

## VIDHYADEEP UNIVERSITY (Anita)

<b>Institute Name: Vidhyadeep Institute of Science</b>			<b>Department Name: Microbiology</b>			
<b>Recommended Programs :B.Sc.Microbiology SEM V</b>						
<b>Course Name</b>	<b>Principles of Bacterial Genetics</b>		<b>Course Code</b>	<b>111501</b>		
<b>Credit Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>N</b>	<b>Total Credits</b>	2
		2				
<b>Minimum weeks per Semester</b>	15 (Including Classwork, examination, preparation, holidays etc.)					
<b>Effective From</b>	June 2024					
<b>Prerequisites (if any)</b>	Basic Science					
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>✓ To understand the fundamental concepts behind various molecular genetics of bacterial cells.</li> <li>✓ To study the regulation and control of genes, genetic codes and its passage to new cells.</li> <li>✓ To know molecular processes involved in genetic replication, translation, transcription</li> <li>✓ To be familiar with various extra chromosomal genes.</li> </ul>					
<b>Course Content</b>	<b>Unit I: GENE STRUCTURE AND REPLICATION IN PROKARYOTES:</b> DNA as genetic material Bacterial gene structure Nucleic acid and protein structure DNA replication in bacteria					7 hours
	<b>Unit II: GENE EXPRESSION</b> Transcription in bacteria The genetic code Translation in bacteria Protein maturation and secretion					7 hours
	<b>Unit III: GENETIC REGULATION, MUTATION AND REPAIR</b> Regulation in transcription Lactose operon Tryptophan operon Regulation of translation Mutations: Spontaneous, induced, detection and isolation of mutants DNA repair					8 hours
	<b>Unit IV: GENETIC RECOMBINATION</b> Horizontal gene transfer Bacterial conjugation Bacterial transformation Transduction					8 hours
<b>Teaching Methodology</b>	Classwork, Discussion, Self-Study, Seminars and/or Assignment.					
<b>References</b>	<ul style="list-style-type: none"> <li>✓ Wiley, J. M., Sherwood, L. M. and Woolverton, C. J., (2014) Prescott, Harley and Klein's Microbiology, 9th Ed., McGraw-Hill Education.</li> </ul>					

	<ul style="list-style-type: none"> <li>✓ Wiley, J. M., Sherwood, L. and Woolverton, C. J., (2017) Prescott, Harley and Klein's Microbiology, 10th Ed., McGraw-Hill Education.</li> <li>✓ Russell, P. J. (2005) iGenetics: A Molecular Approach, 2nd Ed., Benjamin Cummings.</li> <li>✓ Klug, W. S. and Cummings, M. R. (2008) Concepts of Genetics, 9th Ed., Benjamin Cummings.</li> <li>✓ Hartl, D. L. and Jones, E. W., (2009) Genetics: Analysis of genes and genomes, 7th Ed., Jones and Bartlett publishers.</li> </ul>
<b>Course Outcomes</b>	<p>Student shall learn about the chemical structural properties of DNA and protein. Along with, Students shall grasp knowledge of bacterial replication and its molecular aspects.</p> <p>Students shall gain knowledge of structural aspects of bacterial genes. Students shall get in-depth information about molecular mechanisms of passing the genetic information through transcription and translation in bacterial system.</p> <p>Students shall understand the process involve in gene regulation and its control in prokaryotes.</p> <p>Students shall be able to understand genetic inheritance and bacterial recombination..</p>

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K1, K2, ..., K6)
CO1		Y											Y				K1
CO2			Y				Y										K2
CO3					Y										Y		K3, K4
CO4	Y										Y			Y			K5, K6

**High-3      Medium-2      Low-1**

**K<sub>1</sub> =>Remember   K<sub>2</sub> =>Understand**

**K<sub>3</sub> =>Apply**

**K<sub>4</sub> =>Analyze**

**K<sub>5</sub> =>Evaluate**

**K<sub>6</sub> =>Create**

## VIDHYADEEP UNIVERSITY (Anita)

<b>Institute Name: Vidhyadeep Institute of Science</b>		<b>Department Name: Microbiology</b>			
<b>Recommended Programs :B.Sc.Microbiology SEM V</b>					
<b>Course Name</b>	<b>Basic of Immunology</b>		<b>Course Code</b>	<b>1111502</b>	
<b>Credit Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>N</b>	<b>Total Credits</b>
		2			
<b>Minimum weeks per Semester</b>	15 (Including Classwork, examination, preparation, holidays etc.)				
<b>Effective From</b>	June 2024				
<b>Prerequisites (if any)</b>	Basic Science				
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>✓ To understand the basic mechanisms of immune system.</li> <li>✓ To study practical aspects used in clinical immunology laboratories.</li> <li>✓ To emphasize the importance and role of immunology for the public health as in vaccine strategies.</li> <li>✓ To learn about the defective immune conditions and its implications.</li> </ul>				
<b>Course Content</b>	<b>Unit I: INNATE HOST RESISTANCE</b> Innate resistance and adaptive defense Innate barriers: Physical & Mechanical Chemical mediators Cells , tissues and organs of immune system				7 hours
	<b>Unit II: ADAPTIVE IMMUNITY</b> Recognition and Memory Antigens Types of adaptive immunity Recognition of foreignness T cells & B cells				7 hours
	<b>Unit III: DEFENSE MECHANISM AND IMMUNIZATION</b> Innate defense mechanisms Phagocytosis Inflammation Adaptive defenses : Antibodies Monoclonal antibodies and its production Vaccines				8 hours
	<b>Unit IV: IMMUNE DEFECTS</b> Immune tolerance Hypersensitivities Organ specific autoimmune diseases Systemic autoimmune disease Immunodeficiencies Transplantation rejection				8 hours
<b>Teaching Methodology</b>	Classwork, Discussion, Self-Study, Seminars and/or Assignment.				
<b>References</b>	<ul style="list-style-type: none"> <li>✓ Wiley, J. M., Sherwood, L. and Woolverton, C. J., (2017) Prescott, Harley and Klein's Microbiology, 10<sup>th</sup> Ed., McGraw-Hill Education.</li> <li>✓ Owen, J. A, Punt, J., Stranford, S. A. and Jones, P. P. (2013). Kuby Immunology,</li> </ul>				

	<p>7<sup>th</sup> Ed., W. H. Freeman and Company.</p> <ul style="list-style-type: none"> <li>✓ Delves, P. J., Martin, S. J., Burton, D. R. and Roitt, I. M. (2011). Roitt's Essential Immunology, 13<sup>th</sup> Ed., Wiley-Blackwell Publishers.</li> <li>✓ Abbas, A. K., Lichtman, A. H. and Pillai, S. (2012). Cellular and Molecular Immunology, 7<sup>th</sup> Ed., Elsevier-Saunders Publication.</li> </ul>
<b>Course Outcomes</b>	<p>Students shall learn about the overview of the immune system and its one of the two arms, the innate or non-specific immune system.</p> <p>The second arm of the immune system shall be introduced here which is known as adaptive or specific immune system.</p> <p>Students shall learn the practical aspect of the immunology, wherein various laboratory techniques shall be introduced with their principles and its application as in various vaccine strategies.</p> <p>Students shall learn about immune system failures and its consequences of uncontrolled reaction with host.</p>

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K <sub>1</sub> , K <sub>2</sub> , ..., K <sub>6</sub> )
CO1		Y											Y				K <sub>1</sub>
CO2			Y				Y										K <sub>2</sub>
CO3					Y										Y		K <sub>3</sub> , K <sub>4</sub>
CO4	Y										Y			Y			K <sub>5</sub> , K <sub>6</sub>

**High-3**            **Medium-2**            **Low-1**  
**K<sub>1</sub>=>Remember**   **K<sub>2</sub>=>Understand**            **K<sub>3</sub>=>Apply**            **K<sub>4</sub>=>Analyze**            **K<sub>5</sub>=>Evaluate**            **K<sub>6</sub>**  
**=>Create**

## VIDHYADEEP UNIVERSITY (Anita)

Institute Name: Vidhyadeep Institute of Science			Department Name: Microbiology			
Recommended Programs :B.Sc.Microbiology SEM V						
Course Name	Microbial Metabolism		Course Code	1111503		
Credit Hours	L	T	P	N	Total Credits	2
		2				
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)					
Effective From	June 2024					
Prerequisites (if any)	Basic Science					
Course Objectives	<ul style="list-style-type: none"> <li>✓ To develop an understanding of the basic principles and concepts of microbial metabolism.</li> <li>✓ To learn the chemolithotrophic and phototrophic metabolic processes occurring in bacteria.</li> <li>✓ To explore various metabolic processes leading to respiratory and fermentative metabolism of sugars in chemoorganotrophs.</li> <li>✓ To acquire knowledge of electron transport chain and ATP synthesis in chemoorganotrophs.</li> <li>✓ To get acquainted with metabolic processes used for catabolism of proteins, lipids and carbohydrates other than glucose.</li> </ul>					
Course Content	<b>Unit I: INTRODUCTION TO METABOLISM</b> Metabolism: Important principles and concepts ATP the major energy currency of cells Redox reactions Components of Electron transport chain					7 hours
	<b>Unit II:CHEMOLITHOTROHIC AND PHOTOTROPHIC METABOLISM</b> Chemolithotrophy Phototrophy					7 hours
	<b>Unit III: CHEMOORGANOTROPHUC METABOLISM -I</b> Aerobic respiration Glucose to pyruvate: EMP,ED and PPP Pyruvate to CO <sub>2</sub> : TCA cycle and Glycoxylate By Pass Electron Tansport Chain and Oxidative Phosphorylation Anaerobic Respiration Fermentation					8 hours
	<b>Unit IV: CHEMOORGANOTROHIC METABOLISM-II</b> Catabolism of Carbohydrates other than glucose Protein and Amino acid catabolism Lipid Catabolism CO <sub>2</sub> fixation					8 hours
Teaching	Classwork, Discussion, Self-Study, Seminars and/or Assignment.					

<b>Methodology</b>	
<b>References</b>	<ul style="list-style-type: none"> <li>✓ Wiley, J. M., Sherwood, L., Woolverton, C. J. (2017). Prescott's Microbiology. 10<sup>th</sup> Ed. Singapore: McGraw-Hill Education.</li> <li>✓ Rastogi, S., Pathak, N. (2009) Genetic Engineering, 4<sup>th</sup> Ed., Oxford University Press.</li> <li>✓ Madigan, M. T. and Martinko, J. M. (2014). Brock Biology of Microorganisms. 14<sup>th</sup> Ed., Prentice Hall International Inc.</li> <li>✓ Stanier, R.Y., Ingrahm, J. I., Wheelis, M. L. and Painter, P. R. (1987). General Microbiology. 5<sup>th</sup> Ed., McMillan Press.</li> <li>✓ Atlas, R. M. (1997). Principles of Microbiology 2<sup>nd</sup> Ed., Brown Publishers.</li> </ul>
<b>Course Outcomes</b>	<p>Students shall understand the basic principles and concepts of microbial metabolism.</p> <p>Students shall gain knowledge of the energy generating mechanisms in chemolithotrophs and phototrophs.</p> <p>Students shall become acquainted with various metabolic processes used by chemoorganotrophs for energy generation from glucose.</p> <p>Students shall become well versed with the catabolic pathways used for utilization of proteins, lipids and carbohydrates other than glucose.</p>

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K <sub>1</sub> , K <sub>2</sub> , ..., K <sub>6</sub> )
CO1		Y											Y				K <sub>1</sub>
CO2			Y				Y										K <sub>2</sub>
CO3					Y				Y						Y		K <sub>3</sub> , K <sub>4</sub>
CO4	Y										Y			Y			K <sub>5</sub> , K <sub>6</sub>

**High-3**

**Medium-2**

**Low-1**

**K<sub>1</sub> => Remember K<sub>2</sub> => Understand**

**K<sub>3</sub> => Apply**

**K<sub>4</sub> => Analyze**

**K<sub>5</sub> => Evaluate K<sub>6</sub>**

**=> Create**

## VIDHYADEEP UNIVERSITY (Anita)

<b>Institute Name: Vidhyadeep Institute of Science</b>			<b>Department Name: Microbiology</b>		
<b>Recommended Programs :B.Sc.Microbiology SEM V</b>					
<b>Course Name</b>	<b>Applied Environmental Microbiology</b>		<b>Course Code</b>	<b>1111504</b>	
<b>Credit Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>N</b>	<b>Total Credits</b>
		2			2
<b>Minimum weeks per Semester</b>	15 (Including Classwork, examination, preparation, holidays etc.)				
<b>Effective From</b>	June 2024				
<b>Prerequisites (if any)</b>	Basic Science				
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>✓ To develop an understanding of the basic principles and concepts of air microbiology.</li> <li>✓ To learn the process for purification of drinking water and treatment process for waste water.</li> <li>✓ To explore various biodegradation and bioremediation processes.</li> <li>✓ To acquire knowledge of extreme environment and response of microorganisms to adapt the environment.</li> </ul>				
<b>Course Content</b>	<b>Unit I: MICROBIOLOGY OF AIR</b> Microorganisms found in air Number of microorganisms in air Bio aerosols : Sampling and analysis Sampler type Culture methods and microscopy				7 hours
	<b>Unit II:MICROBIOLOGY OF DOMESTIC AND WASTE WATER</b> Purification and sanitary Analysis of waste water Waste water treatment Solid processing				7 hours
	<b>Unit III:BIODEGRADATION AND BIOREMEDIATION</b> Biodegradation Processes Bioremediation Bioremediation of hydrocarbons Bioremediation of marine oil spills				8 hours
	<b>Unit IV: MICROBIOLOGY OF EXTREME ENVIRONMENT</b> Physiology, molecular. adaptations of Hyperthermophiles, Acidophiles, psychrophiles, Barophiles, Halophiles, Alkalophiles				8 hours
<b>Teaching Methodology</b>	Classwork, Discussion, Self-Study, Seminars and/or Assignment.				
<b>References</b>	<ul style="list-style-type: none"> <li>✓ Wiley, J. M., Sherwood, L., Woolverton, C. J. (2017). Prescott's Microbiology. 10th Ed. Singapore: McGraw-Hill Education.</li> <li>✓ Schaechter, M. (2004). The desk encyclopaedia of microbiology, 2nd Ed., Elsevier Academic Press.</li> <li>✓ Schmidt, T. M. and Schaechter, M. (2011). Topics in ecological and environmental microbiology, 1st Ed., Elsevier Academic Press.</li> </ul>				

	<ul style="list-style-type: none"> <li>✓ Salle, A. J. (1974). Fundamental principles of microbiology, 7<sup>th</sup> Ed., Tata McGraw-Hill.</li> <li>✓ Pelczar, M. J. &amp; Chan, E. C. S. (1998). Microbiology, 5<sup>th</sup> Ed., McGraw Hill.</li> <li>✓ Hurst, C. J., Crawford, R. L., Garland J. L. (2007). Manual of Environmental Microbiology, 3<sup>rd</sup> Ed., American Society for Microbiology.</li> <li>✓ Atlas, R. M. (1997). Principles of Microbiology 2<sup>nd</sup> Ed., Brown Publishers.</li> <li>✓ Purohit, S. S. (2008). Microbiology Fundamentals and Applications, 7<sup>th</sup> Ed., Agrobios.</li> </ul>
<b>Course Outcomes</b>	<p>Students shall understand the presence of varied microorganism present in air, sampling and analysis of air flora and sanitization of air.</p> <p>Students shall gain knowledge of different methods for drinking water purification and various steps for treating the waste water and finally the solid waste remains to dispose it.</p> <p>Students shall become acquainted with various biodegradation and bioremediation process of various pollutants in environment.</p> <p>Students shall become well versed with the adaptation and changes in the structure and metabolic pathway to survive in extreme environment as well as use of microbial enzymes of such organism in biotechnology.</p>

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K <sub>1</sub> , K <sub>2</sub> , ..., K <sub>6</sub> )
CO1		Y							Y				Y				K <sub>1</sub>
CO2			Y				Y										K <sub>2</sub>
CO3					Y										Y		K <sub>3</sub> , K <sub>4</sub>
CO4	Y										Y			Y			K <sub>5</sub> , K <sub>6</sub>

**High-3                  Medium-2                  Low-1**

**K<sub>1</sub> =>Remember   K<sub>2</sub> =>Understand      K<sub>3</sub> =>Apply      K<sub>4</sub> =>Analyze      K<sub>5</sub> =>Evaluate      K<sub>6</sub> =>Create**



## VIDHYADEEP UNIVERSITY (Anita)

<b>Institute Name: Vidhyadeep Institute of Science</b>			<b>Department Name: Microbiology</b>			
<b>Recommended Programs :B.Sc.Microbiology SEM V</b>						
<b>Course Name</b>	<b>Food &amp; Dairy Microbiology</b>		<b>Course Code</b>	<b>111505</b>		
<b>Credit Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>N</b>	<b>Total Credits</b>	2
		2				
<b>Minimum weeks per Semester</b>	15 (Including Classwork, examination, preparation, holidays etc.)					
<b>Effective From</b>	June 2024					
<b>Prerequisites (if any)</b>	Basic Science					
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>✓ To understand intrinsic and extrinsic factors and their relationship to microbial growth.</li> <li>✓ To understand the principles of food preservation and the role of beneficial microbes.</li> <li>✓ To understand the role of microorganisms and food spoilage; pathogenic microorganisms, infection and intoxication as well as qualitative and quantitative microbiological analysis.</li> <li>✓ To provide knowledge of the main microbial groups involved in the production of fermented foods.</li> </ul>					
<b>Course Content</b>	<b>Unit I: FOOD MICROBIOLOGY</b> Food spoilage: Intrinsic and Extrinsic Factors Methods used to control food spoilage Filtration Low temperature High temperature Water availability High hydrostatic pressure Radiation Microbial product based inhibition Packaging					7 hours
	<b>Unit II: DAIRY MICROBIOLOGY</b> Composition and nutritive value of milk Methods of testing and gradation of milk Preservation of milk and milk product Cheese production					7 hours
	<b>Unit III:SPOILAGE OF FOOD AND DAIRY PRODUCTS</b> Contamination and spoilage of food Bread Heated Canned food Microbiological examination of food Microscopic technique Cultural technique Food borne outbreaks					8 hours

	Detection of food borne pathogens	
	<b>Unit IV: MICROORGANISMS AS FOOD AND FERMENTED FOODS</b> Single cell protein Mushroom culture Alcoholic beverages Breads	8 hours
<b>Teaching Methodology</b>	Classwork, Discussion, Self-Study, Seminars and/or Assignment.	
<b>References</b>	<ul style="list-style-type: none"> <li>✓ Wiley, J. M., Sherwood, L., &amp; Woolverton, C. J. (2017), Prescott's microbiology, 10th Ed., New York: McGraw-Hill Education.</li> <li>✓ Frazier, W. C. and Westhoff, D. C., (2006). Food Microbiology, 4th Ed., Tata McGraw Hill, India.</li> <li>✓ Sukumar, De. (2013). Outlines of Dairy Technology, 1st Ed., Oxford University.</li> <li>✓ Dubey, R. C. (2010). Textbook of Biotechnology, 1st Ed., S. Chand. Multicolor.</li> <li>✓ Purohit, S. S. (2006). Microbiology: Fundamentals and Applications, 7th Ed., Agrobios (India).</li> <li>✓ Pelczar, M. J. and Chan, E. C. S. (1998). Microbiology, 5th Ed., Tata-McGraw-Hill.</li> <li>✓ Jay, J. M. (2000). Modern Food Microbiology. 6th Ed., Aspen Publishers.</li> </ul>	
<b>Course Outcomes</b>	<p>Students shall learn about factors which affects the growth and adaptation of microorganisms in various environments and conditions, including sanitation practices.</p> <p>Students shall learn about the composition of milk as a good source for microbial growth and preservation of food. Students shall learn role of microorganisms in the production of fermented milk products.</p> <p>Students shall be able to understand spoilage of different foods by microbial activity.</p> <p>Students shall learn about microorganisms that cause disease and method to detect various food borne pathogens.</p> <p>Students shall understand about different microorganisms that can be used as food and their involvement in the production of various fermented foods.</p>	

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K1, K2, ..., K6)
CO1		Y											Y				K1
CO2			Y				Y										K2
CO3					Y										Y		K3, K4
CO4	Y							Y			Y			Y			K5, K6

**High-3 Medium-2 Low-1**

**K<sub>1</sub> =>Remember K<sub>2</sub> =>Understand K<sub>3</sub> =>Apply K<sub>4</sub> =>Analyze K<sub>5</sub> =>Evaluate K<sub>6</sub> =>Create**

## VIDHYADEEP UNIVERSITY (Anita)

Institute Name: Vidhyadeep Institute of Science			Department Name: Microbiology		
Recommended Programs :B.Sc.Microbiology SEM V					
Course Name	Haematology & Blood banking		Course Code	1111506	
Credit Hours	L	T	P	N	Total Credits
		2			
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)				
Effective From	June 2024				
Prerequisites (if any)	Basic Science				
Course Objectives	<ul style="list-style-type: none"> <li>✓ To study the blood and blood components.</li> <li>✓ To investigate and diagnose the disorders of blood, hemostasis and immune function.</li> <li>✓ To learn the typing of blood for transfusion and testing for infectious diseases.</li> <li>✓ To investigate the harmful responses of the body to blood transfusion and learn the collection, separation, delivery and storage of blood components.</li> </ul>				
Course Content	<b>Unit I: INTRODUCTION TO HAEMATOLOGY</b> Definition and functions: Haematology and Blood Haemopoietic system of the blood Components of blood and their function Processing of Blood Types of anticoagulants and its use Mechanism of blood coagulation: Coagulation cascade				7 hours
	<b>Unit II:HAEMATOLOGICAL ANALYSIS</b> Determination of haemoglobin concentration Cyanmethaemoglobin method Determination of hematocrit-PCV,Red cell indices Laboratory investigations of bleeding disorders Bleeding time –Duke method Whole blood clotting time-Lee and White method Prothrombine time-Quick’s method				7 hours
	<b>Unit III: IMMUNOHAEMATOLOGY</b> ABO blood group system ABO grouping and methods Rhesus blood group system Methods for Rh typing Clinically less significant blood group systems				8 hours
	<b>Unit IV: BLOOD BANKING</b> Selection of blood donor Methods of blood collection, transportation and storage of blood Pre-transfusion test of Donor’s blood Preparation and use of blood components Compatibility test -crossmatching				8 hours

<b>Teaching Methodology</b>	Classwork, Discussion, Self-Study, Seminars and/or Assignment.
<b>References</b>	<ul style="list-style-type: none"> <li>✓ Mukherjee, K. L. (1988). Medical Laboratory Technology, Vol 1, 2 &amp; 3, Tata McGraw Hill Publishing.</li> <li>✓ Ochei, J. and Kolhatkar, A. (2000). Medical Laboratory Science-Theory and Practice, Tata McGraw Hill.</li> <li>✓ Godkar, P. B. (2003). Textbook of Medical Laboratory Technology, 3rd Ed., Bhalani Publishing House.</li> <li>✓ Professional guide to diagnostic tests, (2004). 1st Ed., Lippincott Shalliams &amp; Wilkins.</li> </ul>
<b>Course Outcomes</b>	<p>Student shall learn about blood and blood related disorders. Shall enable the students to understand the importance of specimen collection, handling and processing in laboratory testing.</p> <p>Gain knowledge of the principles of each test, possible causes of error, and the interpretation and clinical significance of the findings.</p> <p>Student shall understand the reactions between antigens present on blood cells and antibodies present in plasma which is important for transfusion therapy.</p> <p>Student shall enable the student to protect donor health and safety by collecting blood only from healthy individuals. Student shall understand the tests performed to determine if a particular unit of blood can be transfused safely into a certain patient.</p>

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K1, K2, ..., K6)
CO1		Y											Y				K1
CO2			Y				Y										K2
CO3					Y				Y						Y		K3, K4
CO4	Y										Y			Y			K5, K6

**High-3    Medium-2    Low-1**

**K<sub>1</sub> =>Remember    K<sub>2</sub> =>Understand**

**K<sub>3</sub> =>Apply**

**K<sub>4</sub> =>Analyze**

**K<sub>5</sub> =>Evaluate**

**K<sub>6</sub> =>Create**

## VIDHYADEEP UNIVERSITY (Anita)

<b>Institute Name: Vidhyadeep Institute of Science</b>			<b>Department Name: Microbiology</b>		
<b>Recommended Programs :B.Sc.Microbiology SEM V</b>					
<b>Course Name</b>	<b>Microbiology practical</b>		<b>Course Code</b>	<b>1111507</b>	
<b>Credit Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>N</b>	<b>Total Credits</b>
			6		
<b>Minimum weeks per Semester</b>	15 (Including Classwork, examination, preparation, holidays etc.)				
<b>Effective From</b>	June 2024				
<b>Prerequisites (if any)</b>	Basic Science				
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>✓ To study the drug resistant mutant and isolation of bacteriophage.</li> <li>✓ To study practical related Haematology.</li> <li>✓ To study practicals like Haemoglobin estimation, sugar and protein estimation.</li> <li>✓ To study the practical related to water and milk.</li> </ul>				
<b>Course Content</b>	<ol style="list-style-type: none"> <li>1. Isolation of drug resistant mutant (Gradient plate technique)</li> <li>2. Isolation of Bacteriophage from sewage water sample</li> <li>3. Isolation of Bacterial genomic DNA (Demo)</li> <li>4. Determination of ABO and Rh blood groups (Slide method)</li> <li>5. Widal test- Dreyers technique</li> <li>6. Differential Count, Total count of WBC and RBC</li> <li>7. Haemoglobin estimation</li> <li>8. Estimation of reducing sugar- Cole's method</li> <li>9. Estimation of protein- Folin Lowry's method</li> <li>10. Microbiological analysis of drinking water by MPN and PA test</li> <li>11. Microbiological analysis of milk</li> </ol>				90 hours
<b>Teaching Methodology</b>	Classwork, Discussion, Self-Study, Seminars and/or Assignment.				
<b>References</b>	<ul style="list-style-type: none"> <li>✓ Patel, R. J. and Patel, R. K. (2015). Experimental Microbiology, Vol. 1, 9th Ed.,Aditya.</li> <li>✓ Patel, R. J. and Patel, R. K. (2015). Experimental Microbiology, Vol. 2, 9th Ed.,Aditya.</li> <li>✓ Cappuccino, J.G. and Sherman N. (2005). Microbiology: A Laboratory Manual, 6<sup>th</sup>Ed., Pearson Education (Singapore) Pvt. Ltd.</li> <li>✓ Cappuccino, J.G. and Sherman N. (2005). Microbiology: A Laboratory Manual, 10<sup>th</sup>Ed., Pearson Benjamin Cummings</li> <li>✓ Aneja, K.R., (2003). Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Production Technology, New Age International Publishers.</li> </ul>				
<b>Course Outcomes</b>	<p>Student shall learn about drug resistant mutant and isolation of bacteriophage.</p> <p>Gain knowledge of the practical related Haematology.</p> <p>Student shall understand the practical related Haematology.</p> <p>Student shall enable the student to practical related to water and milk.</p>				

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K <sub>1</sub> , K <sub>2</sub> , ..., K <sub>6</sub> )
CO1		Y											Y				K <sub>1</sub>
CO2			Y				Y										K <sub>2</sub>
CO3					Y				Y						Y		K <sub>3</sub> , K <sub>4</sub>
CO4	Y										Y			Y			K <sub>5</sub> , K <sub>6</sub>

**High-3      Medium-2      Low-1**

**K<sub>1</sub> => Remember   K<sub>2</sub> => Understand      K<sub>3</sub> => Apply      K<sub>4</sub> => Analyze      K<sub>5</sub> => Evaluate      K<sub>6</sub> => Create**

## VIDHYADEEP UNIVERSITY (Anita)

Institute Name: Vidhyadeep Institute of Science			Department Name: Microbiology			
Recommended Programs :B.Sc.Microbiology SEM V						
Course Name	Food Technology		Course Code	1111508		
Credit Hours	L	T	P	N	Total Credits	2
		2				
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)					
Effective From	June 2024					
Prerequisites (if any)	Basic Science					
Course Objectives	<ul style="list-style-type: none"> <li>✓ Apply knowledge gained in food chemistry, microbiology, engineering, and sensory evaluation to the development, processing, and preservation of safe, nutritious, and high-quality food products.</li> <li>✓ Utilize advanced instruments and technologies to process and analyze food products and to solve food safety problems.</li> <li>✓ They will be able to design, implement and evaluate a research-based project to meet demands of the society. Students will get the ability to use appropriate techniques, skills, and modern tools in the food industry and the academic profession.</li> </ul>					
Course Content	<b>Unit I: FOOD BIOTECHNOLOGY</b> History of food biotechnology Traditional fermentation technology Enzyme technology Modern biotechnology Future prospects					7 hours
	<b>Unit II: FOOD PROCESSING</b> Processing concepts General processing concepts Pasteurization process Blanching process flocculation and clearing					7 hours
	<b>Unit III:FOOD PRESERVATION</b> General principles of food preservation. Preservation by use of High temperature Preservation by use of low temperature Preservation by drying Preservation by food additives Preservation by radiation DNA repair					8 hours
	<b>Unit IV: FOOD SPOILAGE</b> Spoilage of fresh and frozen vegetables Spoilage of fruits Spoilage of fresh and processed meats, poultry and seafood Spoilage of miscellaneous foods					8 hours

<b>Teaching Methodology</b>	Classwork, Discussion, Self-Study, Seminars and/or Assignment.
<b>References</b>	<ul style="list-style-type: none"> <li>✓ Campbell-Platt, G. (Ed.). (2011). Food science and technology. Wiley-Blackwell.</li> <li>✓ Frazier, W. C., &amp; Westhoff, D. C. (1988). Food Microbiology. McGraw-Hill.</li> <li>✓ Jay, J. M. (1996). Modern food microbiology. Chapman &amp; Hall.</li> <li>✓ Heldman, D. R., &amp; Hartel, R. W. (1999). Principles of food processing. Aspen Pub..</li> </ul>
<b>Course Outcomes</b>	Students acquire in-depth theoretical and practical knowledge of mathematics, food science, and engineering. They will get proficiency in solving engineering problems related to the food industry and focus on the importance of safe processed nutritious food. They will develop an ability to work in Food industries, research organizations and academia as well as to design or process food products as per the needs and specifications. They will get the proper understanding of professional, ethical, legal, security, and social issues and responsibilities for entrepreneurship skills.

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K <sub>1</sub> , K <sub>2</sub> , ..., K <sub>6</sub> )
CO1		Y											Y				K <sub>1</sub>
CO2			Y				Y										K <sub>2</sub>
CO3					Y										Y		K <sub>3</sub> , K <sub>4</sub>
CO4	Y										Y			Y			K <sub>5</sub> , K <sub>6</sub>

**High-3      Medium-2      Low-1**

**K<sub>1</sub> => Remember    K<sub>2</sub> => Understand      K<sub>3</sub> => Apply      K<sub>4</sub> => Analyze      K<sub>5</sub> => Evaluate      K<sub>6</sub> => Create**



## VIDHYADEEP UNIVERSITY (Anita)

Institute Name: Vidhyadeep Institute of Science			Department Name: Microbiology			
Recommended Programs :B.Sc.Microbiology SEM VI						
Course Name	rDNA technology		Course Code	111601		
Credit Hours	L	T	P	N	Total Credits	2
		2				
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)					
Effective From	June 2024					
Prerequisites (if any)	Basic Science					
Course Objectives	<ul style="list-style-type: none"> <li>✓ To understand the fundamental concepts behind various molecular mechanisms</li> <li>✓ To study various tool and techniques used in r-DNA technology</li> <li>✓ To know concept of gene amplification, sequencing, cloning and transformation</li> <li>✓ To become familiar with various gene modifications techniques and its applications</li> </ul>					
Course Content	<b>Unit I: INTRODUCTION TO GENETIC ENGINEERING</b> Gene cloning, PCR and its importance Gene manipulation techniques: Conventional breeding Protoplast fusion and cell cloning					7 hours
	<b>Unit II: TOOLS OF GENETIC ENGINEERING: ENZYMES AND VECTORS</b> Enzymes for gene cloning Vectors Cloning and expression vector $\lambda$ phage Cosmid vectors Bacterial Artificial Chromosome vector					7 hours
	<b>Unit III: TECHNIQUES OF GENETIC ENGINEERING</b> Construction of cDNA library Genomic library Colony and Plaque hybridization Transformation and clone selection Insertion of phage DNA					8 hours
	<b>Unit IV: APPLICATIONS OF GENETIC ENGINEERING</b> Production of recombinant pharmaceuticals Production of recombinant vaccines Plants that make their own insecticides DNA analysis in the identification of crime suspects					8 hours
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment.					
References	<ul style="list-style-type: none"> <li>✓ Trevan, M. D. (1987). Biotechnology: The Biological Principles, Tata-McGraw-Hill.</li> <li>✓ Singh, B. D. (2011). Biotechnology: Expanding Horizons, 4<sup>th</sup> Ed., Kalyani Publishers.</li> <li>✓ Brown, T. A. (2016). Gene cloning and DNA analysis: An introduction, 7<sup>th</sup> Ed., John Wiley and Sons.</li> <li>✓ Rastogi, S. and Pathak, N. (2009). Genetic Engineering, 1<sup>st</sup> Ed., Oxford University</li> </ul>					

	Press.
<b>Course Outcomes</b>	<p>Student will learn about early development of recombinant technologies. Along with, students will grasp outline of genetic cloning, various techniques for gene manipulation.</p> <p>Students will gain knowledge of various enzymes and vectors used in genetic engineering.</p> <p>Students will get in-depth information about molecular mechanisms of enzymes and vectors involved in genetic engineering.</p> <p>Students will understand the process involve in cDNA and genomic library construction.</p> <p>Student will enable to understand outcome of various genetic engineered products. Student will get to know how recombinant products solve problems in medicine, forensic and agricultural field.</p>

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K <sub>1</sub> , K <sub>2</sub> , ..., K <sub>6</sub> )
CO1		Y											Y				K <sub>1</sub>
CO2			Y				Y										K <sub>2</sub>
CO3					Y				Y						Y		K <sub>3</sub> , K <sub>4</sub>
CO4	Y										Y			Y			K <sub>5</sub> , K <sub>6</sub>

**High-3                  Medium-2                  Low-1**

**K<sub>1</sub> => Remember   K<sub>2</sub> => Understand                  K<sub>3</sub> => Apply                  K<sub>4</sub> => Analyze                  K<sub>5</sub> => Evaluate                  K<sub>6</sub> => Create**

## VIDHYADEEP UNIVERSITY (Anita)

Institute Name: Vidhyadeep Institute of Science			Department Name: Microbiology			
Recommended Programs :B.Sc.Microbiology SEM VI						
Course Name	Epidemiology and Medical microbiology		Course Code	1111602		
Credit Hours	L	T	P	N	Total Credits	2
		2				
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)					
Effective From	June 2024					
Prerequisites (if any)	Basic Science					
Course Objectives	<ul style="list-style-type: none"> <li>✓ To understand the role of virulence factors in causing infectious diseases.</li> <li>✓ To envisage the understanding of an epidemic, its cause and control and the emergence and re-emergence of infectious diseases affecting the world.</li> <li>✓ To gain insight on the different modes of disease transmission air, food, water, vector and direct contact.</li> <li>✓ To study the causative agents, pathogenicity, prevention and control of diseases.</li> </ul>					
Course Content	<b>Unit I: PATHOGENICITY, INFECTIOUS DISEASE AND EPIDEMIOLOGY</b> Pathogenicity drives infectious disease Virulence defines a pathogen's success Epidemiology is an evidence-based science Infectious disease is revealed through patterns within a population Infectious diseases and pathogens are emerging and re-emerging Health-care facilities harbor infectious agents					7 hours
	<b>Unit II: AIR-BORNE DISEASES</b> Airborne transmission Tuberculosis Pneumonia and its types Influenza SARS-CoV2					7 hours
	<b>Unit III: CONTACT AND VECTOR BORNE DISEASES</b> Staphylococcal infections Syphilis Leptospirosis AIDS Malaria Dengue					8 hours
	<b>Unit IV: FOOD AND WATER-BORNE DISEASES</b> Gastroenteritis Rotavirus Salmonellosis Cholera Amoebic dysentery Botulism Hepatitis					8 hours

<b>Teaching Methodology</b>	Classwork, Discussion, Self-Study, Seminars and/or Assignment.
<b>References</b>	<ul style="list-style-type: none"> <li>✓ Willey, J. M., Sherwood, L., and Woolverton, C. J. (2017). Prescott's microbiology, 10<sup>th</sup> Ed., New York: McGraw-Hill Education.</li> <li>✓ Greenwood, D., Slack, R., and Barer, M. (2012). Medical Microbiology A Guide to Microbial Infections, 18<sup>th</sup> Ed., Churchill Livingstone, Elsevier.</li> <li>✓ Pelczar, Chan, and Krieg (1993). Microbiology – Concepts and Application International Ed., McGraw-Hill Education.</li> <li>✓ Ananthnarayan, R and Paniker C. K. (2009). Textbook of Microbiology, 8<sup>th</sup> Ed., Universities Press (India) Pvt. Limited.</li> <li>✓ Ichhpujani, R. and Bhatia, R. (2002). Medical Parasitology, 3<sup>rd</sup> Ed., Jaypee.</li> </ul>
<b>Course Outcomes</b>	<p>Students shall gain knowledge of pathogenicity, virulence factors, patterns of infectious diseases. Students shall understand the rise of an epidemic, control and emerging and re-emerging diseases.</p> <p>Students shall understand the role of air in transmission of infectious disease. Students shall gain insight of the causative agents, pathogenicity, prevention and control of and diseases transmitted by air.</p> <p>Students shall understand the role of vectors in transmission of infectious disease. Students shall gain insight of the causative agents, pathogenicity, prevention and control of and diseases transmitted by vector and direct contact.</p> <p>Students shall understand the role of food and water in transmission of infectious disease. Students shall gain insight of the causative agents, pathogenicity, prevention and control of and diseases transmitted by food and water.</p>

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K <sub>1</sub> , K <sub>2</sub> , ..., K <sub>6</sub> )
CO1		Y											Y				K1
CO2			Y				Y										K2
CO3					Y										Y		K3, K4
CO4	Y										Y			Y			K5, K6

**High-3    Medium-2    Low-1**

**K<sub>1</sub> =>Remember    K<sub>2</sub> =>Understand**

**K<sub>3</sub> =>Apply**

**K<sub>4</sub> =>Analyze**

**K<sub>5</sub> =>Evaluate**

**K<sub>6</sub> =>Create**

## VIDHYADEEP UNIVERSITY (Anita)

<b>Institute Name: Vidhyadeep Institute of Science</b>			<b>Department Name: Microbiology</b>			
<b>Recommended Programs :B.Sc.Microbiology SEM VI</b>						
<b>Course Name</b>	<b>Industrial Microbiology</b>		<b>Course Code</b>	<b>1111603</b>		
<b>Credit Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>N</b>	<b>Total Credits</b>	2
		2				
<b>Minimum weeks per Semester</b>	15 (Including Classwork, examination, preparation, holidays etc.)					
<b>Effective From</b>	June 2024					
<b>Prerequisites (if any)</b>	Basic Science					
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>✓ To gain an insight on the historical development of industrial microbiology.</li> <li>✓ To study the screening techniques for the isolation of industrial important microorganisms and its preservation. importance of various media components and its effect on the optimum production.</li> <li>✓ To understand the designing aspects of bioreactor and types.</li> <li>✓ To learn the various methods of product recovery from the fermentation media.</li> </ul>					
<b>Course Content</b>	<b>Unit I: DEVELOPMENT IN INDUSTRIAL MICROBIOLOGY</b> Component parts of fermentation process Screening for new metabolites Screening Techniques: Primary and Secondary Inoculum development					7 hours
	<b>Unit II: INDUSTRIAL STRAINS AND FERMENTATION MEDIA</b> Isolation of microorganism and culture collections Industrial Strains and strain improvement Fermentation media					7 hours
	<b>Unit III: BIOREACTOR</b> Bioreactor Design of Bioreactor Bioreactor Types Fermentation types and process					8 hours
	<b>Unit IV: DOWNSTREAM PROCESSING</b> Cell harvesting Cell disruption Product recovery Product development, regulation and safety					8 hours
<b>Teaching Methodology</b>	Classwork, Discussion, Self-Study, Seminars and/or Assignment.					
<b>References</b>	<ul style="list-style-type: none"> <li>✓ To gain an insight on the historical development of industrial microbiology.</li> <li>✓ To study the screening techniques for the isolation of industrial important microorganisms and its preservation. importance of various media components and its effect on the optimum production.</li> <li>✓ To understand the designing aspects of bioreactor and types.</li> <li>✓ To learn the various methods of product recovery from the fermentation media.</li> </ul>					
<b>Course Outcomes</b>	Students shall gain an understanding of the pre, post and present development of industrial microbiology. They shall learn the fermentation process development, screening techniques for the isolation of industrially important strains.					

	<p>Students shall acquire the knowledge of the media components and various factors for the optimum production of microbial products on large scale.</p> <p>Students shall learn design of fermenters and the different types of fermenters for the industrial production.</p> <p>Students shall understand the sterilization of media and the methods of product recovery.</p>
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**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K1, K2, ..., K6)
CO1		Y											Y				K1
CO2			Y				Y										K2
CO3					Y				Y						Y		K3, K4
CO4	Y							Y			Y			Y			K5, K6

**High-3      Medium-2      Low-1**

**K<sub>1</sub> =>Remember   K<sub>2</sub> =>Understand      K<sub>3</sub> =>Apply      K<sub>4</sub> =>Analyze      K<sub>5</sub> =>Evaluate      K<sub>6</sub> =>Create**

## VIDHYADEEP UNIVERSITY (Anita)

Institute Name: Vidhyadeep Institute of Science			Department Name: Microbiology		
Recommended Programs :B.Sc.Microbiology SEM VI					
Course Name	Diagnostic Microbiology	Course Code	1111604		
Credit Hours	L	T	P	N	Total Credits
		2			
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)				
Effective From	June 2024				
Prerequisites (if any)	Basic Science				
Course Objectives	<ul style="list-style-type: none"> <li>✓ To gain knowledge of clinical specimen collection, transport and processing for disease diagnosis.</li> <li>✓ To have the concept of identification of the disease pathogen from clinical specimens and treatment of disease.</li> <li>✓ To explain the principles and importance of diagnostic methods applied in clinical laboratory.</li> <li>✓ To have an insight on antimicrobial therapy to cure disease and to know the treatment effectiveness as well as on concept of drug resistance.</li> </ul>				
Course Content	<b>Unit I: INTRODUCTION TO DIAGNOSTIC MICROBIOLOGY</b> Collection and Transport of Specimen: Blood CSF Pus Throat and Mouth Sputum Urogenital Urine Stool Gross Examination of Specimens				7 hours
	<b>Unit II: MOLECULAR METHODS FOR MICROBIAL IDENTIFICATION AND CHARACTERIZATION</b> Specimen Collection and Transport Nucleic Acid Hybridization Methods Hybridization with Signal Amplification Amplification Methods- PCR Based Real Time PCR Amplification Methods- Non-PCR Based Isothermal Amplification Sequencing and Enzymatic Digestion of Nucleic Acids				7 hours
	<b>Unit III: IMMUNOCHEMICAL METHODS AND SEROLOGIC DIAGNOSIS OF INFECTIOUS DISEASES</b> Principles of Immunochemical Methods Used for Organism Detection Serodiagnosis of Infectious Diseases Principles of Serologic Test Methods				8 hours
	<b>Unit IV: ANTIMICROBIAL AGENTS AND SUSCEPTIBILITY</b>				8 hours

	<p><b>TESTING</b>  Antimicrobial Drugs  Methods for antimicrobial susceptibility testing:  Principles  Methods that directly measure antimicrobial activity: Conventional Testing  Methods: Broth Dilution, Agar Dilution, Disk Diffusion  Detection of Specific Resistance Mechanisms  Phenotypic Method-β-Lactamase Detection  Genotypic Methods  Special Methods for Complex Antimicrobial/Organism  Bactericidal Test- Minimal Bactericidal Concentration/Serum Bactericidal  Tests for Activity of Antimicrobial Combinations</p>	
<b>Teaching Methodology</b>	Classwork, Discussion, Self-Study, Seminars and/or Assignment.	
<b>References</b>	<ul style="list-style-type: none"> <li>✓ Tille, P. (2014). Bailey and Scott's diagnostic microbiology.13<sup>th</sup> Ed., Elsevier Health Sciences.</li> <li>✓ Willey, J. M., Sherwood, L. M. and Woolverton, C. J. (2017). Prescott's Microbiology, 10<sup>th</sup> Ed., Mc-Graw Hill Education.</li> <li>✓ Cheesbrough, M. (2005). District laboratory practice in tropical countries, Part 1 and 2. Cambridge university press.</li> <li>✓ Ochei, J. O., and Kolhatkar, A. A. (2000). Medical Laboratory Science: Theory and Practice. McGraw Hill Education.</li> <li>✓ Godkar, P. B. (2003). Textbook of Medical Laboratory Technology, 2 Ed., Bhalani Publishing House.</li> <li>✓ Tang, Yi-Wei and Stratton, C. W. (2013). Advanced Techniques in Diagnostic Microbiology. New York: Springer.</li> <li>✓ Mukherjee, K. L. (2013). Medical Laboratory Technology Vol. 1, 2 and 3, Tata McGraw-Hill Education.</li> </ul>	
<b>Course Outcomes</b>	<p>Student will be able to know the basic steps in collection, transport and processing of clinical specimens and will be able to have knowledge on identification and characterization of infectious agents.</p> <p>Student will be able to understand the advanced molecular techniques and their applications in diagnostic microbiology.</p> <p>Student will be able to explain the principles and importance of the immunochemical and serological diagnostic tests.</p> <p>Student will be able to assess treatment strategies including the appropriate use of antimicrobial agents and common mechanisms of antimicrobial action and resistance.</p>	

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K <sub>1</sub> , K <sub>2</sub> , ..., K <sub>6</sub> )
CO1		Y						Y					Y				K <sub>1</sub>
CO2			Y				Y										K <sub>2</sub>
CO3					Y				Y						Y		K <sub>3</sub> , K <sub>4</sub>
CO4	Y										Y			Y			K <sub>5</sub> , K <sub>6</sub>

**High-3                      Medium-2                      Low-1**  
**K<sub>1</sub> =>Remember   K<sub>2</sub> =>Understand                      K<sub>3</sub> =>Apply                      K<sub>4</sub> =>Analyze                      K<sub>5</sub> =>Evaluate                      K<sub>6</sub> =>Create**



## VIDHYADEEP UNIVERSITY (Anita)

<b>Institute Name: Vidhyadeep Institute of Science</b>			<b>Department Name: Microbiology</b>			
<b>Recommended Programs :B.Sc.Microbiology SEM VI</b>						
<b>Course Name</b>	<b>Microbial products</b>		<b>Course Code</b>	<b>1111605</b>		
<b>Credit Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>N</b>	<b>Total Credits</b>	2
		2				
<b>Minimum weeks per Semester</b>	15 (Including Classwork, examination, preparation, holidays etc.)					
<b>Effective From</b>	June 2024					
<b>Prerequisites (if any)</b>	Basic Science					
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>✓ To understand the large-scale production of primary and secondary metabolites.</li> <li>✓ To gain knowledge of application of microorganisms in agriculture.</li> <li>✓ To know concept of using microorganisms as fuel and energy generation.</li> <li>✓ To become aware of microbial enzymes and its applications.</li> </ul>					
<b>Course Content</b>	<b>Unit I: MICROBIAL METABOLITES</b> Vitamin B12 Citric Acid L-glutamate Health care Products					7 hours
	<b>Unit II: AGRICULTURAL MICROBIAL PRODUCTS</b> Biofertilizers Bioinsecticides Bioherbicides Inoculant formulation					7 hours
	<b>Unit III: BIOENERGY AND BIOMASS PRODUCTION</b> Bioethanol Biogas Hydrogen-a new fuel Microbial Enhanced Oil Recovery					8 hours
	<b>Unit IV: ENZYME TECHNOLOGY</b> Microorganisms producing enzymes Properties of Enzymes Methods of Enzyme production Immobilization of Enzyme Biosensors					8 hours
<b>Teaching Methodology</b>	Classwork, Discussion, Self-Study, Seminars and/or Assignment.					
<b>References</b>	<ul style="list-style-type: none"> <li>✓ Creuger, W. (2005). Biotechnology: A textbook of Industrial Microbiology, 2<sup>nd</sup> Ed., Panima, New Delhi.</li> <li>✓ Dubey, R. C. (2010). Textbook of Biotechnology, 1<sup>st</sup> Ed., S. Chand, Multicolor.</li> <li>✓ Patel, A. H. (2012). Industrial Microbiology. 2<sup>nd</sup> Ed., Macmillan, India.</li> <li>✓ Shivakumar, P. K., Joe, M. M. and Sukesh, K. (2010). An Introduction to Industrial Microbiology, 1<sup>st</sup> Ed., S Chand Publications.</li> <li>✓ Waites, M. J. (2001). Industrial Microbiology: An Introduction, 1<sup>st</sup> Ed., Blackwell publishing</li> <li>✓ Wiley, J. M., Sherwood, L. M. and Woolverton, C. J., (2014) Prescott, Harley and</li> </ul>					

	<p>Klein's Microbiology, 9<sup>th</sup> Ed., McGraw-Hill Education.</p> <p>✓ Ratledge, C. and Kristiansen, B. (2006). Basic Biotechnology, 3<sup>rd</sup> Ed., Cambridge University Press.</p>
<b>Course Outcomes</b>	<p>Students shall understand the commercial production of microbial metabolites on large scale using varied microorganisms.</p> <p>Students shall gain insight of usage of microorganisms as protein source, food supplements, soil supplements and bioinoculants.</p> <p>Students shall acquire knowledge of using microorganisms in energy production and role of microbial enzymes in industries.</p> <p>Students shall gain an understanding of enzymes, its industrial applications, immobilization of enzymes and its use in biosensors.</p>

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K <sub>1</sub> , K <sub>2</sub> , ..., K <sub>6</sub> )
CO1		Y						Y					Y				K <sub>1</sub>
CO2			Y				Y										K <sub>2</sub>
CO3					Y										Y		K <sub>3</sub> , K <sub>4</sub>
CO4	Y								Y		Y			Y			K <sub>5</sub> , K <sub>6</sub>

**High-3**            **Medium-2**            **Low-1**  
**K<sub>1</sub> =>Remember**   **K<sub>2</sub> =>Understand**            **K<sub>3</sub> =>Apply**            **K<sub>4</sub> =>Analyze**            **K<sub>5</sub> =>Evaluate**            **K<sub>6</sub> =>Create**

## VIDHYADEEP UNIVERSITY (Anita)

<b>Institute Name: Vidhyadeep Institute of Science</b>			<b>Department Name: Microbiology</b>			
<b>Recommended Programs :B.Sc.Microbiology SEM VI</b>						
<b>Course Name</b>	<b>Genomics,proteomics and Bioinformatics</b>		<b>Course Code</b>	<b>1111606</b>		
<b>Credit Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>N</b>	<b>Total Credits</b>	2
		2				
<b>Minimum weeks per Semester</b>	15 (Including Classwork, examination, preparation, holidays etc.)					
<b>Effective From</b>	June 2024					
<b>Prerequisites (if any)</b>	Basic Science					
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>✓ To study DNA, gene and genome sequencing methods and genome evolution, so that we can relate biology with that of information science.</li> <li>✓ To provide insights of proteomics and how to link proteomics with genomics.</li> <li>✓ To learn basics of bioinformatics and its various databases.</li> <li>✓ To study sequence retrieval, sequence alignment and various tools used in sequence alignment.</li> </ul>					
<b>Course Content</b>	<b>Unit I: MICROBIAL GENOMICS</b> DNA Sequencing Methods Metagenomics : Access to Uncultured Microbes					7 hours
	<b>Unit II: MICROBIAL PROTEOMICS</b> Bioinformatics: Sequences to Bioinformatics Functional Genomics: Genes to Phenotype System Biology					7 hours
	<b>Unit III: BIOINFORMATICS – I</b> Introduction Aim of Bioinformatics Scope and Research Areas of Bioinformatics Features of Biological Databases Classification Scheme of Biological Databases					8 hours
	<b>Unit IV: BIOINFORMATICS – II</b> Tools for Web Search Data Retrieval Tools Types of Alignments Global, Local and End free Space Alignment Multiple Sequence Alignment BLAST: Variants and BLAST Output Format FASTA Comparison of FASTA and BLAST					8 hours
<b>Teaching Methodology</b>	Classwork, Discussion, Self-Study, Seminars and/or Assignment.					
<b>References</b>	<ul style="list-style-type: none"> <li>✓ Wiley, J. M., Sherwood, L. M. and Woolverton, C. J., (2017) Prescott, Harley and Klein's Microbiology, 10<sup>th</sup> Ed., McGraw-Hill Education.</li> <li>✓ Ghosh, Z. and Mallick, B. (2009). Bioinformatics: Principles and Applications, ,1<sup>st</sup>Ed., Oxford University Press.</li> </ul>					

	<ul style="list-style-type: none"> <li>✓ Rastogi, C., Mendiratta, N. and Rastogi, P. (2008). Bioinformatics: Methods and Applications, 4<sup>th</sup> Ed. PHI learning Pvt. Ltd.</li> <li>✓ Xiong, J. (2006). Essential Bioinformatics, 1<sup>st</sup> Ed., Cambridge University Press.</li> <li>✓ Bosu, O. and Thukral, S. K. (2008). Bioinformatics: Databases, Tools and Algorithms, 1<sup>st</sup> Ed., Oxford university Press.</li> <li>✓ Primrose, S. and Twyman, R. (2006). Principles of Gene Manipulation and Genomics, 7<sup>th</sup> Ed. Black well Publishing, Malden.</li> <li>✓ Madigan, M. T., Bender, K. S., Buckley, D. H., Sattley, W. M. and Stahl, D. A. (2018). Brock Biology of Microorganisms, 15<sup>th</sup> Global Ed., Pearson</li> </ul>
<b>Course Outcomes</b>	<p>The unit will describe the students about sequencing of DNA, genes and genomes including next generation sequencing technologies.</p> <p>The unit will discuss how to relate genomics to proteomics and proteomics to bioinformatics.</p> <p>The unit will introduce definition, branches, biological databases of bioinformatics to students.</p> <p>The unit will explain how to retrieve sequences from databases and how to perform sequence alignments using sequence alignment tools.</p>

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K <sub>1</sub> , K <sub>2</sub> , ..., K <sub>6</sub> )
CO1		Y								Y			Y				K1
CO2			Y				Y										K2
CO3					Y			Y							Y		K3, K4
CO4	Y										Y			Y			K5, K6

**High-3**                      **Medium-2**                      **Low-1**  
**K<sub>1</sub> =>Remember**   **K<sub>2</sub> =>Understand**                      **K<sub>3</sub> =>Apply**                      **K<sub>4</sub> =>Analyze**                      **K<sub>5</sub> =>Evaluate**                      **K<sub>6</sub> =>Create**

## VIDHYADEEP UNIVERSITY (Anita)

<b>Institute Name: Vidhyadeep Institute of Science</b>		<b>Department Name: Microbiology</b>			
<b>Recommended Programs :B.Sc.Microbiology SEM VI</b>					
<b>Course Name</b>	<b>Microbiology practical</b>	<b>Course Code</b>	<b>1111607</b>		
<b>Credit Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>N</b>	<b>Total Credits</b>
			6		
<b>Minimum weeks per Semester</b>	15 (Including Classwork, examination, preparation, holidays etc.)				
<b>Effective From</b>	June 2024				
<b>Prerequisites (if any)</b>	Basic Science				
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>✓ To study the practicals related to various medical problems.</li> <li>✓ To study practical related pharmaceuticals.</li> <li>✓ To study practicals related to fermentative microbial products.</li> <li>✓ To study the practical related to bioinformatics.</li> </ul>				
<b>Course Content</b>	<ol style="list-style-type: none"> <li>1. Bacteriological investigation of medical problems related to blood.</li> <li>2. Bacteriological investigation of medical problems related to stool.</li> <li>3. Bacteriological investigation of medical problems related to purulent exudates, wound, and abscess.</li> <li>4. Bacteriological investigation of medical problems related to urine.</li> <li>5. Determination of Antibiotic Susceptibility (Agar disc method) and MIC.</li> <li>6. Sterility testing by direct inoculation method.</li> <li>7. Fermentative production of amylase and its estimation.</li> <li>8. Estimation of streptomycin.</li> <li>9. Paper chromatography of Amino acids.</li> <li>10. Physical, chemical and microscopic examination of urine.</li> <li>11. Sequence retrieval for nucleic acid and proteins and BLAST analysis.</li> <li>12. Study of permanent slides of four arthropod vectors (<i>Aedes</i> / <i>Anopheles</i> mosquitoes, Rat flea, Mite, Tick).</li> </ol>				90 hours
<b>Teaching Methodology</b>	Classwork, Discussion, Self-Study, Seminars and/or Assignment.				
<b>References</b>	<ul style="list-style-type: none"> <li>✓ Patel, R. J. and Patel, R. K. (2015). Experimental Microbiology, Vol. 1, 9th Ed., Aditya.</li> <li>✓ Patel, R. J. and Patel, R. K. (2015). Experimental Microbiology, Vol. 2, 9th Ed., Aditya.</li> <li>✓ Cappuccino, J.G. and Sherman N. (2005). Microbiology: A Laboratory Manual, 6<sup>th</sup> Ed., Pearson Education (Singapore) Pvt. Ltd.</li> <li>✓ Cappuccino, J.G. and Sherman N. (2005). Microbiology: A Laboratory Manual, 10<sup>th</sup> Ed., Pearson Benjamin Cummings</li> <li>✓ Aneja, K.R., (2003). Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Production Technology, New Age International Publishers.</li> </ul>				
<b>Course Outcomes</b>	<p>Student shall learn about various medical problems.</p> <p>Gain knowledge of the practical related pharmaceuticals..</p> <p>Student shall understand the practical related fermentative microbial products.</p> <p>Student shall enable the student to practical related to bioinformatics.</p>				

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K <sub>1</sub> , K <sub>2</sub> , ..., K <sub>6</sub> )
CO1		Y											Y				K <sub>1</sub>
CO2			Y				Y										K <sub>2</sub>
CO3					Y				Y						Y		K <sub>3</sub> , K <sub>4</sub>
CO4	Y										Y			Y			K <sub>5</sub> , K <sub>6</sub>

**High-3                  Medium-2                  Low-1**

**K<sub>1</sub> =>Remember   K<sub>2</sub> =>Understand                  K<sub>3</sub> =>Apply                  K<sub>4</sub> =>Analyze                  K<sub>5</sub> =>Evaluate                  K<sub>6</sub> =>Create**

## VIDHYADEEP UNIVERSITY (Anita)

Institute Name: Vidhyadeep Institute of Science			Department Name: Microbiology		
Recommended Programs : B.Sc. Microbiology SEM VI					
Course Name	Biofertilizer & Biopesticides		Course Code	1111607	
Credit Hours	L	T	P	N	Total Credits
		2			
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)				
Effective From	June 2024				
Prerequisites (if any)	Basic Science				
Course Objectives	<ul style="list-style-type: none"> <li>✓ Understanding about Bio fertilizers and Bio pesticides</li> <li>✓ Understanding about Algal, VAM, Rhizobium and other fertilizers.</li> <li>✓ To exploit the microbial diversity in various agro-ecologies for biofertilizer application in diversified systems.</li> <li>✓ To study the impact of soil management practices on microbial functions and soil health.</li> <li>✓ improve biofertilizer technology to ensure high quality and improved delivery.</li> <li>✓ Biofertilizers supplement the requirements of fertilizers and do not replace them.</li> </ul>				
Course Content	<b>Unit I: Bio-fertilizers:</b> General account of the microbes used as bio-fertilizers for various crop plants and their advantages over chemical fertilizers. Symbiotic N <sub>2</sub> fixers: Rhizobium- Isolation, characteristics, types, inoculums production and field application, legume / pulses plants. Frankia- Isolation, characteristics, Alder, Casurina plants, non-leguminous crop symbiosis				8 hours
	<b>Unit II: Non-Symbiotic Nitrogen Fixers</b> Free living Azospirillum, Azotobacter-free isolation, characteristics, mass inoculums, production and field application				8 hours
	<b>Unit III: Phosphate Solubilizers</b> Phosphate solubilising microbes-Isolation, characterization, mass inoculums production, field application. Importance of mycorrhizal inoculum, types of mycorrhiza and associated plants				7 hours
	<b>Unit IV: Bio-insecticides</b> General account of microbes used as bioinsecticide and their advantages over synthetic pesticides, Bacillus thuringiensis, production, Field applications, Viruses–cultivation and field applications				7 hours
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment.				
References	<ul style="list-style-type: none"> <li>✓ Kannaiyan, S. Bioethnology of Biofertilizers, CHIPS, Texas.</li> <li>✓ Mahendra K. Rai. Hand book of Microbial biofertilizers, The HaworthPress, Inc. New York.</li> </ul>				

	<ul style="list-style-type: none"> <li>✓ Reddy,S.M. Bioinoculants for sustainable agriculture and forestry,Scientific Publishers.</li> <li>✓ Subba Rao. Soil microorganisms and plant growth Oxford and IBH publishing co. Pvt. Ltd. New Delhi.</li> <li>✓ Saleem, Shakoori. Development of Bioinsecticide, LapLambertAcademic Publishing Gmb HKG</li> <li>✓ Aggarwal. Advanced Environmental Biotechnology, APH publication.</li> </ul>
<b>Course Outcomes</b>	<p>Students will have sound knowledge of microbiology as an independent subject.</p> <p>Students will be having good knowledge regarding various types of microbes present in environment.</p> <p>Students will know regarding various techniques and methods used in microbiology.</p> <p>They will be able to learn about uses of microbiology in various sectors.</p> <p>They will be able to learn about use of microbiology in agriculture, industry etc.</p>

**Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	Knowledge Levels (K1, K2, ..., K6)
CO1		Y											Y				K1
CO2			Y				Y										K2
CO3					Y										Y		K3, K4
CO4	Y										Y			Y			K5, K6

**High-3                  Medium-2                  Low-1**  
**K<sub>1</sub> =>Remember   K<sub>2</sub> =>Understand                  K<sub>3</sub> =>Apply                  K<sub>4</sub> =>Analyze                  K<sub>5</sub> =>Evaluate                  K<sub>6</sub> =>Create**