University of Mumbai

R.P. Gogate College of Arts & Science and R.V. Jogalekar College of Commerce, Ratnagiri (Autonomous)

Bachelor of Science (B.Sc.) Programme In Microbiology

T.Y.B.Sc. [Sem-V & VI]

Course Structure

Under Choice Based Credit System (CBCS)

To be implemented from Academic Year- 2025-2026

Format for Submission of Curriculum to BoS

Name of Programme	**B.Sc. [Microbiology]**
Level	UG
No of Semesters	06
Year of Implementation	**2025-26**
Programme Specific Outcomes (PSO)	1] Learner shall know the various branches of Microbiology. 2] Learner shall know the role of microorganism in day to day life. 3] Learner shall able to Understand and identify the various Microorganisms. 4] Learner shall able to isolate and propagate various microorganisms. 5] Learner shall able to control microbial growth. 6] Learner shall know the fermentation of various fermented food products and industrial products by using microorganisms. 7] Learner should know the importance of microorganisms in infectious diseases.
Relevance of PSOs to the local, regional, national, and global developmental needs (200 words)	Microorganism's role in nature is indispensable. They involved in biodegradation, Fermentation, Antibiotic production, etc. Likewise some are involved in disease generation too. Therefore the understanding of microorganisms becomes essential to propagate or to control its number. As microorganism is responsible for food spoilage, food borne diseases so the maintenance of quality standard high is important from local level to global level. With respect to this learner should know the branches of microbiology. As microorganisms are ubiquitous so learner should know the role of microorganism in day to day life. There are millions of different microbes present on earth so identification of those microbes is globally important. In addition to that such identification skills has great importance in a infectious diseases control. Industrial fermentation processes requires pure culture of microbes so the knowledge of isolation of pure culture and its propagation is essential. Contamination by unwanted microbes is a worldwide problem. Learners must know the methods of microbial growth control. The various decontamination methods is not only locally important but also it is globally essential. In a sterilized/controlled conditions only a good quality fermented food product can be prepared by specific microorganisms. Therefore learners should know skill and knowledge of such fermentation processes. Summarizing, graduates of B.Sc. Microbiology program will be informed citizens who can understand and apply basic microbiological technique at local to global level. It will be able to pursue wide range of careers including biological and life science research in higher educational institutions as well as careers in public health, clinical research, food, pharmaceutical and biotechnological industries.

Bachelor of Science (B.Sc.) Programme
Under Choice Based Credit System (CBCS)
Course Structure

T.Y.B.Sc. [Microbiology]

(To be implemented from Academic Year 2025-26)

Course Code	Semester V	Credits	Course Code	Semester VI	Credits
Discipline Specific Courses (DSC)			***Discipline Specific Courses (DSC)***		
Major Mandatory			***Major Mandatory***		
25_USMBM501	Microbial Genetics (T)	**02**	25_USMBM601	Virology & rDNA Technology (T)	**02**
25_USMBM502	Medical Microbiology & Immunology : Part - I (T)	**02**	25_USMBM602	Medical Microbiology & Immunology : Part - II (T)	**02**
25_USMBM503	Microbial Biochemistry : Part - I (T)	**02**	25_USMBM603	Microbial Biochemistry : Part - II (T)	**02**
25_USMBM504	Microbiology Practical I (P)	**02**	25_USMBM604	Microbiology Practical V (P)	**02**
25_USMBM505	Microbiology Practical II (P)	**02**	25_USMBM605	Microbiology Practical VI (P)	**02**
Major Electives (Any 1)			***Major Electives (Any 1)***		
25_USMBE506	Bioprocess Technology : Part - I (T) **02**	**04**	25_USMBE606	Bioprocess Technology : Part - II (T) **02**	**04**
25_USMBE507	Microbiology Practical III (P) **02**		25_USMBE607	Microbiology Practical VII (P) **02**	
OR			**OR**		
25_USMBE508	Industrial Fermentation (T) **02**		25_USMBE608	Clinical Microbiology & Infectious Diseases (T) **02**	
25_USMBE509	Microbiology Practical IV (P) **02**		25_USMBE609	Microbiology Practical VIII (P) **02**	
Vocational Skill Course (VSC)			***Vocational Skill Course (VSC)***		
25_USMBV510	Medical Laboratory Technology : Part I (T)	**02**	25_USMBV610	Medical Laboratory Technology : Part II (T)	**02**
25_USMBV511	Medical Laboratory Technology Practical I (P)	**02**	25_USMBV611	Medical Laboratory Technology Practical II (P)	**02**
Field Project			***On Job Training***		
25_USMBF512	Field Project (P)	**04**	25_USMBJ612	On Job Training (P)	**04**
Total Credits		**22**	**Total Credits**		**22**

Bachelor of Science (B.Sc.) Programme

Under Choice Based Credit System (CBCS)

Course Structure

T.Y.B.Sc. [Microbiology] - Semester V

(To be implemented from Academic Year 2025-26)

Course Code	Semester V		Credits
Discipline Specific Courses (DSC)			
Major Mandatory			
25_USMBM501	Microbial Genetics (T)		**02**
25_USMBM502	Medical Microbiology & Immunology : Part I (T)		**02**
25_USMBM503	Microbial Biochemistry : Part I (T)		**02**
25_USMBM504	Microbiology Practical I (P)		**02**
25_USMBM505	Microbiology Practical II (P)		**02**
Major Electives (Any 1)			
25_USMBE506	Bioprocess Technology : Part I (T)	**02**	**04**
25_USMBE507	Microbiology Practical III (P)	**02**	
OR			
25_USMBE508	Industrial Fermentation (T)	**02**	
25_USMBE509	Microbiology Practical IV (P)	**02**	
Vocational Skill Course (VSC)			
25_USMBV510	Medical Laboratory Technology : Part I (T)		**02**
25_USMBV511	Medical Laboratory Technology Practical I (P)		**02**
Field Project			
25_USMBF512	Field Project (P)		**04**
Total Credits			**22**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Microbial Genetics (T)**
Course Code	**25_USMBM501**
Class	T.Y.B.Sc.
Semester	V
No of Credits	2
Nature	Theory
Type	Major mandatory
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	Microbial genetics is a subject area within microbiology and genetic engineering. Microorganisms have been used to study many processes and have had applications in various areas of study in genetics The learning of microbial genetics provides technical expertise in micro or molecular biology techniques.

Nomenclature: Microbial Genetics

Course Outcomes:

CO1- The learner will understand the sequence of events, mechanism, enzymes and proteins involved in replication of DNA in prokaryotes and eukaryotes.

CO2- The student will know the central dogma of biology its two-step transcription and translation, maturation of RNA.

CO3- The learner will know the concept of mutation, its types, causes and their effects. This module will also make them understand types of mutagens, damage to DNA due to mutagenesis, various mechanisms of DNA repair.

Curriculum:

Unit	**Title**	**Learning Points**	**No of Lecture**
1	**DNA Replication**	1.1. Historical perspective - Conservative, dispersive, semi-conservative, bidirectional and semi-discontinuous, Theta model of replication. 1.2. Prokaryotic DNA replication - Details of molecular mechanisms involved in Initiation, Elongation and Termination 1.3. Enzymes and proteins associated with DNA replication- Primase, Helicase, Topoisomerase, SSB, DNA polymerases, Ligases, 1.4. Eukaryotic DNA replication - Molecular details of DNA synthesis, replicating the ends of the chromosomes. 1.5. Rolling circle mode of DNA replication	**10**

2	**Transcription, Genetic Code and Translation**	2.1 Central Dogma: An Overview, Transcription process, Transcription in bacteria - Initiation of transcription at promoters, elongation of an RNA chain, termination of an RNA chain. 2.2 Transcription in Eukaryotes - Eukaryotic RNA polymerase, Transcription of protein- coding genes by RNA polymerase II, Transcription initiation, The structure and production of Eukaryotic mRNAs, Production of mature mRNA in Eukaryotes, Processing of Pre-mRNA to mature mRNA. Self-Splicing of Introns, 2.3 Genetic code - Nature of genetic code and characteristics of genetic code. 2.4 Translation process - Transfer RNA, structure of tRNA, 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, Initiation in eukaryotes, Elongation of the polypeptide chain, termination of translation, protein sorting in the cell.	**10**
3	**Mutation and Repair**	**A] Mutation** 3.1 Terminology: alleles, homozygous, heterozygous, genotype, phenotype, Somatic mutation, Germline mutation, Gene mutation, Chromosome mutation, phenotypic lag, hotspots and mutator genes. 3.2 Types of mutations: Point mutation, reverse mutation, suppressor mutation, frameshift mutation, conditional lethal mutation, base pair substitution, transition, transversion, missense mutation, nonsense mutation, silent mutation, neutral mutation. 3.3 Causes of mutation: Natural/spontaneous mutation-- replication error, depurination, deamination. Induced mutation: principle and mechanism with illustrative diagrams a] Chemical mutagens - base analogues, nitrous acid, hydroxyl amine, intercalating agents and alkylating agents. b] Physical mutagen c] Biological mutagen (only examples) 3.4 Ames test 3.5 Detection of mutants	**10**

		B] DNA Repair 3.1 Base excision repair 3.2 Nucleotide excision repair 3.3 SOS repair	

Learning Resources recommended:

Text books:

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", 7 th edition Mc Graw Hill international edition.
8. Robert Weaver, "Molecular biology", 3 rd 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.

Reference books:

1. Benjamin Lewin, "Genes IX", Jones and Bartlett publishers.
2. JD Watson, "Molecular biology of the gene", 5 th edition.

Evaluation Pattern

A. Internal Evaluation

Method	**Marks**
Class Test	10
Assignment	05
Attendance &Class performance	05
Total	**20**

B. Semester End Evaluation (Paper Pattern)

Question No	**Unit**	**Marks**
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		**30**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Medical Microbiology & Immunology: Part – I (T)**
Course Code	**25_USMBM502**
Class	T.Y.B.Sc.
Semester	V
No of Credits	2
Nature	Theory
Type	Major Mandatory
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	Medical microbiology and immunology conducts biochemical assays including biochemical identification of microorganisms. It performs testing for water samples including bacteria identification and specs limits monitoring for microorganism in water samples. Medical microbiology participates in the validation of sterility testing in compliance with FDA guidelines. Immunologists can work as scientists or clinicians across different areas of biomedical research and in diverse clinical specialties ranging from allergy to cancer.

Nomenclature: Medical Microbiology & Immunology: Part - I

Course Outcomes:

CO1- The learners will correlate these virulence factors with the pathogenesis and clinical features of the disease

CO2- The learners will study the mode of transmission, method of diagnosis and modes of prophylaxis of these diseases

CO3- The learners will understand the importance of cytokines, MHC, APCs, Cytokines, and the role in adaptive immunity.

CO4- The learners will understand the various antigen –antibody reactions.

Curriculum:

Unit	Title	Learning Points	No of Lectures
1	**Study of few diseases I (wrt. Cultural characteristics of the etiological agent, pathogenesis & clinical features, laboratory diagnosis, treatment and prevention only)**	1.1. Study of A Few Infectious Diseases of the Respiratory Tract (wrt. Cultural Characteristics of the etiological agent, pathogenesis & clinical features, laboratory diagnosis, treatment and prevention only) a) *S. pyogenes* infections b) Influenza c) Pneumonia caused by *K .pneumoniae* 1.2 Study of urinary tract infections 1.3 Study of skin infections a) Pyogenic skin infections caused by *S. aureus* b) Leprosy c) Viral Infections- Herpes simplex 1.4 Study of gastrointestinal tract infections a) Infections due to Enteropathogenic *E.coli* strains b) Enteric fever - *Salmonella*	**10**
2	**General Immunology – I**	2.1. Organs and tissues of the immune system: a) Primary lymphoid organs - structure and function of Thymus and Bone marrow b) Secondary lymphoid organs – structure and function of Spleen, Lymph node, Mucosa associated lymphoid tissues, Bronchus associated lymphoid tissue, Gut associated lymphoid tissue, Cutaneous associated lymphoid tissue 2.2 Antigens a) Immunogenicity versus antigenicity: Concepts - Immunogenicity, Immunogen, Antigencity, Antigen, Haptens. b) Factors that influence immunogenicity - Foreignness, Molecular size, Chemical composition, Heterogeneity, Susceptibility of antigen to be processed and presented,	**10**

		Immunogen dosage, Route of administration c) Adjuvants d) Epitopes / antigen determinants - General concept, Characteristic properties of B - cell epitopes, concepts of sequential and non-sequential epitopes (with only one example each). Properties of B - cell and T - cell epitopes. Comparison of antigen recognition by T cells and B cells 2.3 Immunoglobulins a) Immunoglobulins – basic structure of Immunoglobulins, heterodimer; types of heavy and light chains; constant and variable regions, Immunoblobulin domains-hinge region. Basic concepts - hypervariable region. b) Immunoglobulin classes and biological activities - Immunogloublin G, Immunogloublin M, Immunogloublin A, Immunogloublin E, Immunogloublin D.	
3	**General Immunology – II**	3.1 Cytokines a) Concepts - cytokines, lymphokines, monokines, interleukines, chemokines. b) Properties of cytokines c) Attributes of cytokines 3.2 Major histocompatibility complex. a) Introduction. b) Three major classes of MHC encoded molecules. c) The basic structure and functions of Class I and Class II MHC Molecules. d) Peptide binding by Class I and Class II MHC molecule 3.3 Antigen presenting cells - Types of APC's 3.4 Antigen Antibody reactions a) Precipitation reaction - Immunoelectrophoresis b) Agglutination reactions - passive agglutination, agglutination inhibition. c) Radioimmunoassay (RIA), d) Enzyme Linked Immunosorbent Assay - indirect, competitive and sandwich ELISA e) Immunofluorescence- Direct and indirect.	**10**

Learning Resources recommended:

Text books:

1. Jawetz, Melnick and Adelberg's Medical Microbiology, 26th Edition, Lange publication
2. Ananthanarayan and Panicker's, Textbook of Microbiology, 10th edition
3. Ananthanarayan and Panicker's, Textbook of Microbiology, 9th edition
4. Ananthanarayan and Panicker's, Textbook of Microbiology, 8th edition
5. Kuby Immunology, 6th Edition, W H Freeman and Company
6. Pathak & Palan, Immunology: Essential & Fundamental, 1 st& 3rd edition, Capital Publishing Company
7. Fahim Khan, Elements of Immunology, Pearson Education

Reference books / Internet references:

1. Kuby Immunology, 7th edition, W H Freeman and Company
2. Ananthanarayan and Panicker's, Textbook of Microbiology, 8th edition
3. Baron Samuel , Medical Microbiology, 4th edition
4. http://www.ncbi.nlm.nih.gov/books/NBK7627/
5. http://www.macmillanlearning.com/catalog/static/whf/kuby/

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance &Class performance	05
Total	**20**

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		**30**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Microbial Biochemistry: Part – I (T)**
Course Code	**25_USMBM503**
Class	T.Y.B.Sc.
Semester	V
No of Credits	02
Nature	Theory
Type	Major Mandatory
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	Microbial biochemistry gains the molecular knowledge in virology, pharmacology and toxicology. It also provides a knowledge of data analysis, marketing and scientific communication. The study helps you to observe things from a completely new perspective to get them translated into new opportunities.

Nomenclature: Microbial Biochemistry: Part – I

Course Outcomes:

CO1- The learner will understand the architecture of the membrane and how solute is transported inside the cell.

CO2- The learner will understand the electron transport chains in prokaryotes and mitochondria and the mechanism of ATP synthesis.

CO3- The learner will understand experimental aspect of studying catabolism of carbohydrates and the various fermentative pathways.

Curriculum:

Unit	Title	Learning Points	No of Lectures
1	**Biological Membranes & Transport**	1.1 Composition and architecture of membrane a) Lipids and properties of phospholipid membranes. b) Integral & peripheral proteins & interactions with lipids c) Permeability	**10**

		d) Aquaporins e) Mechanosensitive channels 1.2 Solute transport across membrane a) Passive transport and facilitated diffusion by membrane proteins b) Co-transport across plasma membrane - (Uniport, Antiport, Symport) c) Active transport & electrochemical gradient d) Ion gradient provides energy for secondary active transport - Lactose transport e) ATPases and transport (only Na-K ATPase) f) Shock sensitive system – Role of binding proteins - Histidine uptake (Diagram and description) g) Phosphotransferase system h) Schematic representation of various membrane transport systems in bacteria. 1.3 Other examples of solute transport: - Bacterial membrane fusion central to many biological processes.	
2	**Bioenergetics & Bioluminescence**	2.1 Biochemical mechanism of generating ATP: Substrate-Level Phosphorylation, Oxidative Phosphorylation & Photophosphorylation 2.2 Electron transport chain a) Universal Electron acceptors that transfer electrons to E.T.C. b) Carriers in E.T.C. ➢ Hydrogen carriers – Flavoproteins, Quinones. ➢ Electron carriers – Iron Sulphur proteins, Cytochromes. c) Mitochondrial ETC ➢ Biochemical anatomy of mitochondria ➢ Complexes in Mitochondrial ETC ➢ Schematic representation of Mitochondrial ETC. 2.3 Prokaryotic ETC a) Organization of electron carriers in	**10**

		bacteria ➢ Generalized electron transport pathway in bacteria ➢ Different terminal oxidases b) Branched bacterial ETC c) Pattern of electron flow in *E. coli* - aerobic and anaerobic 2.4 ATP synthesis a) Explanation of terms – Proton motive force, Proton pump, Coupling sites, P:O ratio, Redox potential (definition of Standard reduction potential) b) Free energy released during electron transfer from NADH to O2 c) Chemiosmotic theory (only explanation) d) Structure & function of Mitochondrial ATP synthase e) Structure of bacterial ATP synthase f) Mechanism by Rotational catalysis g) Inhibitors of ETC, ATPase and uncouplers	
3	**Catabolism & Anabolism of Carbohydrates & Fermentative Pathways**	3.1 Catabolism of Carbohydrates: a) Breakdown of polysaccharides - Glycogen b) Breakdown of oligosaccharides – Lactose c) Major pathways – (with structure and enzymes) ➢ Glycolysis (EMP) ➢ HMP Pathway - Significance of the pathway. ➢ ED pathway ➢ TCA cycle - Action of PDH, Significance of TCA ➢ Anaplerotic reactions 3.2 Amphibolic role of EMP; Amphibolic role of TCA cycle 3.3 Energetics of Glycolysis, TCA and ED pathway – Balance sheet only. Format as in Lehninger (2.5 ATP/NADH and 1.5 ATP / FADH2) 3.4 Fermentative pathways (with structures and enzymes) a) Lactic acid fermentation ➢ Homofermentation ➢ Heterofermentation b) Bifidum pathway 3.5 Anabolism of Carbohydrates	**10**

		a) General pattern of metabolism leading to synthesis of a cell from glucose. b) Gluconeogenesis (only bacterial) c) Biosynthesis of glycogen	

Learning Resources recommended:

Text books:

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, 5 th 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.

Reference books:

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

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance & Class performance	05
Total	**20**

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		**30**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Microbiology Practical I (P)**
Course Code	**25_USMBM504**
Class	T.Y.B.Sc.
Semester	V
No of Credits	2
Nature	Practical
Type	Major Mandatory
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	The microbial genetics and immunology practicals are based on the variety of knowledge related to replica plate technique, UV mutagenesis and identification of microorganisms. Replica plate methods allows each clone to be tested by a variety of methods while retaining a master plate form, which clones, can be picked. It performs testing for water samples including bacteria identification and specs limits monitoring for microorganism in water samples.

Nomenclature: Microbiology practical I

Course Outcomes:

CO1- The learner will acquire the practical skills of laboratory techniques based on UV mutagenesis and UV survival curve.

CO2- The learner will acquire the practical skills of laboratory techniques based on qualitative and quantitative assay of phosphatase.

Curriculum:

Title	Learning Points	No. of Lectures
Microbial Genetics	1. UV survival curve – determination of exposure time leading to 90% reduction 2. Isolation of mutants using UV mutagenesis 3. Gradient plate technique (dye resistant mutant) 4. Replica plate technique for selection & characterization of mutants – auxotroph & antibiotic resistant.	**60**
Microbial Biochemistry: Part – I	5. Quantitative assay of Phosphatase	

Learning Resources recommended:

Text books:

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. Robert Weaver, "Molecular biology", 3 rd edition. Mc Graw Hill international edition
4. Kuby Immunology, 6th Edition, W H Freeman and Company
5. Pathak & Palan, Immunology: Essential & Fundamental, 1 st& 3rd edition, Capital Publishing Company
6. Fahim Khan, Elements of Immunology, Pearson Education

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Experiment (Internal assessment)	10
Viva	05
Journal	05
Total	**20**

B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
Total	**30`**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Microbiology Practical II (P)**
Course Code	**25_USMBM505**
Class	T.Y.B.Sc.
Semester	V
No of Credits	2
Nature	Practical
Type	Major Mandatory
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	The microbial genetics and immunology practicals are based on the variety of knowledge related to replica plate technique, UV mutagenesis and identification of microorganisms. Replica plate methods allows each clone to be tested by a variety of methods while retaining a master plate form, which clones, can be picked. It performs testing for water samples including bacteria identification and specs limits monitoring for microorganism in water samples.

Nomenclature: Microbiology Practical II

Course Outcomes:

CO1- The learner will acquire the hands on skill of identification of isolates obtained from pus, sputum, stool and urine samples.

CO2- The learner will acquire the practical skills of laboratory techniques needed to perform fermentations.

Curriculum:

Title	Learning Points	No. of Lectures
Medical Microbiology & Immunology: Part – I	1. Capsule staining. 2. Study of standard cultures *E. coli, Klebsiella spp., Proteus spp., Salmonalla typhi, S. paratyphi A, S. paratyphi B, S .pyogenes, S. aureus* 3. Identification of isolates obtained from pus, sputum, stool and urine by morphological, cultural and biochemical properties. 4. Antigen Preparation: O & H antigen preparation of *Salmonella*. Confirmation by slide agglutination	**60**
Microbial Biochemistry: Part – I	5. Study of Homo – Heterofermentations	

Learning Resources recommended:

Text books:

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. Robert Weaver, "Molecular biology", 3 rd edition. Mc Graw Hill international edition
4. Kuby Immunology, 6th Edition, W H Freeman and Company
5. Pathak & Palan, Immunology: Essential & Fundamental, 1 st& 3rd edition, Capital Publishing Company
6. Fahim Khan, Elements of Immunology, Pearson Education

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Experiment (Internal assessment)	10
Viva	05
Journal	05
Total	**20**

B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
Total	**30`**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Bioprocess Technology: Part – I (T)**
Course Code	**25_USMBE506**
Class	T.Y.B.Sc.
Semester	V
No of Credits	2
Nature	Theory
Type	Major Elective
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	Bioprocess technology is a part of industrial microbiology, which conducts environmental monitoring on manufacturing facility. Industrial microbiologists study and solve problems related to industrial production processes. Industrial microbiologists may responsible for research, product testing, quality control, product development and genetic engineering. It also supports and prepared protocol for startup and annual environmental monitoring for new facilities, environmental testing and disposition of microbial samples. It participates in the internal audits on microbiology test methods and activities to identify improvement opportunities.

Nomenclature: Bioprocess Technology: Part - I

Course Outcomes:

CO1- The learner shall study the applications of microbes and its strain improvement in Industrial Microbiology.

CO2- The learner shall understand designing of media, growth conditions and techniques for producing and recovering different types of products of commercial value.

CO3- The learner shall study the design of bioreactors for different applications and its process parameters.

Curriculum:

Unit	Title	Learning Points	No of Lectures
1	**Upstream Processing - I**	1.1 Introduction a) An introduction to fermentation processes b) The Component parts of a fermentation process 1.2 Screening methods a) Primary screening b) Secondary screening 1.3 Strain improvement a)The improvement of industrial microorganisms b) The selection of induced mutants synthesizing improved levels of primary metabolites c) The isolation of induced mutants producing improved yields of secondary metabolites. 1.4 Preservation of industrially important organisms	**10**
2	**Upstream Processing - II**	2.1 Fermentation media formulation and raw materials a) Media formulation b) Raw materials for fermentation media 2.2 The development of inocula for industrial fermentations a) Introduction b) Development of inocula for unicellular bacterial process c) Development of inocula for mycelial process 2.3 Sterilization and achievement of aseptic conditions a) Introduction b) Methods of batch sterilization c) The design of continuous sterilization process d) Sterilization of the Fermenter e) Sterilization of the Feeds f) Sterilization of the liquid wastes g) Filter Sterilization	**10**
3	**Fermentation Modes, Equipments and Instruments**	3.1 Modes of fermentation a) Batch, continuous and fed batch fermentation b) Solid substrate fermentation 3.2 Design of fermenter a) Basic functions b) Aseptic operation & Containment c) Body construction d) Agitator (impeller) – function and types e) Baffles f) The aeration system (sparger) - function and types	**10**

		3.3 Instrumentation and control a) Introduction to sensors and its types b) Measurement and control of: pH, temperature, pressure, foam sensing, dissolved oxygen. 3.4 Application of process ➢ Alcohol from Molasses: Introduction, biosynthesis of ethanol, recovery by distillation.	

Learning Resources recommended:

Text books:

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.
8. Microbiology", 2nd edition, Panima Publishing Corporation, New Delhi.
9. Prescott and Dunn's ''Industrial Microbiology''(1982) 4th edition, McMillan Publishers

Reference books:

1. R. C. Dubey, 2005 A Textbook of ''Biotechnology'' S. Chand and Company, New Delhi.
2. H. A. Modi, 2009. ''Fermentation Technology'' Vol: 1 & 2, Pointer Publications, India
3. Practical Fermentation Technology by Brian Mcneil & Linda M. Harvey (2008).

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance &Class performance	05
Total	**20**

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		**30**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Microbiology Practical III (P)**
Course Code	**25_USMBE507**
Class	T.Y.B.Sc.
Semester	V
No of Credits	02
Nature	Practical
Type	Major Elective
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	Microbial biochemistry gains the molecular knowledge in virology, pharmacology and toxicology. Industrial microbiologists study and solve problems related to industrial production processes. Industrial microbiologists may responsible for research, product testing, quality control, product development and genetic engineering. It also supports and prepared protocol for startup and annual environmental monitoring for new facilities, environmental testing and disposition of microbial samples.

Nomenclature: Microbiology Practical III

Course Outcomes:

CO1- The learner will acquire the practical skills of laboratory techniques based on qualitative and quantitative assay of phosphatase.

CO2- The learner will acquire the hands on skill of alcohol fermentation and screening methods.

Curriculum:

Title	**Learning Points**	**No. of Lectures**
Microbiology Practical III	1. Alcohol Fermentation 1.1. Preparation and standardization of yeast inoculums for alcohol fermentation 1.2. Laboratory Alcohol fermentation using jaggery medium, calculation of efficiency of fermentation.	**60**

	2. Determine the alcohol tolerance for yeast. 3. Determine the sugar tolerance for yeast. 4. Chemical estimation of sugar by Cole's ferricyanide method 5. Chemical estimation of alcohol dichromate method 6. Study of oxidative and fermentative metabolism	

Learning Resources recommended:

Text books:

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, 5 th edition, 1987. John Wiley &Sons. New York.
3. Wilson and Walker, 4th edition Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University press.
4. Casida L. E., "Industrial Microbiology" (2009) Reprint, New Age International (P) Ltd, Publishers, New Delhi.
5. Stanbury P. F., Whitaker A. & Hall S. J., (1997), "Principles of Fermentation Technology", 2nd edition, Aditya Books Pvt. Ltd, New Delhi.
6. Crueger W. and Crueger A. (2000) "Biotechnology –"A Textbook of Industrial Microbiology.

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Experiment (Internal assessment)	10
Viva	05
Journal	05
Total	**20**

B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
Total	**30`**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Industrial fermentation (T)**
Course Code	**25_USMBE508**
Class	T.Y.B.Sc.
Semester	V
No of Credits	2
Nature	Theory
Type	Major Elective
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	The ultimate aim of an industrial fermentation process is to produce the desired bioproduct as fast as possible and in the greatest possible quantities, in the simplest and cheapest possible way. In practice, compromises have to be made, in order to provide the optimal conditions for the production of a particular product. The physiology of the microorganisms and the relevant metabolic pathways must be well understood and the needs of the microorganisms, e.g. in terms of nutrients and air (in the case of aerobic cultures) must be satisfied in the best possible way.

Nomenclature: Industrial fermentation

Course Outcomes:

CO1- The learners shall understand the actual process involved in alcoholic fermentations of important products.

CO2- The learners shall understand the production of vinegar, penicillin, baker's yeast etc.

CO3- The students will learn the media composition, biosynthesis of amylases and organic acid fermentations.

Curriculum:

Unit	Title	Learning Points	No of Lectures
1	**Traditional Industrial Fermentations: Beverages**	1.1 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	**10**

		1.2 Beer – Ale and Lager: Elements of brewing process, process details, use of cylindro-conical vessel, primary fermentation, continuous fermentation, aging and finishing, yeasts involved in fermentation. 1.3 Baker's yeast: Outline of production, 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.	
2	**Antibiotics and Vitamin fermentation**	2.1 Penicillin and semisynthetic penicillins: Introduction, biosynthesis and regulation, strain development, production methods. Semisynthetic penicillins: Examples, production, advantages 2.2 Aminoglycoside: Streptomycin: Aminoglycoside antibiotics, biosynthesis, regulation of biosynthesis, strain development, production method, recovery. 2.3 Vitamin B 12: Occurrence and economic significance,structure, biosynthesis, production based on media containing carbohydrates by*Propionibacteria* and *Pseudomonas*, recovery.	**10**
3	**Amylase and Organic acids fermentation**	3.1 Fungal amylase production: ∝ amylase-production from bacteria and fungi, β amylase and glucoamylase, concentration and purification. 3.2 Citric acid: Introduction, strains used for production, biosynthesis, nutrient media, production processes- surface and submerged, product recovery. 3.3 Glutamic acid: Production strains, biosynthesis, effect of permeability on production, conditions of manufacturing, production process and recovery. 3.4 Vinegar (acetic acid): Introduction, biosynthesis, production using generator, production using submerged fermenter, recovery.	**10**

Learning Resources recommended:

Text books:

1. Casida L. E., "Industrial Microbiology" (2009) Reprint, New Age International (P) Ltd, Publishers, New Delhi.
2. H. A. Modi, (2009). ''Fermentation Technology'' Vol. 1 & 2, Pointer Publications, India
3. Okafor Nduka (2007) ''Modern Industrial Microbiology and Biotechnology'', Science Publications Enfield, NH, USA.
4. Crueger W. and Crueger A. (2000) "Biotechnology -"A Textbook of Industrial Mircrobilogy.
5. Microbiology", 2 nd edition, Panima Publishing Corporation, New Delhi.
6. Prescott and Dunn's ''Industrial Microbiology'' (1982) 4th edition, McMillan Publishers.
7. Veerakumari L. "Bioinstrumentation", MJP Publisher
8. Pharmaceutical Microbiology, Hugo and Russell, 7 th edition, Blackwell Science.

Reference books:

1. Peppler, H. J. and Perlman, D. (1979), "Microbial Technology''. Vol 1 & 2, Academic Press.
2. Williams, Bryan L; Wilson, 2 nd edition." A Biologist's guide to principles and techniques of practical biochemistry" Baltimore: University Park Press, 1981.
3. Wilson, Keith, 1936-; Goulding, Kenneth H, 3 rd edition., A Biologist's guide to principles and techniques of practical biochemistry" London ; Baltimore : E. Arnold, 1986.
4. Wilson and Walker, "Principles and techniques of practical biochemistry" 5 th edition.

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance &Class performance	05
Total	**20**

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		**30**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Microbiology Practical IV (P)**
Course Code	**25_USMBE509**
Class	T.Y.B.Sc.
Semester	V
No of Credits	2
Nature	Practical
Type	Major Elective
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	Industrial fermentation is a broader term used for the process of applying microbes for the large-scale production of chemicals, biofuels, enzymes, proteins and pharmaceuticals. Humans were well aware of fermentations, even though they had little knowledge of what caused them, long before they were able to record such an awareness. In simple words, fermentation is a process in which the production of organic substances happens. However, the production of such organic substances is through the activity of microbial organisms. Industrial microbiologists study and solve problems related to industrial production processes. Industrial microbiologists may responsible for research, product testing, quality control, product development and genetic engineering. It also supports and prepared protocol for startup and annual environmental monitoring for new facilities, environmental testing and disposition of microbial samples.

Nomenclature: Microbiology Practical IV

Course Outcomes:

CO1- The learner will acquire the practical skills of laboratory techniques based on antibiotic spectrum of antibiotic producer.
CO2- The learner will acquire the hands on skill of Primary screening.
CO3- The learner will acquire the practical skills used in fermentation technique.

Curriculum:

Title	Learning Points	No. of Lectures
Practical's of industrial fermentation	1. Primary screening of antibiotic producer using Wilkin's agar overlay method. 2. Determination of antibiotic spectrum using agar strip/streak method 3. Production of amylase- Detection, shake flask or solid substrate cultivation and estimation. 4. Determination of concentration of acetic acid in vinegar. 5. Production of white wine using fermentative activity of yeast.	**60**

Learning Resources recommended:

Text books:

1. 1. R. C. Dubey, 2005 A Textbook of ''Biotechnology'' S. Chand and Company, New Delhi.
2. H. A. Modi, 2009. ''Fermentation Technology'' Vol: 1 & 2, Pointer Publications, India
3. Practical Fermentation Technology by Brian Mcneil & Linda M. Harvey (2008).

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Experiment (Internal assessment)	10
Viva	05
Journal	05
Total	**20**

B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
Total	**30`**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Medical Laboratory technology: Part I (T)**
Course Code	**25_USMBV510**
Class	T.Y.B.Sc.
Semester	V
No of Credits	02
Nature	Theory
Type	Vocational Skill Course (VSC)
Highlight revision specific to employability/ entrepreneurship/ skill development	Introduction to Medical Laboratory Technology is a basic course that equips the student with the most essential knowledge and skill pertaining to medical laboratories such as: Importance of laboratory services, Role of medical laboratory technologist, Use of laboratory wares, instruments and sterilization techniques, Prevention and control of laboratory accidents and, Institution of quality control system. Moreover, this course is extremely important for the student as it paves the ways to easily understand various professional courses such as Haematology, Bacteriology, Diagnostic Microbiology and others. Hence, great emphasis should be given to this subject matter so as to train qualified, competent and task oriented medical laboratory technologists.

Nomenclature: Medical Laboratory technology: Part I

Course Outcomes:

CO1: The learner will understand the safety and precautions in diagnostic microbiology.
CO2: The student will know the identification system for bacteria and automation in MLT.
CO3: The student will understand the branch of hematology and will learn different hematological techniques.
CO4: The learner will know the concept in clinical biochemistry. This module will also make them understand the diagnostic tests w.r.t. clinical biochemistry.

Curriculum:

Unit	Title	Learning Points	No of Lectures
I	**Introduction to diagnostic microbiology**	1.1 Safety and special precautions in clinical microbiology lab, Legislative and regulatory control, Infectious waste management, Methods of sterilization, Classification of bio hazardous agents. 1.2 Antimicrobial susceptibility testing: Selection of antimicrobial agents, Disc diffusion test, Dilution antimicrobial susceptibility test, E test, commercial	**10**

		systems. 1.3 Serodiagnostic tests: a) Types of antigen antibody reactions used in diagnostic serology – precipitin reactions, CFT, Haemaglutination inhibition, agglutination reactions,flocculation. b) Solid phase immunoassay methods – Enzyme immunoassay for antibody and antigen detection. c) Immunofluorescent techniques for antibody and antigen detection.	
II	**Automation and newer approaches in MLT**	2.1 Automation: Semiautomated and automated identification systems for Enterobacteriaceae, Non fermentors, Mycobacteria, Staphylococci, anaerobes 2.2 Newer approaches: use of molecular techniques in diagnosis a) Signal amplification methods – Nucleic acid probes,in situ hybridization b) PCR and modifications of PCR c) Post amplification analysis – DNA sequencing, microarray analysis d) Strain typing – Pulse field gel electrophoresis, PCR-RFLP	**10**
III	**Clinical Biochemistry**	3.1 Blood sugar level - Glucose tolerance curve and its interpretation. Evaluation methods of blood glucose – o toluidine, Glucose oxidase - peroxidase. Diabetes and its types. 3.2 Enzymes in diagnostics – determination of enzymes, AST, ALT, ALP, ACP, LDH, GGT, serum lipase. 3.3 Thyroid tests – Introduction – function of thyroid hormones, determination of T-3, T-4, TSH 3.4 Automation in clinical biochemistry - Introduction, classification of automated systems, steps of automation in biochemical analysis, computers in clinical lab with its drawbacks. Commonly used automated analyzers of biochemical laboratories – autoanalysers, clinicon R X L system. 3.5 Cancer marker - Introduction, clinical application, enzymes as tumor markers ALP, CK, LDH, PAP, prostate specific antigens, hormones, oncofetal antigens,carbohydrates, bladder specific, breast tumor markers. 3.6 Pregnancy test – Role of hCG and testing.	**10**

Learning Resources recommended:

1. Koneman's Color Atlas and Textbook of Diagnostic Microbiology, 6th edition, Washington Winn, jr and others. Lippincott Williams & Wilkins.
2. Practical Medical Microbiology, Mackie and McCartney.
3. Medical Microbiology, B.S. Nagoba and Asha Pichare.
4. Essentials of Diagnostic Microbiology, 1998. Lisa Anne Shimeld, Anne T. Rodgers. Delmar Publishers.
5. Text book of medical laboratory technology, 2nd edition, Balani Publishing House. Authors: Praful Godkar and Darshan Godkar.
6. Introduction to MLT 6th ed F.J.Baker & R.E.Silverton Butterworths.
7. Medical laboratory technology, A procedure manual for routine diagnostic tests, Volume I. Kanai Mukherjee. Tata McGraw Hill
8. Medical laboratory technology, A procedure manual for routine diagnostic tests, Volume II. Kanai Mukherjee. Tata McGraw Hill
9. Medical laboratory technology, A procedure manual for routine diagnostic tests, Volume III. Kanai Mukherjee. Tata McGraw Hill
10. Hand book of MLT -Vellore ed-Dr (Mrs) C. Bharucha, Wesley press, Mysore
11. A medical lab for developing countries- Maurice King-ELBS & Oxford uni press
12. Bailey & Scott's - Diagnostic microbiology, 11th ed., Betty Forbes, Daniel, Alice Weissfield. Mosby publisher
13. Atlas of Medical Helminthology and Protozoology, 4th ed. P. L. Chiodini, A. H. Moody, D. W. Manser. Churchill Livingstone
14. A hand book of medical laboratory technology, V. H. Talib 2nd ed.
15. Fundamentals of Biochemistry. New central book agency. Author: A. C. Deb

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance &Class performance	05
Total	**20**

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		**30**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Medical Laboratory Technology practical I (P)**
Course Code	**25_USMBV511**
Class	T.Y.B.Sc.
Semester	V
No of Credits	02
Nature	Practical
Type	Vocational Skill Course (VSC)
Highlight revision specific to employability/ entrepreneurship/ skill development	In the era of modern technology, health care delivery system involves so many different personnel and specialties that the caregiver must have an understanding and working knowledge of other professional endeavours, including the role of diagnostic evaluation. Basically, laboratory and diagnostic tests are tools by and of themselves, they are not therapeutic. In conjunction with a pertinent history and physical examination, these tests can confirm a diagnosis or provide valuable information about a patient status and response to therapy. In addition to these, laboratory findings are essential for epidemiological surveillance and research purposes. If the entire network of a laboratory service is to be effectively utilized and contribute to health care and disease prevention, every member of its work force need to: Follow professional ethics and code of conduct, Experience job satisfaction and have professional loyalty.

Nomenclature: Medical Laboratory Technology practical I

Course Outcomes:

CO1 – The learner will acquire the practical skills of laboratory based on antibiotic susceptibility tests and serodiagnostic tests.
CO2 – The student will gain the knowledge of identification systems of bacteria and newer approaches in MLT.
CO3 – The learner will understand practical's related to clinical biochemistry.

Curriculum:

Title	Learning Points	No. of Lectures
Medical Laboratory Technology practical I	1. Study of hot air oven 2. Study of autoclave 3. Widal test 4. VDRL test 5. Identification of *Staphylococci* 6. Identification of *Enterococci* 7. Identification systems for bacteria – VITEK2 and API20 (Demonstration) 8. Applications of PCR in diagnostics (Demonstration) 9. Estimation of SGPT/ALT 10. Estimation of SGOT/AST 11. MIC of antibiotic 12. Disc diffusion method 13. Blood sugar estimation by GOD/POD 14. Thyroid tests 15. hCG testing for pregnancy	**60**

Learning Resources recommended:

1. Practical Medical Microbiology, Mackie and McCartney.
2. Text book of medical laboratory technology, 2nd edition, Praful Godkar and Darshan Godkar
3. Medical laboratory technology, A procedure manual for routine diagnostic tests, Volume II and III Kanai Mukherjee. Tata McGraw Hill.
4. A hand book of medical laboratory technology, V. H. Talib 2nd ed.

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Experiment (Internal assessment)	10
Viva	05
Journal	05
Total	**20**

B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
Total	**30`**

Syllabus for (B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Field Project (P)**
Course Code	**25_USMBF512**
Class	T.Y.B.Sc.
Semester	V
No of Credits	4
Nature	Project/ Case Study
Type	Field Project
Relevance with Employability/ Entrepreneurship/ Skill development	The courses primary goal is to provide students with the experimental knowledge and skills necessary to carried out research projects. Simultaneously students can develop a range of skills such as critical thinking and analysis, decision-making, research and investigation, communication and presentation, contextual understanding and knowledge that can be applied in real-world settings.

Guidelines and Evaluation pattern for Field Project (FP)

The field project is designed for undergraduate courses to give students the opportunity to participate in hands-on, field-based projects under faculty supervision. A field project allows students to apply their theoretical knowledge to real-world situations by conducting observations, surveys, interviews, and other activities outside the classroom. This experience helps students gain practical skills and develop their communication, innovative thinking, and teamwork abilities.

Course Outcomes:

By the end of the course, students should be able to:

1. Enhance interpersonal skills by working in teams.
2. Improve written and verbal communication by preparing reports, presentations, and discussions on project findings.
3. Develop critical thinking through observations.
4. Apply theoretical concepts learned in the classroom to real-world situations in their respective fields.

Course Duration:

Learners have to work 120 hours (for 4-credits) in semester for field Project.

30 hours (for 4-credits) for classroom activities.

- Project planning and preparation for the field project.
- Preparation of report etc.

90 hours (for 4-credits) for out-of-class activities.

- Implement the planned fieldwork activities according to the project schedule.
- Collect data through interviews, surveys, observations, etc.

Project Report should be of minimum 20-40 pages or as per the guidelines of the concerned department.

Report Structure:

The students will be required to submit a comprehensive report at the end of the Field Project (FP). A project report has to be brief in content and must include the following aspects:

1. **Title Page:**
   Mentioning the title of the FP, name of the student, programme, institution, month and year.
2. **Certificate of Completion:**
   A certificate issued by the supervisor appointed from the department confirming the successful completion of the FP.
3. **Acknowledgments:**
   Recognizing individuals or organizations that provided support, guidance during the FP.
4. **Table of Contents:**
   Providing a clear outline of the report's sections and page numbers.

5. **Introduction:**
   Background information about the FP and its significance. Objectives and scope of the project.
6. **Preparation for the FP:** Description of planning for data collection, such as interviews, survey etc.

7. **Field Visits and Observations:**
   Detailed accounts of the field visits, including locations, dates, and observations made during the visits. Photographs or visual aids to support the observations.
8. **Conclusion & Summary:**
   Summary of the key findings and outcomes of the FP. Reflections on the overall experience and learning during the project.

Broad guidelines for project report:

The field project report shall be prepared as per the broad guidelines given below**:**

- Font type and size: Times New Roman; size:12 for content and 14 for title; size:16 for content and 18 for title; mangal; size:12 for content and 14 for title
- Line Space: 1.5 cm for content and 1 cm for in table work
- Paper Size: A4
- Margin: in Left-1.5cm, Up-Down-Right-1cm.

Assessment Pattern 60:40

Sr. No	Field Project work	Distribution of Marks
1	External: Field work and report	60
2	Internal Evaluation	
	Presentation / Viva-Voce	40

Sr. No.	***Subjects for Field Project***
1	Soil Microbial Diversity in Agricultural vs. Forest Areas.
2	Isolation and Identification of Airborne Microbes in Urban and Rural Areas.
3	Water Quality Assessment Using Microbial Indicators.
4	Study of Antibiotic Resistance in Local Bacterial Isolates.
5	Microbiological Analysis of Street Food Samples.
6	Role of Microbes in Organic Waste Decomposition.
7	Assessment of Fungal Contamination in Stored Grains.
8	Microbial Flora of Human Skin Before and After Sanitizer Use.
9	Isolation of Nitrogen-Fixing Bacteria from Legume Roots.
10	Detection of Coliform Bacteria in Drinking Water Sources.
11	Microbial Contamination in Public Transportation Surfaces.
12	Effect of pH and Temperature on Microbial Growth in Soil Samples.
13	Assessment of Probiotic Content in Commercial Yogurt Brands.
14	Biofilm Formation on Medical Devices: A Case Study in Clinics.
15	Study of Endophytic Microbes in Medicinal Plants.
16	Microbiological Quality of Milk from Local Vendors vs. Packaged Milk.
17	Survey of Antibiotic Usage and Its Effects on Gut Microbiota.
18	Bioremediation Potential of Bacteria from Polluted Sites.
19	Seasonal Variation in Airborne Microbial Load in Classrooms.
20	Any other subjects of your choice and get it approved by the field project guide.

Format for the report

Title page

Title of the Field Project

A Project Submitted

To

R. P. Gogate college of Arts & Science and

R.V. Jogalekar College of Commerce (Autonomous), Ratnagiri

under

University of Mumbai

T. Y. B. Sc.

Semester V

Name of the student

Name of the supervisor

Gogate Jogalekar College (Autonomous), Ratnagiri

Month and Year

On separate page

R. P. Gogate College of Arts and Science and

R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri

Certificate

This is to certify that [Student's Full Name] [Student's Roll Number], has successfully completed field project entitled, "_____" under my supervision.

I further certify that the entire work has been done by the learner under my guidance and that no part of it has been submitted previously for any Degree or Diploma of any University.

It is her/his own work and facts reported by her/his personal findings and investigations.

Name and Signature of supervisor

Date of submission:

On separate page

Acknowledgment

(Model structure of the acknowledgement)

I thank the R. P. Gogate college of Arts & Science and R.V. Jogalekar College of Commerce (Autonomous), Ratnagiri & University of Mumbai for giving me opportunity to do this Field Project.

I would like to thank my Principal, Prof. Dr M. R. Sakhalkar for providing the necessary facilities required for completion of this project.

I take this opportunity to thank our Vice Principal _____ and Head of the department

_____, for his/her moral support and guidance.

I would also like to express my sincere gratitude towards my project supervisor _____whose guidance and care made the project successful.

I would like to thank my College Library, for having provided various reference books and magazines related to my project.

Lastly, I would like to thank each and every person who directly or indirectly helped me in the completion of the project especially my Parents and Peers who supported me throughout my project.

[Name of the learners]

Bachelor of Science (B.Sc.) Programme

Under Choice Based Credit System (CBCS)

T.Y.B.Sc. [Microbiology] - Semester VI

Course Structure

(To be implemented from Academic Year 2025-26)

Course Code	Semester VI		Credits
Discipline Specific Courses (DSC)			
Major Mandatory			
25_USMBM601	Virology & rDNA Technology (T)		**02**
25_USMBM602	Medical Microbiology & Immunology : Part II (T)		**02**
25_USMBM603	Microbial Biochemistry : Part II (T)		**02**
25_USMBM604	Microbiology Practical V (P)		**02**
25_USMBM605	Microbiology Practical VI (P)		**02**
Major Electives (Any 1)			
25_USMBE606	Bioprocess Technology : Part II (T)	**02**	**04**
25_USMBE607	Microbiology Practical VII (P)	**02**	
OR			
25_USMBE608	Clinical Microbiology & Infectious Diseases (T)	**02**	
25_USMBE609	Microbiology Practical VIII (P)	**02**	
Vocational Skill Course (VSC)			
25_USMBV610	Medical Laboratory Technology : Part II (T)		**02**
25_USMBV611	Medical Laboratory Technology Practical II (P)		**02**
On Job Training			
25_USMBJ612	On Job Training (P)		**04**
Total Credits			**22**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Virology and rDNA Technology (T)**
Course Code	**25_USMBM601**
Class	T.Y.B.Sc.
Semester	VI
No of Credits	2
Nature	Theory
Type	Major mandatory
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	Microbes are ideally suited for biochemical and genetics studies. The rDNA technology allows scientist to insert, delete or modify specific genes of an organism's DNA in a precised and controlled manner. Recombinant DNA is also used to produce food additives and enzymes for the production of various food products. The rDNA technology provides technical expertise in micro or molecular biology techniques including real-time PCR and data analysis. It performs PCR, RT-PCR, real time RT-PCR. It utilizes PCR denature, anneal, elongate and amplification of a DNA fragment. DNA fingerprinting utilized for the identification purpose. Bioinformatics helps the doctors to more accurately diagnose and treat diseases.

Nomenclature: Virology and rDNA Technology

Course Outcomes:

CO1- This module will make the student to understand the methods to construct recombinant DNA molecules, also know the tools required like vectors, restriction enzymes etc.

CO2- The student will know about gene expression in prokaryotes, operon as a unit of gene regulation, regulation of gene expression in prokaryotes and bacteriophages. The student will also understand about general structure, life cycle and classification of viruses.

CO3- The learner will understand the basic structure and life cycle of different viruses and their cultivation. The student will get basic knowledge on Prions, Viriods and viruses causing cancer.

Curriculum:

Unit	Title	Learning Points	No of Lectures
1	**Recombinant DNA Technology**	1.1 Branches of Genetics a) Transmission genetics b) Molecular genetics c) Population genetics d) Quantitative genetics 1.2 Model Organisms a) Characteristics of a model organism b) Examples of model organisms used in study c) Examples of studies undertaken using prokaryotic and eukaryotic model organisms 1.3 Plasmids a) Physical nature b) Detection and isolation of plasmids c) Plasmid incompatibility and Plasmid curing d) Cell to cell transfer of plasmids e) Types of plasmids. f) Resistance Plasmids, Plasmids encoding Toxins and other Virulence characteristics, Colfactor, Degradative plasmids. 1.4 Transposable Elements in Prokaryotes a) Insertion sequences b) Transposons: Types, Structure and properties Mechanism of transposition, Integrons. 1.5 Basic steps in Gene Cloning. 1.6 Cutting and joining DNA molecules - Restriction and modification systems, restriction endonucleases, DNA ligases 1.7 Vectors a) Plasmids as cloning vectors. plasmid vectors, pBR322 vector b) Cloning genes into pBR322 c) Phage as cloning vectors, cloning genes into phage vector 1.8 Methods of transformation	**10**

2	**Regulation & Basic Virology**	3.1 A) Lac operon and problems on Lac operon B) Trp operon 3.2 Regulation of lytic and lysogenic pathway of lambda phage 3.3 Viral architecture - Capsid, viral genome and envelope 3.4 Viral classification (Baltimore classification) 3.5 Viral replication cycle - Attachment, penetration, uncoating, types of viral genome, their replication, assembly, maturation & release.	**10**
3	**Advanced Virology**	4.1 Structure of TMV, T4, Influenza virus, HIV. Life cycle of T4 phage, TMV, Influenza Virus and HIV in detail. 4.2 Cultivation of viruses- cell culture techniques, embryonated egg, laboratory animals, Cell culture methods: Equipment required for animal cell culture, Isolation of animal tissue 4.3 Visualization and enumeration of virus particles a) Measurement of infectious units. ➢ Plaque assay ➢ Fluorescent focus assay ➢ Infectious center assay ➢ Transformation assay ➢ Endpoint dilution assay. b) Measurement of virus particles and their components ➢ Electron microscopy. ➢ Atomic force microscopy. ➢ Haemagglutination. ➢ Measurement of viral enzyme activity. 4.4 Role of viruses in cancer: Important definitions, characteristics of cancer cell, Human DNA tumor viruses- EBV, Kaposis sarcoma virus, Hepatitis B and C virus, Papiloma Virus. 4.5 Prions: Defination, Examples of diseases caused by prions, Kuru, PrP protein and protein only hypothesis 4.6 Viroids	**10**

Learning Resources recommended:

Text books:

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. M. Madigan, J. Martinko, J. Parkar, (2009), "Brock Biology of microorganisms", 12th edition, Pearson Education International.
5. Fairbanks and Anderson, (1999), "Genetics", Wadsworth Publishing Company.
6. Prescott, Harley and Klein, "Microbiology",. 7th edition Mc Graw Hill international edition.
7. Edward Wagner and Martinez Hewlett, (2005) "Basic Virology", 2nd edition, Blackwell Publishing
8. Teri Shors,.(2009), "Understanding viruses", Jones and Bartlett publishers.
9. S.Ignacimuthu, (2005), "Basic Bioinformatics", Narosa publishing house.
10. Robert Weaver, (2008), "Molecular biology", 3rd edition, Mc Graw Hill international edition.
11. Primrose and Twyman, (2001), "Principles of gene manipulation and genomics", 6th edition, Blackwell Publishing
12. Arthur Lesk, (2009), "Introduction to Bioinformatics", 3rd edition, Oxford University Press
13. Snustad, Simmons, "Principles of genetics", 3rd edition. John Wiley & sons, Inc.
14. A textbook of biotechnology R. C. Dubey 4 th edition. S. Chand.

Reference books:

1. Flint, Enquist, Racanillo and Skalka, "Principles of virology", 2 nd edition. ASM press.
2. T. K. Attwood & D. J. Parry-Smith, (2003), "Introduction to bioinformatics", Pearson education
3. Benjamin Lewin, (9th edition), "Genes IX", Jones and Bartlett publishers.
4. JD Watson, "Molecular biology of the gene", 5th edition.

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance &Class performance	05
Total	**20**

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		**30**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Medical Microbiology & Immunology: Part – II (T)**
Course Code	**25_USMBM602**
Class	T.Y.B.Sc.
Semester	VI
No of Credits	2
Nature	Theory
Type	Major Mandatory
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	Medical microbiology performs antimicrobial effectiveness testing and other traditional microbiological testing to identify organisms and interpret the results. Tested process equipment and production areas for contamination and environmental pathogens to monitor the effectiveness of sanitation measures throughout the facility. Research focuses on the identification and characterization of bacterial pathogens. Immunologists are actively involved in the drug discovery process in pharmaceutical sector especially for the development of antibodies and vaccines. Immunologists are employed in a varied range of organization across different areas in science and medicine.

Nomenclature: Medical Microbiology & Immunology: Part - II

Course Outcomes:

CO1- The learners shall understand the virulence factors, morphological and cultural features of the pathogen and correlate these virulence factors with the pathogenesis and clinical features of the disease.

CO2- The learners shall understand clinical features of pathogens and identify the causative agent.

CO3- The learners shall understand the structure and role of T and B cells in generating adaptive immunity and thereby study effector responses in both Humoral & Cell Mediated Immunity.

CO4- The learners shall understand the activation of complement system.

Curriculum:

Unit	**Title**	**Learning Points**	**No of Lectures**
1	**Study of a Few Diseases II (with Emphasis on Cultural Characteristics of the Etiological Agent, Pathogenesis,**	**Part A - Study of Human Diseases** 1.1 Study of vector-borne infections.- Malaria 1.2 Study of sexually transmitted infectious diseases - AIDS 1.3 Study of central nervous system infectious diseases -	**10**

	Laboratory Diagnosis and Prevention) and Chemotherapy	Tetanus , Polio **Part B- Chemotherapy of Infectious Agents** 1.4 Mode of action of antibiotics on a) Cell wall- Beta-lactams- Penicillin b) Cell Membrane- Polymyxin c) Protein Synthesis- Streptomycin d) Nucleic acid- Nalidixic acid e) Enzyme inhibitors- Trimethoprim 1.5 List of common antibiotics - used for treating viral, fungal and parasitic diseases. 1.6 Selection and testing of antibiotics for bacterial isolates by Kirby Bauer method	
2	**Immunology - I**	2.1 T cells a) T Cell Receptor-structure (alpha-beta, gamma-delta TCR) b) TCR-CD3 complex - structure and functions. Accessory molecules c) T cell activation d) Costimulatory signals e) Superantigens induced T cell activation f) T cell differentiation (Memory and Effector cells) 2.2 Cell mediated effector response a) General properties of effector T cells b) Cytotoxic T cells and destruction of target cell by perforin/granzyme pathway and Fas pathway c) Killing mechanism of NK cells 2.3 B cells a) B cell receptor and co-receptor-structure and function b) B cell activation and Differentiation 2.4 Humoral Response a) Primary and secondary responses b) In vivo sites for induction of Humoral response c) Germinal centers and antigen induced B cell Differentiation ➢ Cellular events within germinal centers- Overview ➢ Generation of plasma cells and memory cells	**10**
3	**Immunology – II**	3.1 Vaccines a) Active and passive immunization b) Types of vaccines - Killed and attenuated vaccines, Whole organism vaccines, Purified macromolecules as vaccines, recombinant viral vector vaccines, DNA vaccines c) Use of adjuvants in vaccine	**10**

		d) New vaccine strategies e) Ideal vaccine f) Route of vaccine administration, Vaccination schedule 3.2 Immunohaematology a) Human blood group systems, ABO, secretors and non secretors, Bombay Blood group. Rhesus system and list of other blood group systems b) Haemolytic disease of new born, Coombs test. 3.3 Complement System a) Functions and components of complement b) Complement Activation—classical, alternative and lectin pathway	

Learning Resources recommended: Text books:

1. Jawetz, Melnick and Adelberg's Medical Microbiology, 26th edition, Lange publication
2. Ananthanarayan and Panicker's, Textbook of Microbiology, 10th edition 2017
3. Ananthanarayan and Panicker's, Textbook of Microbiology, 9th edition
4. Ananthanarayan and Panicker's, Textbook of Microbiology, 8th edition
5. Introduction to diagnostic microbiology for lab Science Maria Dannessa Delost 2015
6. Prescott's microbiology 10th edition 2017
7. Kuby Immunology,4th and 6th edition, W H Freeman and Company
8. Pathak & Palan, Immunology: Essential & Fundamental, 1st& 3rd edition, Capital Publishing Company
9. Fahim Khan, Elements of Immunology, Pearson Education

Reference books:

1. Baron Samuel , Medical Microbiology, 4th edition
   http://www.ncbi.nlm.nih.gov/books/NBK7627/
2. Kuby Immunology, 7th edition, W H Freeman and Company
   http://www.macmillanlearning.com/catalog/static/whf/kuby/

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance &Class performance	05
Total	**20**

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		**30**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Microbial Biochemistry: Part – II (T)**
Course Code	**25_USMBM603**
Class	T.Y.B.Sc.
Semester	VI
No of Credits	02
Nature	Theory
Type	Major Mandatory
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	In biochemistry has working area like research lab, product development, healthcare and forensics. To successfully gain employment in biochemistry, problem solving, data analysis, process creation and project management are the key skills. In addition, you will develop a deeper understanding of the fundamental processes of life at molecular and cellular levels.

Nomenclature: Microbial Biochemistry: Part - II

Course Outcomes:

CO1- The learner will have an understanding of metabolism of lipids, fatty acids, nucleotides and amino acids.

CO2- The learner will have an understanding of catabolism of protein and nucleotides.

CO3- The learner will have an understanding of regulation of metabolic process and photosynthesis and metabolism of inorganic molecules.

Curriculum:

Unit	Title	Learning Points	No of Lectures
1	**Lipid Metabolism & Catabolism of Hydrocarbons**	1.1 Introduction to Lipids a) Lipids –Definition, classification & functions b) Types and role of fatty acids found in bacteria c) Common phosphoglycerides in bacteria 1.2 Catabolism of Fatty Acids and PHB a) Oxidation of saturated fatty acid by β oxidation pathway b) Oxidation of propionyl CoA by acrylyl- CoA pathway and methylcitrate pathway c) PHB as a food reserve and its degradation 1.3 Anabolism of Fatty Acids & Lipids a) Biosynthesis of straight chain even carbon	**10**

		saturated fatty acid (palmitic acid) b) Biosynthesis of phosphoglycerides in bacteria c) Biosynthesis of PHB 1.4 Catabolism of aliphatic hydrocarbons a) Organisms degrading aliphatic hydrocarbons b) Omega oxidation pathway ➢ Pathway in *Corynebacterium* and yeast	
2	**Metabolism of Proteins and Nucleic Acids.**	2.1 Protein / amino acid catabolism a) Enzymatic degradation of proteins. b) General reactions of amino acids catalyzed by ➢ Amino acid decarboxylases ➢ Amino acid deaminases ➢ Amino acid transaminases ➢ Amino acid racemases c) Metabolic fate of amino acids – Glucogenic and ketogenic amino acids. d) Fermentation of single amino acid - Glutamic acid by *Clostridium tetanomorphum* e) Fermentation of pair of amino acids - Stickland reaction (include enzymes) 2.2 Anabolism of amino acids a) Schematic representation of amino acid families b) Biosynthesis of amino acids of Serine family (Serine, Glycine and Cysteine) 2.3 Catabolism of Nucleotides a) Degradation of purine nucleotides up to uric acid formation b) Salvage pathway for purine and pyrimidine nucleotides 2.4 Biosynthesis of nucleotides a) Nomenclature and structure of nucleotides b) Role of nucleotides (high energy triphosphates) c) Biosynthesis of pyrimidine nucleotides d) Biosynthesis of purine nucleotides e) Biosynthesis of deoxyribonucleotides	**10**
3	**Metabolic Regulation & Photosynthesis**	3.1 Regulation of enzyme activity a) Noncovalent enzyme inhibition ➢ Allosteric enzymes and feedback inhibition b) Covalent modification of enzymes ➢ Regulation of Glutamine synthetase 3.2 DNA binding proteins and regulation of transcription by positive & negative control	**10**

		a) Negative control of transcription: Repression and Induction b) Positive control of transcription: Maltose catabolism in E. coli 3.3 Regulation of EMP and TCA cycle 3.4 Photosynthesis a) Definition of terms in photosynthesis (light and dark reactions, Hill reaction & reagent, Photophosphorylation) b) Photosynthetic pigments c) Photochemical generation of reductant 3.5 Light reactions in: a) Purple photosynthetic bacteria b) Green Sulphur bacteria c) Cyanobacteria (with details) 3.6 Dark reaction ➢ Calvin Benson cycle	

Learning Resources recommended: Text books:

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, 5 th 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. G. Moat, J.W. Foster, M, P. Spector. (2002), Microbial Physiology, 4th edition, WILEY-LISS 7. Madigan, M.T. and J.M. Martinko2006. 11th edition, Brock Biology of Microorganisms. Pearson Prentice Hall.

Reference books:

1. Zubay, G. L (1996), Biochemistry, 4th edition, Wm. C. Brown publishers
2. Zubay, G. L (1996), Principles of Biochemistry, Wm. C. Brown publishers
3. Principles of Biochemistry, Lehninger, 5th edition, W. H. Freeman and Company

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance &Class performance	05
Total	**20**

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		**30**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Microbiology Practical V (P)**
Course Code	**25_USMBM604**
Class	T.Y.B.Sc.
Semester	VI
No of Credits	2
Nature	Practical
Type	Major mandatory
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	The rDNA technology provides technical expertise in micro or molecular biology techniques including real-time PCR and data analysis. It performs PCR, RT-PCR, real time RT-PCR. It utilizes PCR denature, anneal, elongate and amplification of a DNA fragment. DNA fingerprinting utilized for the identification purpose. Research focuses on the identification and characterization of bacterial pathogens. Immunologists are actively involved in the drug discovery process in pharmaceutical sector especially for the development of antibodies and vaccines.

Nomenclature: Microbiology Practical V

Course Outcomes:

CO1- The students will acquire skill to perform the laboratory techniques and experiments based on isolation of genomic DNA.

CO2- The learner will acquire the practical skills of screening of microorganisms producing lipase, PHB and protease.

Curriculum:

Title	Learning Points	No. of Lectures
Virology and rDNA Technology	1. Enrichment of coliphages, phage assay (pilot & proper). 2. Restriction digestion of lambda phage /any plasmid DNA (Demo) 3. Beta galactosidase assay	**60**
Microbial Biochemistry: Part - II	1. Detection of PHB producing bacteria 2. Protein estimation by Lowry's method 3. Qualitative detection of Lipase 4.Study of breakdown of amino acids – Lysine decarboxylase and Deaminase activity	

Learning Resources recommended:

Text books:

1. Prescott, Harley and Klein, "Microbiology". 7th edition Mc Graw Hill international edition.
2. S.Ignacimuthu, (2005), "Basic Bioinformatics", Narosa publishing house.
3. Robert Weaver, (2008), "Molecular biology", 3rd edition, Mc Graw Hill international 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.

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Experiment (Internal assessment)	10
Viva	05
Journal	05
Total	**20**

B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
Total	**30`**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Microbiology Practical VI (P)**
Course Code	**25_USMBM605**
Class	T.Y.B.Sc.
Semester	VI
No of Credits	2
Nature	Practical
Type	Major Mandatory
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	The rDNA technology provides technical expertise in micro or molecular biology techniques including real-time PCR and data analysis. It performs PCR, RT-PCR, real time RT-PCR. It utilizes PCR denature, anneal, elongate and amplification of a DNA fragment. DNA fingerprinting utilized for the identification purpose. Research focuses on the identification and characterization of bacterial pathogens. Immunologists are actively involved in the drug discovery process in pharmaceutical sector especially for the development of antibodies and vaccines.

Nomenclature: Practical VI

Course Outcomes:

CO1- The students will learn Antibiotic selection specific for microorganisms.
CO2- The students will acquire skill to perform blood grouping.
CO3- The students will acquire skill to perform quantitative detection of important metabolic products such as protein and uric acid.

Curriculum:

Title	Learning Points	No. of Lectures
Medical Microbiology & Immunology: Part - II	1. Selection and testing of antibiotics using the Kirby-Bauer method 2. Blood grouping – Direct & Reverse typing 3. Coomb's Direct test 4.Determination of Isoagglutinin titer 5. Demonstration experiment - Widal	**60**
Microbial Biochemistry: Part - II	1. Estimation of uric acid 2. Qualitative and Quantitative assay of Protease 3. Qualitative detection of Lipase	

Learning Resources recommended:

Text books:

1. Prescott, Harley and Klein, "Microbiology",. 7th edition Mc Graw Hill international edition.
2. S.Ignacimuthu, (2005), "Basic Bioinformatics", Narosa publishing house.
3. Robert Weaver, (2008), "Molecular biology", 3rd edition, Mc Graw Hill international 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.

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Experiment (Internal assessment)	10
Viva	05
Journal	05
Total	**20**

B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
Total	**30`**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Bioprocess Technology: Part – II (T)**
Course Code	**25_USMBE606**
Class	T.Y.B.Sc.
Semester	VI
No of Credits	2
Nature	Theory
Type	Major Elective
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	Industrial microbiology used for the production of important substances, such as antibiotics, food products, enzymes, amino acids, vaccines and fine chemicals. Industrial microbiology trains junior microbiologists on microbiology test methods and lab procedures. The demonstrated good laboratory documentation skills and documentation requirements. It performs preparatory testing and anti-microbial preservative effectiveness testing on pharmaceutical products.

Nomenclature: Bioprocess Technology: Part - II

Course Outcomes:

CO1- The learners shall understand the recovery and purification process involved in fermentations of important products.

CO2- The learners shall understand knowledge of applications of animal and plant tissue culture techniques.

CO3- The learners shall understand the working of important instruments used in biochemical analysis and bioassay.

Curriculum:

Unit	Title	Learning Points	No of Lectures
1	**Downstream Processing**	1.1 Recovery and purification a) Introduction b) Methods of DSP: Precipitation, Filtration, Centrifugation, Cell Disruption, Liquid-Liquid Extraction, Solvent Recovery, Chromatography, Whole Broth Processing 1.2 Effluent treatment a) Introduction b) Treatment process (Physical, chemical and biological)	**10**

2	**Advances in Bioprocess Technology**	2.1 Animal biotechnology a) Primary cell culture and established cell lines b) Basic techniques of mammalian cell culture c) Growth media d) Cell viability- Direct and Indirect methods for quantification e) Applications of cell culture: Vaccines, somatic cell fusion, valuable products. 2.2 Plant tissue culture a) Introduction b) Requirements for in vitro culture, Methods of plant cell and tissue culture c) Types of cultures of plant materials: explants, callus, organogenesis, root culture, shoot culture, micropropagation, suspension culture, protoplast culture. d) Applications: Production of virus free plant, In vitro selection of cell lines for disease resistance. 2.3 Immobilized enzyme and cells a) Introduction and Definitions b) Methods c) Immobilized Enzyme Reactors d) Applications	**10**
3	**Quality Assurance, Quality Control, and Bioassay**	3.1 Quality assurance and quality control. a) Definitions, Chemical and pharmaceutical products b) Q.A and Q.C wrt.- Raw materials, method of manufacturing, in process items, finished products, label and labeling, packaging materials c) Control of microbial contamination during manufacturing 3.2 Sterilization control and assurance. 3.3 Bioassay a) Introduction b) Types: Diffusion, End Point, Turbidometric, Metabolic Response, Enzymatic 3.3 Intellectual Property Rights a) Introduction b) Overview of patent system	**10**

Learning Resources recommended:

Text books:

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. H. K. Das., "Text book of Biotechnology", 2nd and 3rd edition.
5. A textbook of biotechnology R. C. Dubey 4th edition. S. Chand.
6. H. A. Modi, (2009). ''Fermentation Technology'' Vol. 1 & 2, Pointer Publications, India
7. Okafor Nduka (2007) ''Modern Industrial Microbiology and Biotechnology'', Science Publications Enfield, NH, USA.
8. Crueger W. and Crueger A. (2000) "Biotechnology -"A Textbook of Industrial Mircrobilogy.
9. Microbiology", 2 nd edition, Panima Publishing Corporation, New Delhi.
10. Prescott and Dunn's ''Industrial Microbiology'' (1982) 4th edition, McMillan Publishers.
11. Veerakumari L. "Bioinstrumentation", MJP Publisher
12. Pharmaceutical Microbiology, Hugo and Russell, 7 th edition, Blackwell Science.

Reference books:

1. Peppler, H. J. and Perlman, D. (1979), "Microbial Technology''. Vol 1 & 2, Academic Press.
2. Williams, Bryan L; Wilson, 2 nd edition." A Biologist's guide to principles and techniques of practical biochemistry" Baltimore: University Park Press, 1981.
3. Wilson, Keith, 1936-; Goulding, Kenneth H, 3 rd edition., A Biologist's guide to principles and techniques of practical biochemistry" London ; Baltimore : E. Arnold, 1986.
4. Wilson and Walker, "Principles and techniques of practical biochemistry" 5 th edition.

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance &Class performance	05
Total	**20**

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		**30**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Microbiology Practical VII (P)**
Course Code	**25_USMBE607**
Class	T.Y.B.Sc.
Semester	VI
No of Credits	02
Nature	Practical
Type	Major Elective
Highlight revision specific to employability/ entrepreneurship/ skill development	To successfully gain employment in biochemistry, problem solving, data analysis, process creation and project management are the key skills. Industrial microbiology used for the production of important substances, such as antibiotics, food products, enzymes, amino acids, vaccines and fine chemicals.

Nomenclature: Microbiology Practical VII

Course Outcomes:

CO1- The learner will acquire the practical skills of screening of microorganisms producing lipase, PHB and protease.

CO2- The students will acquire skill to perform detection of enzymes which play an important role in amino acid and nitrate metabolism.

CO3- The students will acquire skill to perform quantitative detection of important metabolic products such as protein and uric acid.

CO4-The learner will acquire the practical skills and techniques involved in running a bioassay, immobilization of cells & sterility testing.

Curriculum:

Title	Learning Points	No. of Lectures
Microbiology Practical VII	1. Bioassay of Penicillin. 2. Bioassay of Cyanocobalamin. 3. Perform immobilization of yeast cells for invertase activity - making of beads, Determination of activity and count by haemocytometer and viable count. 5. Sterility testing of injectable. 6. Chemical estimation of Penicillin 7. Estimation of phenol. 8. Industrial Visit	**60**

Learning Resources recommended:

Text books:

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, 5 th edition, 1987. John Wiley & Sons. New York.
3. Crueger W. and Crueger A. (2000) "Biotechnology -"A Textbook of Industrial Microbiology.
4. Casida L. E., "Industrial Microbiology" (2009) Reprint, New Age International (P) Ltd, Publishers, New Delhi.
5. Stanbury P. F., Whitaker A. & Hall S. J., (1997), "Principles of Fermentation Technology", 2nd edition, Aditya Books Pvt. Ltd, New Delhi.

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Experiment (Internal assessment)	10
Viva	05
Journal	05
Total	**20**

B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
Total	**30`**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Clinical Microbiology & Infectious Diseases (T)**
Course Code	**25_USMBE608**
Class	T.Y.B.Sc.
Semester	VI
No of Credits	2
Nature	Theory
Type	Major Elective
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	Clinical microbiology focuses on the isolation and characterization of infectious organisms so they can be managed and treated in patients. Infections can be caused by bacteria, fungi, viruses, and parasites. To diagnose an infection, a sample must be collected from a patient at a body site where the detection of a pathogen or its associated biomarkers is likely to signify disease. Clinical microbiology is a subspecialty of medicine which is laboratory based and is dedicated to the detection of infection by the analysis of clinical samples. It is distinct from but overlaps with infectious diseases, which, in contrast, have a clinical base. Clinical microbiology is one of a group of laboratory or pathology based specialties which includes clinical biochemistry, clinical immunology, clinical genetics, clinical haematology and histopathology which all historically arose from discrete areas of expertise.

Nomenclature: Clinical Microbiology & Infectious Diseases

Course Outcomes:

CO1- The learners shall understand the virulence mechanism of bacteria.
CO2- The learners shall understand the characteristics, pathogenesis, diagnosis, treatment and prevention of infectious diseases.
CO3- The learners shall understand the mechanism of action of chemotherapeutic agent.

Curriculum:

Unit	Title	Learning Points	No of Lectures
1	**Bacterial Strategies for Evasion**	1.1. Study of virulence mechanisms in bacteria a) Pathogenicity islands b) Bacterial virulence factors ➢ Adherence factors ➢ Invasion of host cells and tissues 1.2 Toxins a) Exotoxins b) Exotoxins associated with diarrhoeal diseases and food poisoning c) LPS of gram negative bacteria 1.3 Enzymes a) Tissue degrading enzymes b) IgA1 proteases 1.4 Antiphagocytic factors 1.5 Intracellular pathogenicity 1.6 Antigenic heterogeneity 1.7 The requirement for iron	**10**
2	**Study of Infectious Diseases**	2.1 Study of A Few Infectious Diseases wrt. Cultural Characteristics of the etiological agent, pathogenesis & clinical features, laboratory diagnosis, treatment and prevention only a) Fungal infections- Candidiasis b) Rotavirus diarrhoea c) Syphilis d) Gonorrhoea e) Polio f) Meningococcal meningitis	**10**
3	**Chemotherapeutic agents and Drug resistance**	3.1 Attributes of an ideal chemotherapeutic agent a) Selective toxicity b) Bioavailability of drug c) Route of drug administration d) LD50 and MBC 3.2 Mechanism of action of antibiotic- Cephalosporin, Carbapenems. Imidazole, Tetrracycline, Chloramphenicol, Rifamycin, Trimethoprim 3.3 Mechanisms of drug resistance a) Evolution of drug resistance b) Pathways c) Origin for ESBL, VRE, MRSA	**10**

		3.4 Methods that detect *S. aureus* resistance to methicillin, and determination of ESBL strains	

Learning Resources recommended:

Text books:

1. Jawetz, Melnick and Adelberg's Medical Microbiology, 26th Edition, Lange publication
2. Ananthanarayan and Panicker's, Textbook of Microbiology, 10th edition
3. Ananthanarayan and Panicker's, Textbook of Microbiology, 9th edition
4. Ananthanarayan and Panicker's, Textbook of Microbiology, 8th edition
5. Kuby Immunology, 6th Edition, W H Freeman and Company
6. Pathak & Palan, Immunology: Essential & Fundamental, 1st & 3rd edition, Capital Publishing Company
7. Fahim Khan, Elements of Immunology, Pearson Education
8. Introduction to diagnostic microbiology for lab Science Maria Dannessa Delost 2015
9. Prescott's microbiology 10th edition 2017

Reference books / Internet references:

1. Kuby Immunology, 7th edition, W H Freeman and Company
2. Ananthanarayan and Panicker's, Textbook of Microbiology, 8th edition
3. Baron Samuel , Medical Microbiology, 4th edition
4. http://www.ncbi.nlm.nih.gov/books/NBK7627/
5. http://www.macmillanlearning.com/catalog/static/whf/kuby/

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance &Class performance	05
Total	**20**

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		**30**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Microbiology Practical VIII (P)**
Course Code	**25_USMBE609**
Class	T.Y.B.Sc.
Semester	VI
No of Credits	2
Nature	Practical
Type	Major Elective
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	Infectious diseases are disorders caused by organisms — such as bacteria, viruses, fungi or parasites. Many organisms live in and on our bodies. They're normally harmless or even helpful. But under certain conditions, some organisms may cause disease. Antibiotic resistance occurs when bacteria change so that antibiotic medicines can't kill them or stop their growth. As a result, bacterial infections become extremely difficult to treat. The clinical microbiology and infectious diseases practicls are ased on variety of knowledge related to qualitative and quantitative tests. The identification of clinical pathogens is achieved. It allows the testing of antibiotic resistance like MRSA and VRE.

Nomenclature: Microbiology Practical IV

Course Outcomes:

CO1- The learner will acquire the practical skills of laboratory techniques used in qualitative and quantitative assay of pathogens.
CO2- The learner will acquire the hands on skill of detection of antibiotic resistant isolates.
CO3- The learner will acquire the practical skills of antigenic preparation of pathogen.

Curriculum:

Title	Learning Points	No. of Lectures
Practical's of clinical microbiology and infectious diseases	1. Qualitative and Quantitative test for VDRL 2. Identification of candida species using germ tube test and growth on chrom agar. 3. Detection of specific types of antibiotic resistance- MRSA and VRE. 4. Determination MBC of an antibiotic. 5. Study of virulence factor of *S. aureus*	**60**

Learning Resources recommended:

Text books:

1. Kuby Immunology, 6th Edition, W H Freeman and Company
2. Pathak & Palan, Immunology: Essential & Fundamental, 1st& 3rd edition, Capital Publishing Company
3. Fahim Khan, Elements of Immunology, Pearson Education

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Experiment (Internal assessment)	10
Viva	05
Journal	05
Total	**20**

B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
Total	**30`**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Medical Laboratory Technology – Part II (T)**
Course Code	**25_USMBV610**
Class	T.Y.B.Sc.
Semester	VI
No of Credits	02
Nature	Theory
Type	Vocational Skill Course (VSC)
Highlight revision specific to employability/ entrepreneurship/ skill development	Introduction to Medical Laboratory Technology is a basic course that equips the student with the most essential knowledge and skill pertaining to medical laboratories such as: Mycology, Parasitology, Virology, Organ function tests, Clinical pathology and histopathology. This course is extremely important for the student as it paves the ways to easily understand various professional courses such as Haematology, Bacteriology, Urinalysis, Parasitology, and others. Hence, great emphasis should be given to this subject matter so as to train qualified, competent and task oriented medical laboratory technologists.

Nomenclature: Medical Laboratory Technology – Part II

Course Outcomes:

CO1- The learner will understand the steps involved in specimen collection.
CO2 -The learner will get the knowledge of Parasitology, Mycology and Virology.
CO3 -The student should be able to understand various organ function test.
CO4 -The students shall understand the examination of biological specimens.

Curriculum:

Unit	Title	Learning Points	No of Lectures
I	**Mycology, Parasitology, and Virology**	**2.1 Mycology:** a) Laboratory approach for diagnosis of fungal infections- Specimen collection and transport, processing, direct examination, preparation of mounts for study, selection and inoculation of culture media b) Identification of dermatophytes and Candida. **2.2 Parasitology:** Collection, transport and processing of specimens. a) Fecal specimens- Preservation of clinical specimens, visual examination, processing fresh stool specimens for ova and parasitic examination. b) Examination of intestinal specimens other than stool. **2.3 Virology:** a) Collection of specimens for diagnosis, b) Transportation and storage of specimens, c) Methods for diagnosis of viral infections (Tabulation), d) Detection of HIV, Hepatitis B viral infections in clinical specimens.	**10**
II	**Organ Function Tests**	**2.1** Cardiac Profile Test – Introduction, Functions of heart, Ischemic heart diseases and their manifestation; Lipid profile tests. **2.2** Gastric function Tests – Introduction, gastric analysis, tests involved and gastrointestinal hormones. **2.3** Liver function tests – Introduction to liver function, types of jaundice; abnormalities of bile pigment and bile acid, change in enzyme and plasma proteins and their determination **2.4** Kidney function test – Introduction-kidney function; test to determine renal blood flow; creatinine clearance; urea clearance; diseases of kidney.	**10**

III	**Clinical Pathology and Histopathology**	**3.1** Routine urine analysis – Physiology of urine formation, composition of normal urine, collection of urine specimens, routine examination of urine – physical, chemical & microscopic **3.2** Routine stool analysis – Importance of stool examination, collection of fecal specimen physical examination – color & consistency, odor, presence of blood mucus & pus. Other findings in stool microscopic examinations **3.3** Examination of C.S.F. – C.S.F. collection, C.S.F. analysis **3.4** Semen analysis, clinical significance, specimen collection, laboratory investigations: physical examination, microscopic examination, sperm morphology – normal & abnormal, chemical examination **3.5** Lab examination of sputum – Collection, examination: quantity, consistency, Colour, odour, examination of stained/unstained sputum, chemical examination, parasites **3.6** Basic histopathology techniques – Basic steps for tissue processing: fixing, embedding, microtomy , staining, mounting (to be covered in brief), cytological techniques (brief idea)	**10**

Learning Resources recommended:

1. Koneman's Color Atlas and Textbook of Diagnostic Microbiology, 6th edition, Washington Winn, jr and others. Lippincott Williams & Wilkins.
2. Practical Medical Microbiology, Mackie and McCartney.
3. Medical Microbiology, B.S. Nagoba and Asha Pichare.
4. Essentials of Diagnostic Microbiology, 1998. Lisa Anne Shimeld, Anne T. Rodgers. Delmar Publishers.
5. Text book of medical laboratory technology, 2nd edition, Balani Publishing House. Authors: Praful Godkar and Darshan Godkar.
6. Introduction to MLT 6th ed F.J.Baker & R.E.Silverton Butterworths.
7. Medical laboratory technology, A procedure manual for routine diagnostic tests, VolumeI. Kanai Mukherjee. Tata McGraw Hill

8. Medical laboratory technology, A procedure manual for routine diagnostic tests, VolumeII. Kanai Mukherjee. Tata McGraw Hill
9. Medical laboratory technology, A procedure manual for routine diagnostic tests, Volume III. Kanai Mukherjee. Tata McGraw Hill
10. Hand book of MLT -Vellore ed-Dr (Mrs) C. Bharucha, Wesley press, Mysore
11. A medical lab for developing countries- Maurice King-ELBS & Oxford uni press
12. Bailey & Scott's - Diagnostic microbiology, 11th ed., Betty Forbes, Daniel, Alice Weissfield. Mosby publisher
13. Atlas of Medical Helminthology and Protozoology, 4th ed. P. L. Chiodini, A. H. Moody, D.W. Manser. Churchill Livingstone
14. A hand book of medical laboratory technology, V. H. Talib 2nd ed.
15. Fundamentals of Biochemistry. New central book agency. Author: A. C. Deb

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance & Class performance	05
Total	**20**

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		**30**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**Medical Laboratory Technology Practical II (P)**
Course Code	**25_USMBV611**
Class	T.Y.B.Sc
Semester	VI
No of Credits	02
Nature	Practical
Type	Vocational Skill Course (VSC)
Highlight revision specific to employability/ entrepreneurship/ skill development	Mastering key laboratory techniques such as different staining and the identification of fungal and parasitic organisms is essential for enhancing employability in the healthcare sector. These skills are critical for roles in clinical microbiology, public health, and pathology, where accurate diagnostics are paramount. For instance, proficiency in techniques like stool culture and the examination of urine and sputum not only strengthens analytical capabilities but also prepares individuals for diverse laboratory environments. This knowledge opens entrepreneurial opportunities, such as developing innovative diagnostic tools and health monitoring products. Overall, these competencies foster essential analytical skills and pave the way for career advancement in various biosciences, making them invaluable for both employability and entrepreneurial pursuits.

Nomenclature: Medical Laboratory Technology Practical II

Course Outcomes:

CO1 - The learner will acquire the lab skills related to mycology and parasitology.
CO2 - The learner shall perform the various pathological tests related to organ functions.
CO3 - The student will learn the staining techniques to study different pathogens.

Curriculum:

Title	Learning Points	No. of Lectures
Medical Laboratory Technology Practical II	1. Gram's staining. 2. Albert's staining. 3. Acid fast staining. 4. Identification of Dermatophytes (Demonstration of permanent slides). 5. Identification of *Candida albicans*. 6. Identification of Malarial parasitic forms in blood smears. 7. Study of transport media. 8. Stool culture and analysis 9. Physical, Chemical, Microscopic examination of a. Urine b. Sputum 10. Pap's staining for the demonstration of Barr bodies in cells 11. Estimation of Cholesterol 12. Estimation of total bilirubin 13. Estimation of creatinine in serum and urine 14. Estimation of blood urea 15. Use of histopathology in lab diagnosis	**60**

Learning Resources recommended:

1. Practical Medical Microbiology, Mackie and McCartney.

2. Text book of medical laboratory technology, 2nd edition, Balani Publishing House.

Authors: Praful Godkar and Darshan Godkar.

3. Medical laboratory technology, A procedure manual for routine diagnostic tests, Volume II and III Kanai Mukherjee. Tata McGraw Hill.

4. A hand book of medical laboratory technology, V. H. Talib 2nd ed.

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Experiment (Internal assessment)	10
Viva	05
Journal	05
Total	**20**

B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
Total	**30`**

Syllabus for (T.Y.B.Sc. Microbiology) Autonomous from the year 2025-26

Name of the Course	**On Job Training**
Course Code	**25_USMBJ612**
Class	UG
Semester	VI
No of Credits	4
Nature	Practical
Type	On Job Training
Relevance with Employability/ Entrepreneurship/ Skill development	On the job training provides learner with the opportunity to acquire hands on experience and practical skills required for specific job roles. It bridges the gap between theoretical knowledge and the practical requirements of the job. Learner can gain valuable insights into the industry practice, company culture, this experience makes them confident and competent candidate when applying for the position increasing the employability prospects. OJT is instrumental in skill development as it focuses on practical job specific competencies like technical skills, soft skills. Overall OJT enhances employability, foster entrepreneurship by providing valuable exposure in various field.

Guidelines and Evaluation pattern for On Job Training
(100 Marks)

Introduction:
Inclusion of On Job Training in the course curriculum of the PG and UG programme is one of the ambitious aspects in the programme structure. The main objective of inclusion of On Job Training is to inculcate ability to interpret particular aspect of the study in his/ her own words.

Guidelines for On Job Training:
Students will be required to undertake a designated project or tasks in an organization or industry relevant to their field of study. The course aims to provide students with practical exposure and hands-on experience in a professional work environment related to their field of study.

Course Objectives:

By the end of the course, students should be able to:

1. Gain exposure to real-world insights and apply theoretical knowledge to practical situations
2. Enhance skills regarding problem-solving, decision-making, and communication skills.
3. Understand organizational dynamics and work culture.
4. Build industry connections and networking opportunities.

Course Duration:

Minimum **120 hours** of On Job Training with an Organization /Private firm.

- The theme of the OJT should be based on any study area of the Major course.
- Project Report should be of minimum 30 pages.
- Experience Certificate is Mandatory.

Report Structure:

The students will be required to submit a comprehensive report at the end of the On-the-Job Training. A project report has to be brief in content and must include the following aspects:

a) **Title Page:**
   Mentioning the title of the report, name of the student, program, institution, and the period of training.
b) **Certificate of Completion:**
   A certificate issued by the organization or supervisor confirming the successful completion of the training.
c) **Declaration:**
   A statement by the student declaring that the report is their original work and acknowledging any assistance or references used.
d) **Acknowledgments:**
   Recognizing individuals or organizations that provided support, guidance, or resources during the training.
e) **Table of Contents:**
   Providing a clear outline of the report's sections and page numbers.
f) **Executive Summary:**
   A bird’s eye view of your entire presentation has to be precisely offered under this category.
g) **Introduction on the Company:**
   A concise representation of company/ organization defining its scope, products/ services and its SWOT analysis.
h) **Your Role in the Organization during the On Job Training:**
   The key aspects handled, the department under which you were deployed and brief Summary report duly acknowledged by the reporting head.
i) **Challenges and overcoming of challenges:**
   The challenges confronted while churning out theoretical knowledge into practical world.

j) Conclusion:

A brief overview of your experience and suggestions to bridge the gap between theory and practice.

k) Appendix:

1.1 Appendix I: OJT Undertaking
1.2 Appendix II: Draft Resume Template
1.3 Appendix III: Organization Outreach Letter
1.4 Appendix IV(A/B): A) Relieving Letter of Student (for fulltime OJT) B)Relieving Letter of Student (for parttime OJT)
1.5 Appendix V**:** Relieving Letter of Student from organization
1.6 Appendix VI: Student Diary (Log) Recording Format
1.7 Appendix VII: Attendance Sheet
1.8 Appendix VIII: Supervisor Evaluation of Intern
1.9 Appendix IX: Student Feedback of OJT
1.10 Appendix X: Performance for Evaluation of OJT by Institute

Broad guidelines for project report:

The project report based on On Job Training shall be prepared as per the broad guidelines given below**:**

- Font type: Times New Roman (Font size :16)
- Font size: 12-For content, 14-for Title
- Line Space: 1.5-for content and 1-for in table work
- Paper Size: A4
- Margin: in Left-1.5, Up-Down-Right-1
- The Project Report shall be bounded.

Course Outcomes:

1. Apply theoretical knowledge and concepts acquired during the academic program to real-world work scenarios.
2. Develop practical skills and competencies necessary for successful professional engagement.
3. Demonstrate effective problem-solving, decision-making, and critical thinking abilities in a work environment.
4. Adapt to and navigate organizational dynamics and work culture in the chosen industry.
5. Prepare a comprehensive report documenting the training/project experience, findings, and recommendations.

Rubric for Evaluation of 'On the Job Training' Project

Criteria	Marks	Description
Project Report (60 Marks)		
a) Title Page	02	Properly formatted with title, student name, program, institution, and training period.
b) Certificate of Completion	05	Inclusion of a valid certificate from the organization/supervisor.
c) Declaration	01	A clear statement of originality and acknowledgment of assistance.
d) Acknowledgments	02	Proper recognition of support and guidance received.
e) Table of Contents	05	Clear and accurate outline of the report's sections with page numbers.
f) Executive Summary	05	Concise overview of the entire presentation.
g) Introduction on the Company	05	Detailed representation of the company/organization including its scope, products, and services.
h) Role in the Organization	10	Comprehensive description of key aspects handled, department deployment, and summary report acknowledged by the reporting head.
i) Challenges and Overcoming Challenges	05	Insightful analysis of challenges faced and methods used to overcome them.
j) conclusion	05	Brief overview of the experience with suggestions to bridge the gap between theory and practice.
Appendix:		
Appendix I: OJT Undertaking	15	Mandatory inclusion
Appendix II: Draft Resume Template		Mandatory inclusion
Appendix III: Organization Outreach Letter		Mandatory inclusion
Appendix IV: Relieving Letter of Student		Mandatory inclusion
Appendix V: Student Diary (Log) Recording Format		Mandatory inclusion
Appendix VI: Attendance Sheet		Mandatory inclusion
Appendix VII: Supervisor Evaluation of Intern		Mandatory inclusion

Appendix VIII: Student Feedback of OJT		Mandatory inclusion
Appendix IX: Performance for Evaluation of OJT by Institute		Mandatory inclusion
Documentation and Presentation (40 Marks)		
Quality and effectiveness of presentation	10	Assesses the clarity, engagement, and overall impact of the presentation in conveying the report objectives and outcomes.
Depth of knowledge and demonstrated skills	10	Evaluates the understanding and practical application of key concepts, techniques, and skills relevant to the report.
Relevance of learning experience	05	Measures how well the training experience aligns with the trainee's career goals and the industry's practical requirements.
Practical applications	10	Assesses the trainee's ability to effectively apply learned skills and knowledge to real tasks and challenges during the training project.
Understanding of Organizational Dynamics	05	Insight into organizational structure, culture, and dynamics.
Total Marks	**100**	

Appendices

Appendix I: OJT Undertaking

1. Student Name:	
2. Class	
3. Roll No	
4. UID	
5. ABC ID	
6. Current Address	
7. Residence Address	
8. Email id	
9. Mobile Nos.	
10. Aadhar Number	
11. Mode of OJT	Online /Offline
I confirm that I agree with the terms, conditions, and requirements of the OJT Policy Student Signature: Date:	
I confirm that the student has attended the OJT orientation and has met all paperwork and process requirements to participate in the OJT program, and has received approval from his/her mentor. Sign of Department Faculty Coordinator Date:	

Appendix II: Draft Resume Template

Name:
Contact Number and Email ID:
Education:

(HEI / COLLEGE) Name: Year:
Degree:
Specialization:
SGPA:(PG SEMESTER I)
College Name: <bachelor's degree> Year:
Degree:
Specialization:
CGPA:
OJT / Work Experience – Yes / No

If YES
Organization: Year:
Project:
Brief:
Academic Experience:

Other Achievements and Personal Interests

- List other achievements also in reverse chronological order
- Leadership positions held outside of your formal work environment
- Personal interests and accomplishments that will distinguish you from other applicants
- Volunteer service/Social Work

Appendix III: Organization Outreach Letter

< (HEI) /College Name Letter Head>

To,

The (Manager, HR) .....

.....

Subject: Request for 120 hours OJT of Students pursuing < >

Dear Sir,

The college (HEI) name established in <year>, < (HEI /college name) >, Maharashtra reflects the vision of leading industrialists and educationalists. Institute is accredited with '< >' grade by NAAC in [Month year]. The HEI /college name has been recognized about it's over all academic excellence and infrastructure.

In view of the above, I request your good self to allow our following (no. of students) students for practical raining in your esteemed organization. Kindly accord your permission and give at least one-week time for students to join training after confirmation.

Sr. No.	Name	Roll no.	Year	Department

The resumes of these students are attached with this letter. If vacancies exist, kindly do plan for Interviews for the students in above branches.

A line of confirmation will be highly appreciated.

Yours sincerely,

Nodal Officer/TPO

< HEI /college name and Date>

Appendix IV: A) Relieving Letter of Student (for fulltime OJT)

< HEI /college name Letter Head>

To,

The General Manager (HR) .....

.....

Subject: Relieving letter of student

Dear Sir,

Kindly refer your letter/e-mail dated ----------on the above cited subject. As permitted by your good self the following students will undergo Industrial OJT in your esteemed organization under your sole guidance and direction.

Sr. No.	Name	Roll no.	Year	Department

This training being an essential part of the curriculum, the following guidelines have been prescribed in the curriculum for the training. You are therefore, requested to please issue following guidelines to the concerned student mentor.

- OJT schedule may be prepared and a copy of the same may be sent to us.
- Each student is required to prepare OJT diary and report.
- Kindly check the OJT diary of the student daily.
- Issue instruction regarding working hours during training and maintenance of the attendance record

You are requested to evaluate the student's performance on the basis of grading i.e. Excellent, Very Good, Satisfactory and Non-Satisfactory on the below mentioned factors:

- Attendance and general behavior
- Relation with workers and supervisors
- Initiative and efforts in learning
- Knowledge and skills improvement
- Contribution to the organization

The performance report may please be forwarded to the undersigned on completion of training in sealed envelope.

Your efforts in this regard will positively enhance knowledge and practical skills of the students, your cooperation will be highly appreciated, and we shall feel obliged.

The students will abide by the rules and regulation of the organization and will maintain a proper discipline with keen interest during their OJT. The students will report to you on dated _____along with a copy of this letter.

Yours sincerely,

Nodal Officer/TPO

< HEI /college name and Date>

Appendix IV: B) Relieving Letter of Student (for parttime OJT)

< HEI /college name Letter Head>

To,

The General Manager (HR) .....

.....

Subject: Relieving letter of student

Dear Sir,

Kindly refer your letter/e-mail dated ----------on the above cited subject. As permitted by your good self the following students will undergo Industrial OJT in your esteemed organization under your sole guidance and direction. The students will attend their OJT after completing their daily college work as part of their academic curriculum.

Sr. No.	Name	Roll no.	Year	Department

This training being an essential part of the curriculum, the following guidelines have been prescribed in the curriculum for the training. You are therefore, requested to please issue following guidelines to the concerned student mentor.

- OJT schedule may be prepared and a copy of the same may be sent to us.
- Each student is required to prepare OJT diary and report.
- Kindly check the OJT diary of the student daily.
- Issue instruction regarding working hours during training and maintenance of the attendance record

You are requested to evaluate the student's performance on the basis of grading i.e. Excellent, Very Good, Satisfactory and Non-Satisfactory on the below mentioned factors:

- Attendance and general behavior
- Relation with workers and supervisors
- Initiative and efforts in learning
- Knowledge and skills improvement
- Contribution to the organization

The performance report may please be forwarded to the undersigned on completion of training in sealed envelope.

Your efforts in this regard will positively enhance knowledge and practical skills of the students, your cooperation will be highly appreciated, and we shall feel obliged.

The students will abide by the rules and regulation of the organization and will maintain a proper discipline with keen interest during their OJT. The students will report to you on dated _____along with a copy of this letter.

Yours sincerely,

Nodal Officer/TPO

< HEI /college name and Date>

Appendix V: Relieving Letter of Student from organization

<Organization Letter Head>

To,
The Principal
[College Name]
[College Address]

Subject: Relieving Letter for Student

Dear Sir,

This is to certify that the following students from your esteemed institution have successfully completed their Industrial OJT in our organization as per the guidelines provided:

Sr. No.	Name	Roll no.	Year	Department

The students were under the supervision and guidance of our mentors and were engaged in various projects/tasks as part of their training. They have followed the rules and regulations of our organization and maintained a proper discipline throughout the OJT period.

Performance Evaluation:
The performance of the students has been evaluated based on the following criteria:

- Attendance and General Behavior
- Relation with Workers and Supervisors
- Initiative and Efforts in Learning
- Knowledge and Skills Improvement
- Contribution to the Organization

We have provided each student with feedback on their performance, which we hope will assist in their continued academic and professional growth. The detailed performance reports are enclosed in sealed envelopes for your reference.
We appreciate the opportunity to collaborate with your institution in providing practical exposure to the students and look forward to future engagements.

Yours sincerely,
[Signature]
[Name]
General Manager (HR)
[Company Name]
[Date]

Appendix VI: Student Diary (Log) Recording Format

Week (Dates during the week)	Task Assigned	Activities Performed	Key Learnings	Additional Remarks

Signature of Industry Supervisor

Appendix VII: Attendance Sheet

<Organization Letter Head>

Name & Address of Organization

_____
_____
_____

Name of the Student	
Roll Number	
Name of Course	
Date of Commencement of Training	
Date of Completion of Training	

Month and Year:

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

- Attendance Sheet should remain affixed in Daily Training Diary. Do not remove or tear it off.
- Holidays should be marked in Red Ink in attendance column. Absent should be marked as ‘A’ in Red Ink.

Name and Signature with date of OJT Supervisor _____

Appendix VIII: Supervisor Evaluation of Intern

<Organization Letter Head>

Student Name: _____ Date: _____

Work Supervisor: _____ Title: _____

Organization: _____

OJT Address: _____ Dates

of OJT: From _____To _____

Please evaluate intern by indicating the frequency with which you observed the following behaviours:

Parameters	Needs Improvement	Satisfactory	Good	Excellent
1. Behaviours				
2. Performs in a dependable manner				
3. Cooperates with co-workers and supervisors				
4. Shows interest in work				
5. Learns quickly				
6. Shows initiative				
7. Produces high quality work				
8. Accepts responsibility				
9. Accepts criticism				
10. Demonstrates organizational skills				
11. Uses technical knowledge and expertise				
12. Shows good judgment				
13. Demonstrates creativity/originality				
14. Analyzes problems effectively				
15. Is self-reliant				
16. Communicates well				
17. Writes effectively				
18. Has a professional attitude				
19. Gives a professional appearance				
20. Is punctual				
21. Uses time effectively				

Overall performance of student intern (circle one):
(Needs improvement / Satisfactory / Good / Excellent)
Additional comments, if any: _____
Signature of Industry supervisor: _____
Manager: _____

Appendix IX: Student Feedback of OJT

(To be filled by Students after OJT completion)

Student Name: _____ Date: _____
Industrial Supervisor: _____Title: _____
Supervisor Email: _____OJT is: ____Paid ____Unpaid_____
Organization: _____
OJT Address:_____
Faculty Coordinator: _____Department: _____
Dates of OJT: From _____ To _____

Give a brief description of your OJT work (title and tasks for which you were responsible):
Was your OJT experience related to your major area of study?

- Yes, to a large degree
- Yes, to a slight degree
- No, not related at all

Indicate the degree to which you agree or disagree with the following statements.

This experience has:	Strongly Agree	Agree	No opinion	Disagree	Strongly Disagree
1. Given me the opportunity to explore a career field					
2. Allowed me to apply classroom theory to practice					
3. Helped me develop my decision-making and problem-solving skills					
4. Expanded my knowledge about the work world prior to permanent employment					
5. Helped me develop my written and oral communication skills					
6. Provided a chance to use leadership skills (influence others, develop ideas with others, stimulate decision-making and action)					
7. Expanded my sensitivity to the ethical implications of the work involved					
8. Made it possible for me to be more confident in new situations					
9. Given me a chance to improve my interpersonal skills					
10. Helped me learn to handle responsibility and use my time wisely					

11. Helped me discover new aspects of myself that I didn't know existed before					
12. Helped me develop new interests and abilities					
13. Helped me clarify my career goals					
14. Provided me with contacts which may lead to future employment					
15. Allowed me to acquire information and/ or use equipment not available at my Institute					

- In the Institute OJT program, faculty members are expected to be mentors for students. Do you feel that your faculty coordinator served such a function? Why or why not?

- How well were you able to accomplish the initial goals, tasks and new skills that were set down in your learning contract? In what ways were you able to take a new direction or expand beyond your contract? Why were some goals not accomplished adequately?
- In what areas did you most develop and improve?

- What has been the most significant accomplishment or satisfying moment of your OJT?

- What did you dislike about the OJT?

- Considering your overall experience, how would you rate this OJT? (Circle one).
- -Satisfactory/ Good/ Excellent

- Give suggestions as to how your OJT experience could have been improved. (Could you have handled added responsibility? Would you have liked more discussions with your professor concerning your OJT? Was closer supervision needed? Was more of an orientation required?)

<Signature of Student>
<Name, Roll number, Date>

Appendix X: Performa for Evaluation of OJT by Institute

< HEI /college name Letter Head>

1. Name of Student: _____
2. Mob. No.: _____
3. Roll No.: _____
4. Branch/Semester: _____
5. Period of Training: _____
6. Home Address with contact No. _____
7. Address of Training Site: _____
8. Address of Training Providing Agency: _____
9. Name/Designation of Training In- charge: _____
10. Type of Work: _____
11. Date of Evaluation: _____
12. Please rate the following: _____

Sr.no.	Particular	Marks
1	Project Report	60 Marks
2	Documentation and Presentation	40 Marks

Overall Marks: _____.

Additional Remarks:_____.

Signature of Faculty Mentor: _____

Format

1 st page (Main Page)

Title of the Report

a Project Submitted

To

R. P. Gogate college of Arts & Science and

R.V. Jogalekar College of Commerce, Ratnagiri (Autonomous)

Under

University of Mumbai

For partial completion of the degree

of

Bachelor of Science

Under the Faculty of Science

By

Name of Student

Under the Guidance

of

Name of the Guiding Teacher

R. P. Gogate college of Arts & Science and

R.V. Jogalekar College of Commerce, Ratnagiri (Autonomous)

Near District Court

Month and Year

On separate page

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[Company/Institution Logo]

CERTIFICATE OF COMPLETION

This is to certify that [Student's Full Name] [Student's Roll Number], has successfully completed the Academic On-the-Job Training Programme at [Company/Institution Name]

This training covered a period of 120 hours, during which [he/she] actively participated and demonstrated excellent dedication and commitment to learning.

The following work was performed by [him/her]:

- [Brief description of the work performed during the training period]

This training has provided [him/her] with valuable insights and practical experience in [relevant field/industry]. [He/She] has exhibited commendable skills, enthusiasm, and a keen interest in learning.

Certifying Authority:

_____

[Name and

Designation]

[Company/Institutio

n Name] [Contact

Information] [Date]

[Seal/Signature]

On separate page

Declaration by learner

I the undersigned Miss/Mr. _____
[Name of the learner] here by, declare that work embodied in this report titled _____forms my own contribution to project work carried out under the guidance of [Name of the guiding teacher]

I, here by further declare that all information of this document has been obtained and presented in accordance with academic rules and ethical conduct.

Name and Signature of the learner

Certified by
Name and signature of the Guiding Teacher

On separate page

Acknowledgment
(Model structure of the acknowledgement)

To list who all have helped me is difficult because they are so numerous and the depth is so enormous.

I would like to acknowledge the following as being idealistic channels and fresh dimensions in the completion of this project.

I thank the R. P. Gogate college of Arts & Science and R.V. Jogalekar College of Commerce, Ratnagiri (Autonomous) for giving me opportunity to do this project.

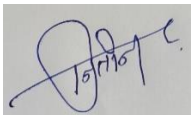
I would like to thank my Principal, Prof. Dr M.R. Sakhalkar Sir for providing the necessary facilities required for completion of this project.

I take this opportunity to thank our Coordinator (Name of VP or HOD) for his/her moral support and guidance.

I would also like to express my sincere gratitude towards my project guide _____whose guidance and care made the project successful.

I would like to thank my College Library, for having provided various reference books and magazines related to my project.

Lastly, I would like to thank each and every person who directly or indirectly helped me in the completion of the project especially my Parents and Peers who supported me throughout my project.



Chairperson,
(Dr. Nitin Potdar)
BoS, Microbiology