Initiation of transcription at promoters, elongation of an RNA chain, termination of an RNA chain using Rho dependent and independent mechanism. Accuracy of Transcription.
- Genetic code - Nature of genetic code and characteristics of genetic code. Discovery of Genetic Code
- Translation process - Transfer RNA, structure of tRNA, tRNA genes, Recognition of the tRNA anticodon by the mRNA codon, Adding of amino acid to tRNA , Ribosomal RNA and Ribosomes, Ribosomal RNA Genes, Initiation of translation, Initiation in Bacteria, Elongation of the polypeptide chain, termination of translation, protein sorting in the cell.

UNIT III: Mutation and Repair

- Mutation: Mutation Terminology: alleles, homozygous, heterozygous, genotype, phenotype, Somatic mutation, Germline mutation, Gene mutation, Chromosome mutation, hotspots and mutator genes
- Types and causes of mutations: Point mutation, reverse mutation, frameshift mutation, base pair substitution, transition, transversion, missense mutation, nonsense mutation, silent mutation, neutral mutation, depurination, deamination
- Chemical and physical mutagens - Base analogues, nitrous acid, hydroxyl amine, intercalating agents, alkylating agents, UV radiation
- Ames Test: A Screen for Potential Mutagens, Replica-plating technique: screen for mutant strains
- DNA Repair: Mismatch repair, Light repair, Base excision repair, Nucleotide excision repair

UNIT IV: Genetic Exchange

- Genetic analysis of Bacteria
- Gene transfer mechanisms in bacteria
- Transformation: Introduction and History, Types of transformation mechanisms and pathways in prokaryotes – *Haemophilus influenzae* and *Bacillus subtilis*.
- Conjugation: Introduction and Discovery of conjugation in bacteria, Properties of F plasmid/Sex factor, F plus and F minus cells, Formation of HFR, Conjugation of FHR and F minus, Sexduction, Formation of partial diploids, Mapping of bacterial genes using conjugation - Wolman and Jacob experiment.
- Transduction: Introduction and discovery of Transduction, Lytic and Lysogenic phages, Mechanism of Generalized transduction, Mechanism of Specialized transduction.

10

Scheme of Examination and Assessment Pattern

Paper – 100 Marks

A. External Examination: Semester End External - 75 marks **Time: 2.5 hours**

Format of Question Paper

All the questions shall be compulsory.

Question No	Nature of Questions	Marks
Q1	Subjective questions based onUnit-1,2,3 & 4(Based on all 4 units. 15 marks each with 100% option)	15
Q2	Subjective questions on Unit-1, (15 marks with 100% option)	15
Q3	Subjective questions on Unit- 2, (15 marks with 100% option)	15
Q4	Subjective questions on Unit- 3, (15 marks with 100% option)	15
Q5	Subjective questions on Unit- 4, (15 marks with 100% option)	15
		Total 75

Note:

1. Equal weightage is to be given to all the modules

B. Internal Examination: Continuous Evolution - 25 marks

	Assessment / Evaluation	Marks
1.	Class Test (MCQ's/ Match the Pair/ Answer in one sentence/ Puzzles)	20
2.	Overall conduct as a responsible student, manners, attentiveness and inquisitiveness, skill in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05
	Total	**25**

11

REFERENCES:

1. Peter J. Russell (2006), "I Genetics-A molecular approach", 2nd edition.
2. Benjamin A. Pierce (2008), "Genetics a conceptual approach", 3rd edition, W. H. Freeman and company.
3. R. H. Tamarin, (2004), "Principles of genetics", Tata McGraw Hill.
4. D. Nelson and M. Cox, (2005), "Lehninger's Principles of biochemistry", 4th edition, Macmillan worth Publishers.
5. M. Madigan, J. Martinko, J. Parkar, (2009), "Brock Biology of microorganisms", 12th edition, Pearson Education International.
6. Fairbanks and Anderson, (1999), "Genetics", Wadsworth Publishing Company.
7. Prescott, Harley and Klein, "Microbiology", 7th edition Mc Graw Hill international edition.
8. Robert Weaver, "Molecular biology", 3rd edition. Mc Graw Hill international edition.
9. Nancy Trun and Janine Trempy, (2004), "Fundamental bacterial genetics", Blackwell Publishing
10. Snustad, Simmons, "Principles of genetics", 3rd edition. John Wiley & sons, Inc.

Smt. Chandibai Himathmal Mansukhani College
(Autonomous)

Third Year B.Sc.
(Microbiology)

Semester- V

Title: Medical Microbiology and Immunology
Part - I

Paper II

With effect from
Academic Year 2025-2026

Title: Medical Microbiology & Immunology: Part – I

Course Code: CHM(A)USMB502

Sr. No.	Heading	Particulars
1	**Description of the Course:**	This course explores bacterial evasion strategies, including virulence mechanisms, toxins, and factors like LPS and tissue-degrading enzymes. It covers microbial infections across various systems, including respiratory, urinary, skin, and gastrointestinal infections. Immunology topics include immune system organs, antigens, immunoglobulins, cytokines, and MHC molecules, along with antigen-antibody reactions such as precipitation, agglutination, and ELISA. Techniques like Western blotting, immunofluorescence, and radioimmunoassay are also introduced for diagnostic applications.
2	**Vertical**	--
3	**Type** **Teaching Method**	Theory Lectures/ Discussion / Presentation/ Case Studies/Industrial visit Flipped classroom etc.
4	**Credit**	2.5 Credits
5	**Hours allotted**	48 Hours
6	**Marks allotted**	100 Marks
7	**Course Objectives**: 1. The medical microbiology course aims to assist students in expanding upon the foundational knowledge of host defence mechanisms acquired in SY. B.Sc. 2. It has been crafted to emphasize the key aspects of medical microbiology, such as etiology, transmission, pathogenesis, clinical signs, laboratory diagnosis, prevention, and treatment of different diseases. 3. The students have developed a fundamental knowledge of Innate Immunity and host defence mechanisms in their earlier classes, and Immunology, which is a crucial component of Medical Microbiology, has been structured to aid in understanding how our immune system effectively protects against invading pathogens in a coherent manner. 4. This encompasses our capacity to protect ourselves from microorganisms by grasping the ideas of Humoral and Cellular/Innate immunity, the elements and organs of the immune system, the various types of antigens we face, and crucially, the distinct kinds of antigen-antibody interactions.	

8	**Learning Outcomes**: Upon completion of the course, student will be able to: **LO1** connect the virulence factors with the disease's pathogenesis and clinical characteristics. **LO2** discuss the transmission methods and consequently the preventive measures for these diseases. **LO3** visualize how the adaptive immune responses work together to combat invading pathogens and the organs and tissues engaged. **LO4** examine the function of antigen in triggering the immune response. **LO5** relate the structure and roles of immunoglobulin.
9	**Syllabus** **UNIT I: Bacterial Strategies for Evasion** • **Study of virulence mechanisms in bacteria**: Study of virulence mechanisms in bacteria and pathogenicity islands. Bacterial virulence factors. Adherence factors. Invasion of host cells and tissues and food poisoning. • **Toxins**: Exotoxins and Exotoxins associated with diarrheal diseases. • **LPS of gram-negative bacteria**: Enzymes Tissue degrading enzymes. Antiphagocytic factors. **UNIT II: Microbial Infections** • **Study of respiratory tract infections:** *S. pyogenes* and Pneumonia caused by *K. pneumoniae*. • **Study of urinary tract infections.** • **Study of skin infections:** Pyogenic skin infections caused by *Pseudomonas* and *S. aureus*. • **Study of gastrointestinal tract infections:** Infections due to enteropathogenic *E.coli* strains, Enteric fever, Salmonella, Shigellosis. **UNIT III: General Immunology – I** • **Organs and tissues of the immune system:** Organs and tissues of the immune system: Primary lymphoid organs - structure and function of Thymus and Bone marrow Secondary lymphoid organs – structure and function of Spleen, Lymph node, Mucosa associated lymphoid tissues. • **Antigens**: Immunogenicity versus antigenicity: Concepts - Immunogenicity, Immunogen, Antigenicity, Antigen, Haptens. Haptens as valuable research and diagnostic tools. Factors that influence immunogenicity - Foreignness, Molecular size, Chemical composition, Heterogeneity, Susceptibility of antigen to be processed and presented, Contribution of the biological system to immunogenicity Genotype of the recipient, Immunogen dosage, Route of administration Types of antigens – heterophile antigens, isophile antigens, sequestered antigens, superantigens, bacterial and viral antigens. • **Immunoglobulins**: Basic structure of Immunoglobulins, heterodimer; types of heavy and light chains; constant and variable regions, Immunoglobulin domains-hinge region. Immunoglobulin classes and biological activities - Immunoglobulin G, Immunoglobulin M, Immunoglobulin A, Immunoglobulin E, Immunoglobulin D, (including diagrams) Antigenic determinants on immunoglobulins – isotypes, allotypes, idiotypes. **UNIT IV: General Immunology – II** • **Cytokines:** Concepts of cytokines, Attributes of cytokines, Biological functions of cytokines • **Major histocompatibility complex**: Introduction: Major histocompatibility complex,

three major classes of MHC encoded molecules, the basic structure and functions of Class I and Class II MHC molecules.

- **Antigen presenting cells**: Endogenous antigens: The cytosolic pathway, Exogenous antigens: The endocytic pathway.
- **Antigen Antibody reactions**: Precipitation reaction Immunoelectrophoresis Precipitation reaction. Immunoelectrophoresis Agglutination reactions-haeme- agglutination, bacterial agglutination, passive agglutination, agglutination inhibition. Radioimmunoassay (RIA), Enzyme Linked Immunosorbent Assay-indirect competitive and sandwich ELISA Immunofluorescence- Direct and indirect. Western blotting.

10

Scheme of Examination and Assessment Pattern

Paper – 100 Marks

A. External Examination: Semester End External - 75 marks **Time: 2.5 hours**

Format of Question Paper

All the questions shall be compulsory.

Question No	Nature of Questions	Marks
Q1	Subjective questions based on onUnit-1,2,3 & 4(Based on all 4 units. 15 marks with 100% option)	15
Q2	Subjective questions on Unit-1, (15 marks with 100% option)	15
Q3	Subjective questions on Unit- 2, (15 marks with 100% option)	15
Q4	Subjective questions on Unit- 3, (15 marks with 100% option)	15
Q5	Subjective questions on Unit- 4, (15 marks with 100% option)	15
		Total 75

Note:

1. Equal Weightage is to be given to all the modules.

B. Internal Examination: Continuous Evolution - 25 marks

	Assessment / Evaluation	Marks
1.	Class Test (MCQ's/ Match the Pair/ Answer in one sentence/ Puzzles)	20
2.	Overall conduct as a responsible student, manners, attentiveness and inquisitiveness, skill in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05
	Total	**25**

11

REFERENCES:

1. Jawetz, Melnick and Adelberg's Medical Microbiology, 26th Edition, Lange publication
2. Ananthanarayan and Panicker's, Textbook of Microbiology, 10th edition
3. Baron Samuel , Medical Microbiology, 4th edition
4. Kuby Immunology, 6th Edition, W H Freeman and Company

	5. Pathak & Palan, Immunology: Essential & Fundamental, 1st& 3rd edition, Capital Publishing Company. 6. Fahim Khan, Elements of Immunology, Pearson Education.

Smt. Chandibai Himathmal Mansukhani College
(Autonomous)

Third Year B.Sc.
(Microbiology)

Semester- V

Title: Practical based on Microbial Genetics & Medical Microbiology & Immunology: Part - I

Practical

With effect from
Academic Year 2025-2026

Title: Practical based on Microbial Genetics & Medical Microbiology & Immunology: Part – I

Course Code: CHM(A)USMBP05

Sr. No.	Heading	Particulars
1	**Description of the Course:**	These practical cover a range of microbiological, genetic, and diagnostic techniques. Students explore UV-induced DNA damage and repair mechanisms, select and characterize mutants using gradient and replica plate methods, and solve problems related to genetic code and bacterial genetic exchange. Diagnostic skills are developed through tests like acid-fast staining, Widal, and ELISA, alongside the study of standard bacterial cultures and identification of clinical isolates for pathogen detection and characterization.
2	**Vertical**	--
3	**Type**	Practical
4	**Credit**	3 Credits
5	**Hours allotted**	96 Hours
6	**Marks allotted**	100Marks
7	**Course Objectives:** 1. To learn how microorganisms repair UV-induced DNA damage through dark and light repair pathways, enhancing their understanding of microbial resilience and genetic stability. 2. To gain practical skills in selecting and characterizing bacterial mutants using gradient and replica plate techniques for antibiotic resistance and auxotrophy. 3. To understand bacterial genetic exchange processes such as conjugation, transformation, and transduction, and calculate gene transfer frequencies, providing insight into microbial evolution and genetics. 4. To acquire hands-on experience in identifying pathogens from clinical samples using various microbiological techniques, including biochemical tests, acid-fast staining, and serological assays like the Widal test. 5. To learn to use immunoassays such as Dot ELISA for detecting specific antigens or antibodies in clinical samples, fostering skills in diagnostic microbiology and immunology.	

8	**Learning Outcomes**: Upon completion of the course, student will be able to: **LO1** gain the ability to analyze and interpret the effects of UV radiation on microbial DNA and understand microbial repair mechanisms, including dark and light repair processes. **LO2** select and characterize bacterial mutants, including those with antibiotic resistance or auxotrophy, using techniques like gradient plates and replica plating. **LO3**calculate gene transfer frequencies (transconjugants, transformants, and transductants) and determine the order of genes, deepening their understanding of bacterial genetics and evolution. **LO4** capable of identifying pathogens from clinical samples (pus, sputum, stool, urine) using morphological, biochemical, and cultural methods, applying diagnostic techniques like the Widal test. **LO5** demonstrate proficiency in conducting immunoassays, including Dot ELISA, to detect specific antibodies or antigens in clinical samples, enhancing diagnostic and research capabilities in microbiology.
9	**Syllabus** **Practical Based on Microbial Genetics, Credits -1.5, 48 Hours** 1. UV survival curve – Determination of exposure time leading to 90% reduction. 2. UV survival curve - Study of dark repair, Study of Light Repair. 3. Gradient plate technique (dye resistant mutant). 4. Replica plate technique for selection & characterization of mutants – auxotroph & antibiotic resistant. 5. Problems on Genetic code - Determining Amino acid and Nucleotide sequences. 6. Problems on bacterial genetic exchange - Determining the order of genes, Determining percent transconjugants, transformants, and transductants. **Practical Based on Medical Microbiology and Immunology: Part - I, Credits -1.5, 48Hours** 1. To determine SLO and SLS activity of *S .pyogenes.* 2. Acid Fast staining- Demonstration. 3. Study of standard cultures *E. coli, Klebsiella spp., Pseudomonas spp., Salmonella typhi, S. paratyphi A, S. paratyphi B, Shigella spp., S .pyogenes, S. aureus.* 4. Identification of isolates obtained from pus, sputum, stool and urine by morphological, cultural and biochemical properties. 5. Widal- Qualitative and Quantitative. 6. Dot ELISA- Demonstration.

10	**Scheme of Examination and Assessment Pattern** Paper – 100 Marks **External Examination: Semester End External - 100 marks** Format of Question Paper

Question No	Nature of Questions	Marks
Q1	Major-1 Based on Microbial Genetics	30
Q2	Quiz: Based on Microbial Genetics , Medical Microbiology and Immunology: Part - I	10
Q3	Major-2 Medical Microbiology & Immunology: Part - I	30
Q4	Minor-2 Medical Microbiology & Immunology: Part - I	15
Q5	Viva: Based on Microbial Genetics , Medical Microbiology & Immunology: Part - I	05
Q6	Journal: Based on Microbial Genetics, Medical Microbiology Immunology: Part - I	10
	Total 100	

The learner is required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination. In case of loss of Journal and / or Report, a Lost Certificate should be obtained from the Head of the Department /Co-ordinator of the department; failing which the student will not be allowed to appear for the practical examination.

Smt. Chandibai Himathmal Mansukhani College
(Autonomous)

Third Year B.Sc.
(Microbiology)

Semester- V

Title: Microbial Biochemistry: Part-I

Paper III

With effect from
Academic Year 2025-2026

Title: MICROBIAL BIOCHEMISTRY: PART-I

Course Code: CHM(A)USMB503

Sr. No.	Heading	Particulars
1	**Description of the Course:**	The Microbial Biochemistry course covers the biochemical processes that drive microbial life, focusing on biological membranes, protein transport mechanisms, and bioenergetics. It explores ATP generation through substrate-level and oxidative phosphorylation, and the role of electron transport chains in both mitochondria and bacteria. The course delves into carbohydrate metabolism, including glycolysis, the TCA cycle, and fermentation pathways. Practical methods for studying metabolism, including biochemical mutants, are emphasized. The course highlights the relevance of microbial biochemistry in biotechnological applications.
2	**Vertical**	--
3	**Type** **Teaching method**	Theory Lectures/ Discussion / Presentation/ Case Studies/Industrial visit Flipped classroom etc.
4	**Credit**	2.5Credits
5	**Hours allotted**	48 Hours
6	**Marks allotted**	100 Marks
7	**Course Objectives:** 1. Microbial biochemistry is the branch of science that explores the chemical processes that take place inside all living things including bacteria, plants and animals. 2. It is a laboratory based science that combines biology and chemistry, using chemistry knowledge and techniques to understand and solve biological problems. Microbial physiology is understood best with knowledge of biochemistry. 3. The course thus focuses on the need to study in vitro as well as in vivo, various uptake & intermediary metabolic processes and methods to study metabolism. The course is designed to make the students understand the principles of energy generation by different physiological groups of organisms and expose them to carbohydrate metabolism. 4. Bioenergetics, the advanced area, unfolds the universal mechanisms of energy generation by using electron transport systems and gaining knowledge of energy conservation. Through the concepts of biosynthesis, and polymerization namely glycogen and peptidoglycan biosynthesis, the student also learns anabolic processes.	

8	**Learning Outcomes**: Upon completion of the course, student will be able to: **LO 1** understand the transport of solute inside the cell and architecture of the membrane. **LO 2** explain the electron transport chains in mitochondria & prokaryotes and understand the mechanism of ATP synthesis. **LO 3** discuss the experimental aspect of studying catabolism and anabolism. **LO 4** describe the various pathways for the breakdown of carbohydrates, reactions of amphibolic pathways and various other pathways producing different end products. **LO 5** describe reactions of anabolism in carbohydrate synthesis.
9	**Syllabus** **UNIT I: Biological Membranes & Transport** • Composition and architecture of membrane • Lipids and properties of phospholipid membranes • Integral & peripheral proteins • Aquaporins • Mechanosensitive channels • Methods of studying solute transport- Use of whole cells, Liposomes, Proteoliposomes • Solute transport across membrane Passive transport and facilitated diffusion Co-transport across plasma membrane (Uniport, Antiport, Symport) Active transport Ion gradient provides energy for secondary active transport Na-K ATPase Phosphotransferase system Schematic representation of various membrane transport systems in bacteria • Other examples of solute transport Iron transport: A special problem Assembly of proteins into membranes and protein export **UNIT II: Bioenergetics & Bioluminescence** • Biochemical mechanism of generating ATP: Substrate-Level Phosphorylation, Oxidative Phosphorylation & Photophosphorylation • Electron transport chain Universal electron acceptors that transfer electrons to ETC Carriers in ETC Mitochondrial ETC • Biochemical anatomy of mitochondria Complexes in Mitochondrial ETC Schematic representation of Mitochondrial ETC • Prokaryotic ETC Organization of electron carriers in bacteria Different terminal oxidases Branched bacterial ETC Pattern of electron flow in *E coli* - aerobic and anaerobic • ATP synthesis Chemiosmotic theory (only explanation) Structure & function of Mitochondrial ATP synthase

Structure of bacterial ATP synthase
Mechanism by rotational catalysis
Inhibitors of ETC, ATPase and uncouplers

- Other modes of generation of electrochemical energy
  ATP hydrolysis
  Oxalate formate exchange
  Bacteriorhodopsin: Definition, function as proton pump and significance
  Bioluminescence
  Brief survey of bioluminescent systems
  Biochemistry of light emission
  Schematic diagram
  Significance / Application

UNIT III: Studying Metabolism & Catabolism of Carbohydrates

- Experimental Analysis of metabolism
  Goals of the study
  Levels of organization at which metabolism is studied
  Metabolic probes, Use of radioisotopes in biochemistry, Pulse labelling
  Assay and study of radio respirometry to differentiate EMP & ED
  Use of biochemical mutants, Sequential induction
- Catabolism of Carbohydrates
  Breakdown of polysaccharides – Glycogen, Starch, Cellulose
  Breakdown of oligosaccharides - Lactose, Maltose, Sucrose, Cellobiose
  Utilization of monosaccharides - Fructose, Galactose
  Major pathways – (with structure and enzymes)
  Glycolysis (EMP), ED pathway
  TCA cycle - Action of PDH, Significance of TCA
  Incomplete TCA in anaerobic bacteria
  Anaplerotic reactions, Glyoxylate bypass
  Amphibolic role of EMP; Amphibolic role of TCA cycle
  Energetics of Glycolysis, TCA, and ED pathway – Balance sheet only
  Format as in Lehninger (2.5 ATP/NADH and 1.5 ATP / FADH2)
  Based on this format, make balance sheet for Glycolysis - Lactic acid and Alcohol fermentation and ED pathway

UNIT IV: Fermentative Pathways & Anabolism of Carbohydrates

- Fermentative pathways (with structures and enzymes)
  Lactic acid fermentation
  Homofermentation, Heterofermentation, Bifidum pathway
  Alcohol fermentation
  By ED pathway in bacteria, By EMP in yeasts.

- Other modes of fermentation in microorganisms
  Mixed acid, Acetone-Butanol
  Propionic acid -Acrylate and succinate propionate pathway
- Anabolism of Carbohydrates
  General pattern of metabolism leading to synthesis of a cell from glucose

Sugar nucleotides, Gluconeogenesis (only bacterial)
Biosynthesis of glycogen, Biosynthesis of Peptidoglycan

10

Scheme of Examination and Assessment Pattern

Paper – 100 Marks

A. External Examination: Semester End External - 75 marks **Time: 2.5 hours**

Format of Question Paper

All the questions shall be compulsory.

Question No	Nature of Questions	Marks
Q1	Subjective questions based on Unit-1,2,3 & 4(Based on all 4 units. 15 marks with 100% option)	15
Q2	Subjective questions on Unit-1, (15 marks with 100% option)	15
Q3	Subjective questions on Unit- 2, (15 marks with 100% option)	15
Q4	Subjective questions on Unit- 3, (15 marks with 100% option)	15
Q5	Subjective questions on Unit- 4, (15 marks with 100% option)	15
		Total 75

Note:

1. Equal Weightage is to be given to all the modules.

B. Internal Examination: Continuous Evolution - 25 marks

	Assessment / evaluation	Marks
1.	Class Test -MCQ's/ Match the Pair/ Answer in one sentence/ Puzzles	20
2.	Overall conduct as a responsible student, manners, attentiveness and inquisitiveness, skill in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05
	Total	**25**

11

REFERENCES:

1. Stanier, R. Y., M. Doudoroff and E. A. Adelberg. General Microbiology, 5th edition, The Macmillan press Ltd
2. Conn, E.E., P. K .Stumpf, G. Bruening and R. Y. Doi. 1987. Outlines of Biochemistry, 5th edition, 1987. John Wiley &Sons. New York.
3. Gottschalk,G., (1985), Bacterial Metabolism, 2nd edition, Springer Verlag
4. White, D., (1995), The Physiology and Biochemistry of Prokaryotes, 3rd edition, Oxford University Press
5. Nelson, D. L. and M.M. Cox (2005), Lehninger, Principles of biochemistry. 4th edition, W. H. Freeman and Company
6. Rose, A.H. (1976) Chemical Microbiology, 3rd edition. Butterworth-Heinemann
7. Zubay, G. L (1996), Biochemistry, 4th edition, Wm. C. Brown publishers
8. Mathews, C.K., K.E. van Holde, D.R. Appling, S, J, Anthony-Cahill (2012) Biochemistry, 4th edition. Pearson
9. Wilson and Walker, 4th edition Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University press.

	10. Zubay, G. L (1996), Principles of Biochemistry, Wm. C. Brown publishers 11. Cohen, G.N. (2011). Microbial Biochemistry. 2nd edition, Springer

Smt. Chandibai Himathmal Mansukhani College
(Autonomous)

Third Year B.Sc.
(Microbiology)

Semester- V

Title: BIOPROCESS TECHNOLOGY: PART-I

Paper IV

With effect from
Academic Year 2025-2026

Title: BIOPROCESS TECHNOLOGY: PART-I

Course Code: CHM(A)USMB504)

Sr. No.	Heading	Particulars
1	**Description of the Course:**	The Bioprocess Technology course covers key aspects of industrial fermentation, focusing on screening, strain improvement, and culture preservation. It explores media formulation, inoculum development, and sterilization techniques for ensuring aseptic conditions. The course also discusses bioreactor design, including batch, continuous, and fed-batch systems, along with fermentation instrumentation for monitoring vital parameters. Students learn about traditional fermentations like wine, beer, and ethanol production. Additionally, the course emphasizes the production and recovery of microbial products, biosafety practices, and containment levels.
2	**Vertical**	--
3	**Type** **Teaching Method**	Theory Lectures/ Discussion / Presentation/ Case Studies/Industrial visit Flipped classroom etc.
4	**Credit**	2.5 Credits
5	**Hours allotted**	48 Hours
6	**Marks allotted**	100 Marks
7	**Course Objectives**: 1. The Bioprocess Technology I course is designed to equip learners with foundational and applied knowledge in industrial microbiology, focusing on key techniques used across various stages such as strain improvement, fermentation equipment, and sterilization protocols. It offers a comprehensive understanding of different types of industrial fermenters and emphasizes crucial process parameters involved in large-scale production. 2. As an application-driven subject, bioprocess technology serves as a bridge from laboratory research to commercial product development, enabling learners to explore traditional fermentation processes for products like wine, beer, and vinegar. 3. Overall, this course prepares students to grasp and apply fermentation technologies effectively and to empower graduates with the competency to navigate the intersection of science and business.	

8	**Learning Outcomes**: Upon completion of the course, student will be able to: **LO 1** understand and learn methods for screening of industrial important microbes and their strain improvement. **LO 2** know sterilization parameters in industry, and make aware about batch, continuous, fed batch and solid substrate fermentations. **LO 3** discuss the design and functionality of various types of bioreactors, including their suitability for specific applications and key operational parameters. **LO 4** formulate appropriate media and optimize growth conditions and methodologies for the production and recovery of commercially valuable microbial products. **LO5** develop a comprehensive understanding of biosafety practices, including the principles and classification of containment levels.
9	**Syllabus** **Unit I: Upstream Processing – I** • Introduction An introduction to fermentation processes The range of fermentation processes The Component parts of a fermentation process • Screening methods Primary and secondary screening, High throughput screening methods • Strain improvement The improvement of industrial microorganisms Selection of induced mutants synthesizing improved levels of primary metabolites The improvement of strains by modifying properties other than the yield of product • Preservation of cultures Preservation of industrially important organisms Quality control of preserved stock Key Criteria's, Development of a master culture bank (MCB) Variability test to ensure reproducibility of the MCB **Unit II: Upstream Processing – II** • Fermentation media formulation and raw materials Media formulation, Raw materials for fermentation media • The development of inocula for industrial fermentations Development of inocula for unicellular bacterial process Development of inocula for mycelial process • Sterilization and achievement of aseptic conditions Medium sterilization (concept of nabla factor) Methods of batch sterilization The design of continuous sterilization process Sterilization of the Fermenter, Sterilization of the Feeds Sterilization of the liquid wastes, Filter Sterilization Filter sterilization of fermentation media Filter sterilization of air, Filter sterilization of fermenter exhaust air • Scale up and scale down of fermentation

Unit III: Fermentation Modes, Equipment and Instruments

- Modes of fermentation
  Batch, continuous, fed batch fermentation and Solid substrate fermentation
- Design of fermenter
  Basic design and functions of fermenter
  Aseptic operation & containment
  Body construction
  Agitator (impeller) – function, types, mechanical seal and magnetic drive
  Baffles, aeration system (sparger) - function and types
  Introduction to valves and steam traps
  Examples of fermenters
  Air Lift fermenter with inner and outer loop, Deep Jet, Photobioreactor
- Instrumentation and control
  Types of sensors used in fermenter
  Measurement and control of: pH, temperature, pressure, foam sensing, dissolved oxygen, inlet and exit gas analysis.

Unit IV: Traditional Fermentations

- Wine – Red, White, Champagne and Sherry
  Alcoholic fermentation, Composition of grape juice
  Sulphur dioxide addition, Factors affecting wine fermentation
  Examples and role of yeasts involved in fermentation
  Malolactic fermentation
  Technological aspects of wine making: red, white, champagne, sherry
  Examples of aroma compounds of wine, Types and examples of wine
- Beer – Ale and Lager
  Elements of brewing process, Process details
  Use of cylindro-conical vessel
  Primary and Continuous fermentation
  Aging and finishing, Yeasts involved in fermentation
- Alcohol from Molasses
  Introduction, Biosynthesis of ethanol
  Production process: preparation of nutrient solution, fermentation, recovery by distillation
- Vinegar (acetic acid)
  Introduction, Biosynthesis
  Production using generator, Production using submerged fermenter
  Recovery
- Baker's yeast
  Yeast strains and their properties

Factors important in production: oxygen requirement and aeration, concentration of sugar, pH, temperature, preparation of substrate, fermentation, harvesting of yeast cells, production of compressed and active dry yeast

10

Scheme of Examination and Assessment Pattern

Paper – 100 Marks

A. External Examination: Semester End External - 75 marks Time: 2.5 hours

Format of Question Paper

All the questions shall be compulsory.

Question No	Nature of Questions	Marks
Q1	Subjective questions based on Unit-1,2,3 & 4(Based on all 4 units. 15 marks with 100% option)	15
Q2	Subjective questions on Unit-1, (15 marks with 100% option)	15
Q3	Subjective questions on Unit- 2, (15 marks with 100% option)	15
Q4	Subjective questions on Unit- 3, (15 marks with 100% option)	15
Q5	Subjective questions on Unit- 4, (15 marks with 100% option)	15
		Total 75

Note:

1. Equal Weightage is to be given to all the modules.

B. Internal Examination: Continuous Evolution - 25 marks

	Assessment / Evaluation	Marks
1.	Class Test -MCQ's/ Match the Pair/ Answer in one sentence/ Puzzles	20
2.	Overall conduct as a responsible student, manners, attentiveness and inquisitiveness, skill in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05
	Total	**25**

11

REFERENCES:

1. Casida L. E., "Industrial Microbiology" (2009) Reprint, New Age International (P) Ltd, Publishers, New Delhi.
2. Stanbury P. F., Whitaker A. & Hall S. J., (1997), "Principles of Fermentation Technology", 2nd edition, Aditya Books Pvt. Ltd, New Delhi.
3. Stanbury P. F., Whitaker A. & Hall S. J 3rd edition (2017) "Principles of Fermentation Technology"
4. Peppler, H. J. and Perlman, D. (1979), "Microbial Technology''. Vol. 1 & 2, Academic Press
5. H. A. Modi, (2009). ''Fermentation Technology'' Vol. 1 & 2, Pointer Publications, India.
6. Okafor Nduka (2007) ''Modern Industrial Microbiology and Biotechnology'', Science Publications Enfield, NH, USA.
7. Crueger W. and Crueger A. (2000) "Biotechnology -"A Textbook of Industrial Microbiology", 2nd edition, Panima Publishing Corporation, New Delhi.
8. Prescott and Dunn's ''Industrial Microbiology''(1982) 4th edition, McMillan Publishers
9. R. C. Dubey, 2005 A Textbook of ''Biotechnology'' S. Chand and Company, New Delhi.

	10. H. A. Modi, 2009. ''Fermentation Technology'' Vol: 1 & 2, Pointer Publications, India 11. Practical Fermentation Technology by Brian Mcneil& Linda M. Harvey (2008).

Smt. Chandibai Himathmal Mansukhani College
(Autonomous)

Third Year B.Sc.
(Microbiology)

Semester- V

Title: Practical Based on Microbial Biochemistry Part-I & Bioprocess Technology: Part - I

Practical

With effect from
Academic Year 2025-2026

Title: Practical Based on Microbial Biochemistry: Part-I & Bioprocess Technology: Part – I

Course Code: CHM(A)USMBP06

Sr. No.	Heading	Particulars
1	**Description of the Course:**	The practical cover diverse microbiological and bioprocess technologies. Students isolate bioluminescent organisms, study oxidative and fermentative metabolism, and perform enzyme assays for phosphatase activity. They isolate lactic acid bacteria, explore fermentation types, and test glucose detection and liver enzyme levels. Alcohol fermentation, yeast inoculum standardization, and alcohol and sugar tolerance studies are also conducted. Antibiotic producers are screened, and industrial visits enhance understanding of large-scale bioprocessing, offering a comprehensive view of applied biotechnology.
2	**Vertical**	--
3	**Type**	Practical
4	**Credit**	3 Credits
5	**Hours allotted**	96 Hours
6	**Marks allotted**	100Marks
7	**Course Objectives:** 1. To enable students to explore and differentiate between oxidative and fermentative metabolic pathways in microorganisms, and to understand their ecological and industrial significance. 2. To quip students with the techniques for performing qualitative and quantitative assays to measure enzyme activities like phosphatase, glucose oxidase, and liver enzymes, applying these methods in biochemical diagnostics. 3. To train students to isolate and identify important microorganisms, such as lactic acid bacteria and bioluminescent organisms, using selective media, staining methods, and biochemical tests. 4. To provide hands-on experience with fermentation techniques, including alcohol fermentation, yeast inoculum preparation, and fermentation efficiency calculation, to understand their applications in biotechnology and industry. 5. To enable students to screen microorganisms for antibiotic production using various methods, and assess the spectrum of activity to understand microbial interactions and antibiotic resistance mechanisms.	

8	**Learning Outcomes**: Upon completion of the course, student will be able to: **LO1** differentiate between oxidative and fermentative metabolic pathways in microorganisms, and understand how metabolic processes like fermentation and bioluminescence contribute to microbial function and industrial applications. **LO2** develop skills in conducting qualitative and quantitative enzyme assays, including phosphatase activity, glucose detection, and liver enzyme analysis, enabling them to evaluate metabolic activity in biological samples. **LO3** gain practical experience in isolating and identifying lactic acid bacteria and other microorganisms, using selective media, staining techniques, and biochemical tests. **LO4** students will gain an in-depth understanding of fermentation processes, including alcohol fermentation, yeast inoculum standardization, and fermentation efficiency calculations. **LO5** acquire the ability to screen microorganisms for antibiotic production and determine the spectrum of antibiotic activity, applying this knowledge to understand microbial resistance and potential therapeutic applications in medicine and industry.
9	**Syllabus** **Practical Based on MICROBIAL BIOCHEMISTRY: PART-I Credits-1.5,** 48 Hours 1. Isolation and study of Bioluminescent organisms 2. Study of oxidative and fermentative metabolism 3. Qualitative and Quantitative assay of Phosphatase 4. Isolation of Lactic acid bacteria. 5. Study of Homo - Hetero Fermentation in Lactic acid bacteria 6. Glucose detection by GOD/POD in serum 7. Determination of SGOT(Serum Glutamate Oxaloacetate Transaminase) and SGPT (Serum Glutamate Pyruvate Transaminase) in serum **Practical Based on BIOPROCESS TECHNOLOGY: PART-I Credits-1.5,** 48 Hours 1. Alcohol Fermentation • Preparation and standardization of yeast inoculum for alcohol fermentation • Laboratory Alcohol fermentation using jaggery medium, calculation of efficiency of fermentation. 2. Determine the alcohol tolerance for *Saccharomyces cerevisiae* 3. Determine the sugar tolerance for *Saccharomyces cerevisiae* 4. Chemical estimation of sugar by Cole's ferricyanide method 5. Chemical estimation of alcohol 6. Primary screening for antibiotic producers using Wilkin's agar overlay method 7. Determination of antibiotic spectrum using agar strip / streak method 8. Industrial Visit

10	**Scheme of Examination and Assessment Pattern** Paper – 100 Marks **External Examination: Semester End External - 100 marks** Format of Question Paper

Question No	Nature of Questions	Marks
Q1	Major-1 Based on Microbial Biochemistry: Part - I	30
Q2	Quiz: Based on Microbial Biochemistry: Part – I& Bioprocess Technology: Part - I	10
Q3	Major-2 Bioprocess Technology: Part - I	30
Q4	Minor-2 Bioprocess Technology: Part - I	15
Q5	Viva: Based on Microbial Biochemistry: Part – I &Bioprocess Technology: Part - I	05
Q6	Journal: Based on Microbial Biochemistry: Part – I & Bioprocess Technology: Part - I	10
		Total 100

The learner is required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination. In case of loss of Journal and / or Report, a Lost Certificate should be obtained from the Head of the Department /Co-ordinator of the department; failing which the student will not be allowed to appear for the practical examination.

Smt. Chandibai Himathmal Mansukhani College
(Autonomous)

Third Year B.Sc.
(Microbiology)

Semester- V

Title: Introduction to Biotechnology
(Applied Component)
Paper V

With effect from
Academic Year 2025-2026

Title: Introduction to Biotechnology
Course Code: (CHM(A)UMAC501)

Sr. No.	Heading	Particulars
1	**Description of the Course:**	The syllabus is as per the Credit Based Semester and Grading System (CBSGS) and continuous evaluation consisting of components of Internal Assessment and External Assessment. In accordance with the updated syllabus, it has been made sure that students receive a steady stream of information and the latest developments in the subject of Applied component focusing mainly on Biotechnology. This course offers a comprehensive overview of biotechnology with a focus on practical and industrial applications. Advantages of biotechnology, legal aspects of patenting inventions, and development of recombinant therapeutic products. It examines genetic modification in food, its safety, and the release of genetically engineered organisms.
2	**Vertical**	--
3	**Type** **Teaching Method**	Theory Lectures/ Discussion / Presentation/ Case Studies/Industrial visit Flipped classroom etc.
4	**Credit**	2 Credits
5	**Hours allotted**	48 Hours
6	**Marks allotted**	100Marks
7	**Course Objectives:** 1. To acquire knowledge pertaining to the concept ethical, legal, and social implications of patenting biotechnological inventions. 2. To be able to understand and evaluate the safety, risks, and benefits of genetically modified organisms and recombinant therapeutic products. 3. To understand and learn bioremediation, including how genetically modified microbes and plants can be utilized to clean up contaminated soil and water. 4. To acquaint with understanding of the microorganisms that contribute to advancements in industrial and marine biotechnology.	

8	**Learning Outcomes**: Upon completion of the course, student will be able to: **LO1** understand the benefits and applications of biotechnology in healthcare, agriculture, and the environment. **LO2** understand the principles and types of reactions in bioremediation. **LO3** explain the degradation pathways of pesticides, herbicides, and pollutants in soil and water. **LO4** apply techniques like retroviral vectors, DNA microinjection, and embryonic stem cell engineering. **LO5** describe the production methods for single-cell proteins (SCPs) like yeast, spirulina, and mushrooms.

9	**Syllabus**

UNIT I: Role of Biotechnology in Society

- Benefits of Biotechnology.
- Patenting Biotechnology Invention
- Recombinant therapeutic product for human healthcare
- Genetic modification and food consumption
- Are Genetically Modified Food is safe?
- Release of genetically engineered organisms
- Human embryonic stem cell research
- Organ cloning
- Application of Human genetic r-DNA research

UNIT II: Bioremediation in Biotechnology:

- Introduction and Types of reaction in Bioremediation.
- Biodegradation of pesticides and herbicide
- Bioremediation of contaminated soil and waste water.
- Bioremediation using genetically engineered microbes (GEM)
- Higher plants in Bioremediation: Phytoremediation
- Transgenic plants for phytoremediation
- Bioremediation market.

UNIT III: Animal Biotechnology:

- Transgenic Mice-Methodology
- The retroviral Vector method
- The DNA microinjection method
- The engineering embryonic stem cell method.
- Genetic modification- Genetic modification with the Cre-lox P recombination system
- RNA interference, Transgenesis with high capacity vectors.

UNIT IV: Industrial and Marine Biotechnology:

- Introduction to Industrial Biotechnology
- Production of SCP – Yeast, Spirulina, Mushroom
- Production of Biopolymers – Biogums.
- Introduction to Marine Biotechnology
- Biotechnological Potential of Marine Microbes
- Bioactive compounds from other Marine Organisms: Fungi, Microalgae.
- Marine Bio-resources, Marine Secondary Metabolites, Marine Proteins, Marine Lipids, Cosmetics from Marine Sources, Marine Drugs, Marine Microbial Enzymes, Marine Drugs as Pharmaceuticals

10

Scheme of Examination and Assessment Pattern

Paper – 100 Marks

A. External Examination: Semester End External - 75 marks Time: 2.5 hours

Format of Question Paper

All the questions shall be compulsory.

Question No	Nature of Questions	Marks
Q1	Subjective questions based onUnit-1,2,3 & 4(Based on all 4 units. 15 marks each with 100% option)	15
Q2	Subjective questions on Unit-1, (15 marks with 100% option)	15
Q3	Subjective questions on Unit- 2, (15 marks with 100% option)	15
Q4	Subjective questions on Unit- 3, (15 marks with 100% option)	15
Q5	Subjective questions on Unit- 4, (15 marks with 100% option)	15
		Total 75

Note:

1. Equal Weightage is to be given to all the modules

B. Internal Examination: Continuous Evolution - 25 marks

	Assessment / Evaluation	Marks
1.	Class Test (MCQ's/ Match the Pair/ Answer in one sentence/ Puzzles)	20
2.	Overall conduct as a responsible student, manners, attentiveness and inquisitiveness, skill in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05
	Total	**25**

11

REFERENCES:

1. Elements of Biotechnology: 2009 PK Gupta, Rastogi Publications Edition 2nd.
2. Bernard R Glick and Jack J Pasternak. Molecular Biotechnology: Principles and Applications of recombinant DNA. 4th Edition.
3. Primrose and others. Principles of Gene manipulations. 7th edition. 2004 Blackwell Science.
4. Peter J. Russell 2006, "Genetics-A molecular approach", 3rd edition.
5. R. C. Bubey. A Textbook of Biotechnology. 2006 S. Chand and Company Ltd.
6. B. D. Singh. Biotechnology. Kalyani Publishers.
7. Prescott and Dunn's - Industrial Microbiology-1982 4th Edition, McMillan Publishers
8. Marine biotechnology in the twenty-first century-Problems, promise, and products, National academy press
9. Biotechnology 2004 U .Satyanarayana Books and Allied (P) Ltd.

Smt. Chandibai Himathmal Mansukhani College
(Autonomous)

Third Year B.Sc.
(Microbiology)

Semester- V

Title: Introduction to Biotechnology
(Applied Component)
Practical

With effect from
Academic Year 2025-2026

Title: Practical on Introduction to Biotechnology

Course Code: CHM(A)UMAC5P1

Sr. No.	Heading	Particulars
1	**Description of the Course:**	The syllabus is as per the Credit Based Semester and Grading System (CBSGS) and continuous evaluation consisting of components of Internal Assessment and External Assessment. In accordance with the updated syllabus, it has been made sure that students receive a steady stream of information and the latest developments in the subject of Applied component focusing mainly on Biotechnology. This course offers a comprehensive overview of biotechnology with a focus on practical and industrial applications. Advantages of biotechnology, legal aspects of patenting inventions, and development of recombinant therapeutic products. It examines genetic modification in food, its safety, and the release of genetically engineered organisms.
2	**Vertical**	--
3	**Type**	Practical
4	**Credit**	2 Credits
6	**Hours allotted**	96 Hours
7	**Marks allotted**	100 Marks
8	**Course Objectives**: 1. To enable students to understand the process of isolation of genomic DNA. 2. To equip the students with monitoring the quality of industrial effluent. 3. To train students for isolation of microbial polysaccharide producing organisms, marine microflora.	

9 **Learning Outcomes**: Upon completion of the course, student will be able to:

LO1 understand the benefits of isolation of genomic DNA.
LO2 understand the principles and types of reactions in bioremediation.
LO3 explain the degradation pathways of pesticides, herbicides, and pollutants in soil and water.
LO4 describe the production methods for single-cell proteins (SCPs) like yeast, spirulina, and mushrooms.

10 **Syllabus**

Practical Based on Introduction to Biotechnology Credits-2, 96 Hours

1. Isolation of genomic DNA (bacterial / yeast / onion)
2. Enrichment and isolation of Sulphate reducing bacteria.
3. Determination of COD and BOD of sewage sample /Industrial Effluent
4. Production of Biopesticide
5. Production of Microbial polysaccharide and determination of yield.
6. Cultivation of Edible mushroom
7. Isolation of marine microbial flora

11 **Scheme of Examination and Assessment Pattern**

Paper – 100 Marks

External Examination: Semester End External - 100 marks

Format of Question Paper

Question No	Nature of Questions	Marks
Q1	Major Practical	40
Q2	Minor Practical	30
Q3	Quiz	20
Q4	Journal	10
		Total 100

The learner is required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination. In case of loss of Journal and / or Report, a Lost Certificate should be obtained from the Head of the Department /Co-ordinator of the department; failing which the student will not be allowed to appear for the practical examination.

Department of Microbiology:

Sr No	Name of the Faculty	Designation and College	Signature
1.	Dr. Sandhya Mulchandani	BOS-Chairperson, Associate Professor Smt. CHM College, Ulhasnagar	Mulchandani
2.	Dr. Rasika Pawar	Assistant Professor Smt. CHM College, Ulhasnagar	
3.	Dr. Pranali Shete	Assistant Professor Smt. CHM College, Ulhasnagar	
4.	Dr. Ashish Jain	Associate Professor Smt. CHM College, Ulhasnagar	
5.	Dr. Nitinkumar Patil	Assistant Professor Smt. CHM College, Ulhasnagar	
6.	Ms.Renu Jaisinghani	Assistant Professor Smt. CHM College, Ulhasnagar	

Name & Signature of the BoS Chairperson: Dr. Sandhya Mulchandani Mulchandani

Name & Signature of the Dean: Dr. Neena Anand

SMT. CHANDIBAI HIMATHMAL MANSUKHANI COLLEGE ULHASNAGAR 421 003