

## Course Outcomes

| 2015 Scheme                                                                                                                                                                                                                                       | 2017 Scheme                                                                                                                                                                                                                                       | 2018 Scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| <b>15MAT31-Engineering Mathematics-III</b>                                                                                                                                                                                                        | <b>17MAT31-Engineering Mathematics-III</b>                                                                                                                                                                                                        | <b>18BT41-Biostatics-(AE)</b><br>CO1:Application of data distribution in biotechnology problems, concepts about histogram, frequency curve<br>CO2:Describe the abilities of central tendency and importance of statistics in biology<br>CO3: Applying the concepts of design of experiments by statistical method of analysis<br>CO4:Illustrste the concept relating to discrete, continuous statistical concepts relating to binominal distribution, Normal distribution and regression analysis<br>CO5: Study the importance of concepts of t-test, F-test, Chi-square test, ANOVA, factorial design and cluster design |
| <b>15BT32-Unit Operations-(KMV)</b><br><br>CO1: Describe the rheological behavior of fluids<br>CO2: Examine the principle of flow measuring instruments and analyze the application of Bernoulli equation<br>CO3: Apply the principles of various | <b>17BT32-Unit Operations-(KMV)</b><br><br>CO1: Describe the rheological behavior of fluids<br>CO2: Examine the principle of flow measuring instruments and analyze the application of Bernoulli equation<br>CO3: Apply the principles of various | <b>18BT32-Microbiology-(HPP)</b><br><br>CO1: Able to learn the classification, structural features and functional aspects of prokaryotic and eukaryotic organism<br>CO2: Understanding of microbial techniques for isolation, growth and characterization of microbes                                                                                                                                                                                                                                                                                                                                                     |

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| <p>mechanical operations like size reduction, sedimentation, filtration and mixing.</p> <p>CO4: Analyze the heat governing laws and explain the about heat transfer equipments</p> <p>CO5: Evaluation of various mass transfer operations</p>                                                                                                                                                                                | <p>mechanical operations like size reduction, sedimentation, filtration and mixing.</p> <p>CO4: Analyze the heat governing laws and explain the about heat transfer equipments</p> <p>CO5: Evaluation of various mass transfer operations</p>                                                                                                                                                                                | <p>CO3: Analyse different types of growth patterns, metabolites and metabolic pathways</p> <p>CO4: Outline the role of microorganisms towards environmental protection, industrial applications and infectious diseases.</p>                                                                                                                                                                                                                                                                           |
| <p><b>15BT33-Biochemistry-(SG)</b></p> <p>CO1: Explain the basic types of chemical reactions and biomolecules</p> <p>CO2: Analyze high energy molecules and Photosynthesis reactions</p> <p>CO3: Illustrate about transport mechanism across the cell membrane and analyze its regulation</p> <p>CO4: Understand the basic metabolic pathways of CHO, Lipids, amino acid and nucleic acids and analyze their regulations</p> | <p><b>17BT33-Biochemistry-(VM)</b></p> <p>CO1: Explain the basic types of chemical reactions and biomolecules</p> <p>CO2: Analyze high energy molecules and Photosynthesis reactions</p> <p>CO3: Illustrate about transport mechanism across the cell membrane and analyze its regulation</p> <p>CO4: Understand the basic metabolic pathways of CHO, Lipids, amino acid and nucleic acids and analyze their regulations</p> | <p><b>18BT33-Unit Operation-(KMV)</b></p> <p>CO1: Describe the rheological behavior of fluids</p> <p>CO2: Examine the principle of flow measuring instruments and analyze the application of Bernoulli equation</p> <p>CO3: Apply the principles of various mechanical operations like size reduction, sedimentation, filtration and mixing.</p> <p>CO4: Analyze the heat governing laws and explain the about heat transfer equipments</p> <p>CO5: Evaluation of various mass transfer operations</p> |
| <p><b>15BT34-Microbiology-(RKC)</b></p> <p>CO1: Able to learn the classification, structural features and functional aspects of prokaryotic and eukaryotic organism</p> <p>CO2: Understanding of microbial techniques for isolation, growth and characterization of microbes</p>                                                                                                                                             | <p><b>17BT34-Microbiology-(BBM)</b></p> <p>CO1: Able to learn the classification, structural features and functional aspects of prokaryotic and eukaryotic organism</p> <p>CO2: Understanding of microbial techniques for isolation, growth and characterization of microbes</p>                                                                                                                                             | <p><b>18BT34-Introduction to Biomolecules</b></p> <p>CO1: Explain the foundational principles of biomolecules' structure and their function</p> <p>CO2: Analyze high energy molecules and Photosynthesis reactions</p> <p>CO3: Illustrate about transport</p>                                                                                                                                                                                                                                          |

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| <p>CO3: Analyse different types of growth patterns, metabolites and metabolic pathways</p> <p>CO4: Outline the role of microorganisms towards environmental protection, industrial applications and infectious diseases.</p> <p>CO5: Describe the biogeochemical cycles and microbial pollutants present in water soil and air</p>                           | <p>CO3: Analyse different types of growth patterns, metabolites and metabolic pathways</p> <p>CO4: Outline the role of microorganisms towards environmental protection, industrial applications and infectious diseases.</p> <p>CO5: Describe the biogeochemical cycles and microbial pollutants present in water soil and air</p>                           | <p>mechanism across the cell membrane and analyze its regulation</p>                                                                                                                                                                                                                                                                                         |
| <p><b>15BT35-Cell biology &amp; Genetics (SC)</b></p> <p>CO1: Generalizing a on contemporary knowledge of cytoskeletal architecture</p> <p>CO2: Describe cell structure and function</p> <p>CO3: Understand and analyze the principles and concept of genetics and population genetics</p> <p>CO4: Appraise inherited disorders on the basis of heredity</p> | <p><b>17BT35-Cell biology &amp; Genetics (SC)</b></p> <p>CO1: Generalizing a on contemporary knowledge of cytoskeletal architecture</p> <p>CO2: Describe cell structure and function</p> <p>CO3: Understand and analyze the principles and concept of genetics and population genetics</p> <p>CO4: Appraise inherited disorders on the basis of heredity</p> | <p><b>18BT35-Cell biology &amp; Genetics (SC)</b></p> <p>CO1: Generalizing a on contemporary knowledge of cytoskeletal architecture</p> <p>CO2: Describe cell structure and function</p> <p>CO3: Understand and analyze the principles and concept of genetics and population genetics</p> <p>CO4: Appraise inherited disorders on the basis of heredity</p> |
| <p><b>15BT36-Basics of computer application</b></p> <p>CO1: Understand C- language with updated tool</p> <p>CO2: Apply the basic concepts of MATLAB, Internet.</p> <p>CO3:Use the software with special reference to biotechnological applications</p>                                                                                                       | <p><b>17BT36-Basics of computer application</b></p> <p>CO1: Understand C- language with updated tool</p> <p>CO2: Apply the basic concepts of MATLAB, Internet.</p> <p>CO3:Use the software with special reference to biotechnological applications</p>                                                                                                       | <p><b>18BT36-Phyton Programming</b></p> <p>CO1: Develop algorithmic solutions to simple computational problems</p> <p>CO2: Read, write, execute by hand simple Python programs.</p> <p>CO3: Structure simple Python programs for solving problems.</p> <p>CO4: Decompose a Python program into functions.</p>                                                |

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| <b>15BTL37-Unit Operation Laboratory</b><br><br>CO1. Experiments on the basic principles of fluid mechanics and to analyze the flow measurement instruments<br>CO2. Illustrate the fluid flow problems with the application of momentum and energy equations<br>CO3. Examine the principles of sedimentation, filtration and mass transfer operations through experimental studies            | <b>17BTL37-Unit Operation Laboratory</b><br><br>CO1. Experiments on the basic principles of fluid mechanics and to analyze the flow measurement instruments<br>CO2. Illustrate the fluid flow problems with the application of momentum and energy equations<br>CO3. Examine the principles of sedimentation, filtration and mass transfer operations through experimental studies            | <b>18BTL37-Microbiological Lab</b><br><br>CO1. Use different laboratory equipment and instruments for microbiological operations<br>CO2. Prepare the media and use for the cultivation of the microbes<br>CO3. Perform laboratory experiments for the isolation, identification and characterization of microorganisms<br>CO4. Determination and evaluation of microbial load and its control |
| <b>15BTL38-Microbiological Lab</b><br><br>CO1. Use different laboratory equipment and instruments for microbiological operations<br>CO2. Prepare the media and use for the cultivation of the microbes<br>CO3. Perform laboratory experiments for the isolation, identification and characterization of microorganisms<br>CO4. Determination and evaluation of microbial load and its control | <b>17BTL38-Microbiological Lab</b><br><br>CO1. Use different laboratory equipment and instruments for microbiological operations<br>CO2. Prepare the media and use for the cultivation of the microbes<br>CO3. Perform laboratory experiments for the isolation, identification and characterization of microorganisms<br>CO4. Determination and evaluation of microbial load and its control | <b>18BTL38-Unit Operation Laboratory</b><br><br>CO1. Experiments on the basic principles of fluid mechanics and to analyze the flow measurement instruments<br>CO2. Illustrate the fluid flow problems with the application of momentum and energy equations<br>CO3. Examine the principles of sedimentation, filtration and mass transfer operations through experimental studies            |
| <b>15BT41-Biostatistics &amp; Bio modeling-(AHV)</b><br><br>CO1: Apply the concepts of data                                                                                                                                                                                                                                                                                                   | <b>17BT41-Biostatistics &amp; Bio modeling-(AHV)</b><br><br>CO1: Apply the concepts of data                                                                                                                                                                                                                                                                                                   | <b>18BT41-Stoichiometry-(KMOV)</b><br><br>CO1: Practice and compute the material                                                                                                                                                                                                                                                                                                              |

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| <p>distribution in Biotechnology problems-histogram, frequency curve etc.</p> <p>CO2: Describe about the utilities of statistics and probability to the biological data, suitable curve fitting by other methods.</p> <p>CO3: Apply the concepts relating to regression correlation, test of hypothesis for t-test and z-test</p> <p>CO4: Appreciate the concepts of probability, random variables and its distributions</p> <p>CO5: Perform modeling and simulations experiments for select biological processes using appropriate data</p>            | <p>distribution in Biotechnology problems-histogram, frequency curve etc.</p> <p>CO2: Describe about the utilities of statistics and probability to the biological data, suitable curve fitting by other methods.</p> <p>CO3: Apply the concepts relating to regression correlation, test of hypothesis for t-test and z-test</p> <p>CO4: Appreciate the concepts of probability, random variables and its distributions</p> <p>CO5: Perform modeling and simulations experiments for select biological processes using appropriate data</p> | <p>balance of three different phases such as solid, liquid and gas</p> <p>CO2: Illustrate material balance without chemical reaction in various unit operations</p> <p>CO3: Analyze the material balance involving in chemical reaction</p> <p>CO4: Calculate the energy balance and heat capacity for different phases and mixtures</p> <p>CO5: Infer the stoichiometry principles in bioprocess technology</p>                                   |
| <p><b>15BT42-Biochemical Thermodynamics (KVM)</b></p> <p>CO1: State &amp; describe the concepts of system, surrounding, process, laws of thermodynamics and entropy.</p> <p>CO2: Explain the PVT behavior of fluids &amp; gases, equations of state for real gases and heat effects accompanying chemical reactions</p> <p>CO3. Explain the different thermodynamic properties ,their relations and thermodynamic diagrams</p> <p>CO4. Determine the partial molar properties &amp; explain criteria of phase, biochemical reaction equilibrium and</p> | <p><b>17BT42-Biochemical Thermodynamics (AHV)</b></p> <p><b>CO1:</b> Discuss the basic concepts of thermodynamics in process industries</p> <p><b>CO2:</b> Explain the PVT Behavior and compressibility charts</p> <p><b>CO3:</b> Illustrate the thermodynamic properties of pure fluids</p> <p><b>CO4:</b> Compute the properties of solutions and phase equilibria</p> <p>CO5: Employ the knowledge of biochemical energetics – to determine the characteristics of energy rich compounds</p>                                              | <p><b>18BT42-Molecular Biology (SC)</b></p> <p>CO1: Explain replication in prokaryotes and Eukaryotes</p> <p>CO2: Distinguish transcription process in prokaryotes and Eukaryotes</p> <p>CO3: Illustrate the process of translation in prokaryotes and Eukaryotes</p> <p>CO4: Analyze gene regulation in prokaryotes and Eukaryotes</p> <p>CO5: Elaborate significance of genetic recombination and gene mapping in prokaryotes and Eukaryotes</p> |

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| equilibrium conversion                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>15BT43-Molecular Biology (RKC)</b><br>CO1: Explain replication in prokaryotes and Eukaryotes<br>CO2: Distinguish transcription process in prokaryotes and Eukaryotes<br>CO3: Illustrate the process of translation in prokaryotes and Eukaryotes<br>CO4: Analyze gene regulation in prokaryotes and Eukaryotes<br>CO5: Elaborate significance of genetic recombination and gene mapping in prokaryotes and Eukaryotes                                                                      | <b>17BT43-Molecular Biology (CS)</b><br>CO1: Explain replication in prokaryotes and Eukaryotes<br>CO2: Distinguish transcription process in prokaryotes and Eukaryotes<br>CO3: Illustrate the process of translation in prokaryotes and Eukaryotes<br>CO4: Analyze gene regulation in prokaryotes and Eukaryotes<br>CO5: Elaborate significance of genetic recombination and gene mapping in prokaryotes and Eukaryotes                                                                            | <b>18BT43-Immunotechnology</b><br>CO-1: Discuss the molecular and cellular mechanisms involved in the development and regulation of the immune response<br>CO-2: Describe the cause, challenges and treatment for Immune System Pathologies and Dysfunctions.<br>CO-3: Apply the major immunological laboratory techniques and their application to both clinical analysis and experimental research |
| <b>15BT44-Bioprocess Principles and Calculations (SD)</b><br>CO1: Practice and compute the material balance of three different phases such as solid, liquid and gas<br>CO2: Illustrate material balance without chemical reaction in various unit operations<br>CO3: Analyze the material balance involving in chemical reaction<br>CO4: Calculate the energy balance and heat capacity for different phases and mixtures<br>CO5: Infer the stoichiometry principles in bioprocess technology | <b>17BT44-Bioprocess Principles and Calculations (KMV/KLS)</b><br>CO1: Practice and compute the material balance of three different phases such as solid, liquid and gas<br>CO2: Illustrate material balance without chemical reaction in various unit operations<br>CO3: Analyze the material balance involving in chemical reaction<br>CO4: Calculate the energy balance and heat capacity for different phases and mixtures<br>CO5: Infer the stoichiometry principles in bioprocess technology | <b>18BT44-Cell culture techniques</b><br>CO-1: Understand the concepts of laboratory design and equipments for cell culture techniques<br>CO-2: Correlate between different biological samples and understand the importance of different media in tissue culture<br>CO-3: Comprehend the applications of plant, animal and microbial cell culture in industry, healthcare and environment           |
| <b>15BT45-Structural Biology-(BBM)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>17BT45-Structural Biology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>18BT45-Biochemical thermodynamics</b>                                                                                                                                                                                                                                                                                                                                                             |

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| <p>CO1: Explain the fundamental principles and function of proteins.</p> <p>CO2: Describe and apply the foundational principles of macromolecular structure and functions.</p> <p>CO3: Apply the diverse techniques for the structural elucidation of biomolecules</p> <p>CO4: Explain and analyze macromolecular interactions and their dynamics.</p>                                                                                              | <p>CO1: Explain the fundamental principles and function of proteins.</p> <p>CO2: Describe and apply the foundational principles of macromolecular structure and functions.</p> <p>CO3: Apply the diverse techniques for the structural elucidation of biomolecules</p> <p>CO4: Explain and analyze macromolecular interactions and their dynamics.</p>                                                                                              | <p><b>(AHV)</b></p> <p><b>CO1:</b> Discuss the basic concepts of thermodynamics in process industries</p> <p><b>CO2:</b> Explain the PVT Behavior and compressibility charts</p> <p><b>CO3:</b> Illustrate the thermodynamic properties of pure fluids</p> <p>CO4: Compute the properties of solutions and phase equilibria</p> <p>CO 05: Employ the knowledge of biochemical energetics – to determine the characteristics of energy rich compounds</p> |
| <p><b>15BT46-Clinical Biochemistry</b></p> <p>CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism</p> <p>CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved</p> <p>CO3: Assess and analyze the clinical manifestations of hormonal disturbances</p> <p>CO4: Discuss the medical problems associated with blood and mechanism of detoxification</p> | <p><b>17BT46-Clinical Biochemistry</b></p> <p>CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism</p> <p>CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved</p> <p>CO3: Assess and analyze the clinical manifestations of hormonal disturbances</p> <p>CO4: Discuss the medical problems associated with blood and mechanism of detoxification</p> | <p><b>18BT46-Clinical Biochemistry</b></p> <p>CO1: Understand the basic metabolic pathways of CHO, Lipids, amino acid and nucleic acids and analyze their regulations</p> <p>CO2: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism and hormonal disturbance</p> <p>CO3: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved</p>                                 |
| <p><b>15BTL47- Cell and Molecular Biology Laboratory</b></p>                                                                                                                                                                                                                                                                                                                                                                                        | <p><b>17BTL47-Cell and Molecular Biology Laboratory</b></p>                                                                                                                                                                                                                                                                                                                                                                                         | <p><b>18BTL47-Biochemistry Laboratory</b></p> <p>CO-1: Demonstrate the basic laboratory</p>                                                                                                                                                                                                                                                                                                                                                              |

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| CO-1: Prepare and analyze the mitotic and meiotic cell divisions<br>CO-2: Create and interpret somatic cell fusion<br>CO-3: Generate DNA and run various fragments through electrophoresis                                                                                                                                                                                                                                       | CO-1: Prepare and analyze the mitotic and meiotic cell divisions<br>CO-2: Create and interpret somatic cell fusion<br>CO-3: Generate DNA and run various fragments through electrophoresis                                                                                                                                                                                                                                       | mathematics necessary to perform tests, make dilutions, and<br>prepare buffer solutions<br>CO-2: Compare/contrast Qualitative and quantitative analysis of various Biomolecules                                                                                                                                                                                                                       |
| <b>15BTL48-Clinical Biochemistry lab</b><br><br>CO-1: Demonstrate the basic laboratory mathematics necessary to perform tests, make dilutions, and<br>prepare buffer solutions<br>CO2: Compare/contrast Qualitative and quantitative analysis of various Biomolecules                                                                                                                                                            | <b>17BTL48-Clinical Biochemistry lab</b><br><br>CO-1: Demonstrate the basic laboratory mathematics necessary to perform tests, make dilutions, and<br>prepare buffer solutions<br>CO2: Compare/contrast Qualitative and quantitative analysis of various Biomolecules                                                                                                                                                            | <b>18BTL48- Immuno technology laboratory</b><br><br>CO-1: Perform the various Immunodiagnostic techniques based on agglutination and precipitation<br>CO-2: Examination of qualitative and quantitative analysis such as ELISA, Lymphocytes count and Immunoblot<br>CO-3: Execution of isolation and purification of antibodies                                                                       |
| <b>15BT51-Bio kinetics and Bio reaction Engineering</b><br><br>CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data<br>CO-2: Design of performance equations for the different reactors<br>CO-3: Discuss the performance and distinguish between the different types of ideal and non-ideal reactors<br>CO-4: Determine enzyme activity, to study the fundamentals of Microbial growth | <b>17BT51-Bio kinetics and Bio reaction Engineering</b><br><br>CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data<br>CO-2: Design of performance equations for the different reactors<br>CO-3: Discuss the performance and distinguish between the different types of ideal and non-ideal reactors<br>CO-4: Determine enzyme activity, to study the fundamentals of Microbial growth | <b>18BT51-Biobusiness and Entrepreneurship</b><br><br><b>CO-1:</b> Discuss about the Bio Entrepreneurship<br><b>CO-2:</b> Illustrate the importance of Business in Agriculture at present era<br><b>CO-3:</b> - Assess the entrepreneurship opportunity in Industrial Biotechnology<br><b>CO-4:</b> Infer the project Management, IPR and start up schemes<br><b>CO-5:</b> Describe the Importance of |

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| kinetics and its stoichiometry<br>CO-5: Describe medium requirements and media formulation for the optimal bio process                                                                                                                                                                                                                                                                                                                                                                                                    | kinetics and its stoichiometry<br>CO-5: Describe medium requirements and media formulation for the optimal bio process                                                                                                                                                                                                                                                                                                                                                                     | bioethics, bio safety and Regulatory norms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>15BT52-Genetic Engineering and applications</b><br><br>CO1:Explain & compare the different tools & enzymes used in recombinant DNA<br>CO2: Illustration of techniques such as PCR, Blotting & construction of libraries<br>CO3: Differentiate and learn the gene/DNA transfer techniques between<br>CO4:Outline the various methods of producing transgenic organisms and Plants<br><b>CO-5:</b> Summarize the applications of genetic engineering for the welfare of mankind & society producing transgenic organisms | <b>17BT52-Genetic Engineering and applications</b><br><br>CO1:Explain & compare the different tools & enzymes used in recombinant DNA<br>CO2: Illustration of techniques such as PCR, Blotting & construction of libraries<br>CO3: Differentiate and learn the gene/DNA transfer techniques between<br>CO4:Outline the various methods of producing transgenic organisms and Plants<br><b>CO-5:</b> Summarize the applications of genetic engineering for the welfare of mankind & society | <b>18BT52 - Chemical reaction engineering</b><br><br>CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data<br>CO-2: Design of performance equations for the different reactors<br>CO-3: Discuss the performance and distinguish between the different types of ideal and non-ideal reactors<br>CO-4: Determine enzyme activity, to study the fundamentals of Microbial growth kinetics and its stoichiometry<br>CO-5: Describe medium requirements and media formulation for the optimal bio process |
| <b>15BT53-Immuno Technology (RKC)</b><br><br>CO-1: Outline the basic concept of immune system and different types of antibodies<br>CO-2: Discuss the molecular and cellular mechanisms involved in the development and regulation of the immune response                                                                                                                                                                                                                                                                  | <b>17BT53-Immuno Technology (RNK)</b><br><br>CO-1: Outline the basic concept of immune system and different types of antibodies<br>CO-2: Discuss the molecular and cellular mechanisms involved in the development and regulation of the immune response                                                                                                                                                                                                                                   | <b>18BT53-Enzyme technology and Biotransformation</b><br><br><b>CO-1:</b> Explain and apply the knowledge to select appropriate methods for isolation, purification and characterization of enzymes<br><b>CO-2:</b> Discuss the catalytic action, mechanism & kinetics                                                                                                                                                                                                                                                                        |

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| <p>CO-3: Explain the types of hypersensitivity and autoimmune diseases</p> <p>CO-4: Describe the various methods of transplantation and role of tumor antigens</p> <p>CO-5: Apply the major immunological laboratory techniques and their application to both clinical analysis and experimental research</p>                                                                    | <p>CO-3: Explain the types of hypersensitivity and autoimmune diseases</p> <p>CO-4: Describe the various methods of transplantation and role of tumor antigens</p> <p>CO-5: Apply the major immunological laboratory techniques and their application to both clinical analysis and experimental research</p>                                                                    | <p><b>CO-3:</b> Choose and apply scientific method to the process of enzyme immobilization techniques</p> <p><b>CO-4:</b> Comprehend the applications of nonconventional media in enzyme catalysis and design the methods for the creation of novel enzymes and biotransformation of drugs</p> <p><b>CO-5:</b> Explain and apply uses of enzymes in clinical diagnostics and bioprocess industries</p>    |
| <p><b>15BT54-Bioinformatics</b></p> <p>CO-1: Understand and apply different databases, resource and software tools for sequence alignment</p> <p>CO-2: Apply and analyze the phylogenetic analysis and different predictive methods for DNA and protein</p> <p>CO-3: Apply different tools for genomics analysis</p> <p>CO-4: Design various biomolecules by in-silico tools</p> | <p><b>17BT54-Bioinformatics</b></p> <p>CO-1: Understand and apply different databases, resource and software tools for sequence alignment</p> <p>CO-2: Apply and analyze the phylogenetic analysis and different predictive methods for DNA and protein</p> <p>CO-3: Apply different tools for genomics analysis</p> <p>CO-4: Design various biomolecules by in-silico tools</p> | <p><b>18BT54-Genomics and Proteomics</b></p> <p>CO-1: Define structural, comparative and functional genomics and proteomics and its uses in various research Fields</p> <p>CO2: Summarize on genomics and genome management</p> <p>CO3: Describe various methods and techniques of Genomics, high throughput DNA sequencing technology, expression profiling, proteome analysis, and its applications</p> |
| <p><b>15BT553-Animal Biotechnology</b></p> <p>CO1: Explain the basic principles and techniques in genetic engineering, gene transfer techniques for animals and animal cell lines.</p> <p>CO:2 Gain knowledge about the recent</p>                                                                                                                                               | <p><b>17BT553-Animal Biotechnology</b></p> <p>CO1: Explain the basic principles and techniques in genetic engineering, gene transfer techniques for animals and animal cell lines.</p> <p>CO:2 Gain knowledge about the recent</p>                                                                                                                                               | <p><b>18BT55-Bio analytical Techniques</b></p> <p>CO1: Define the fundamentals of downstream processing for product recovery</p> <p>CO2: Understand the requirements for successful operations of analytical</p>                                                                                                                                                                                          |

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| <p>advances in animal breeding.</p> <p>CO3: Explain the contribution 'Functional genomics' is making and is likely to make in animal biotechnology now and in future.</p> <p>CO4: Appraise the role of biotechnology in animal science for sustainable ecosystem and human welfare.</p>                                                                                                                                                                                                                                                                                                                                                               | <p>advances in animal breeding.</p> <p>CO3: Explain the contribution 'Functional genomics' is making and is likely to make in animal biotechnology now and in future.</p> <p>CO4: Appraise the role of biotechnology in animal science for sustainable ecosystem and human welfare.</p>                                                                                                                                                                                                                                                                                                                                                               | <p>techniques</p> <p>CO3: Apply principles of various analytical devices used in research and enhance problem solving techniques</p>                                                                                                                                                                                                                                                                                                           |
| <p><b>15BT563-Biotechnology for Sustainable Environment</b></p> <p>CO 1: Apply reasoning to identify the components of environmental ecosystems and effect of pollutant on environment.</p> <p>CO2: Characterize the various parameters of water, waste water and solid waste from their sources to provide valid conclusions.</p> <p>CO3: Understand the impact of recovery, recycle of the useful resources from wastes by adopting advanced techniques to demonstrate the need for sustainable development.</p> <p>CO4: Identify and Demonstrate the knowledge to use suitable equipment for abatement and control of air and noise pollution.</p> | <p><b>17BT563-Biotechnology for Sustainable Environment</b></p> <p>CO 1: Apply reasoning to identify the components of environmental ecosystems and effect of pollutant on environment.</p> <p>CO2: Characterize the various parameters of water, waste water and solid waste from their sources to provide valid conclusions.</p> <p>CO3: Understand the impact of recovery, recycle of the useful resources from wastes by adopting advanced techniques to demonstrate the need for sustainable development.</p> <p>CO4: Identify and Demonstrate the knowledge to use suitable equipment for abatement and control of air and noise pollution.</p> | <p><b>18BT56-Genetic Engineering and Applications</b></p> <p>CO1: Explain &amp; compare the different tools &amp; enzymes used in recombinant DNA</p> <p>CO2: Illustration of techniques such as PCR, Blotting &amp; construction of libraries</p> <p>CO3: Differentiate and learn the gene/DNA transfer techniques between Plants</p> <p>CO-5: Summarize the applications of genetic engineering for the welfare of mankind &amp; society</p> |
| <p><b>15BTL57-Genetic Engineering and Immunotechnology laboratory</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p><b>17BTL57-Genetic Engineering and Immunotechnology laboratory</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p><b>18BTL57-Biokinetics and Enzyme technology Laboratory</b></p>                                                                                                                                                                                                                                                                                                                                                                             |

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| <p>CO-1: Perform the various Immunodiagnostic techniques based on agglutination and precipitation</p> <p>CO-2: Examination of qualitative and quantitative analysis such as ELISA, Lymphocytes count and Immunoblot</p> <p>CO-3: Execution of genetic engineering techniques for the isolation of NA, quantification, purity check, amplification and gene cloning.</p> | <p>CO-1: Perform the various Immunodiagnostic techniques based on agglutination and precipitation</p> <p>CO-2: Examination of qualitative and quantitative analysis such as ELISA, Lymphocytes count and Immunoblot</p> <p>CO-3: Execution of genetic engineering techniques for the isolation of NA, quantification, purity check, amplification and gene cloning.</p> | <p>CO1: State and define the nature of the reaction, rate of the reaction, rate constant and enzyme activity</p> <p>CO2: Compose RTD data in MFR and PFR</p> <p>CO3: Describe the batch reactor performance</p>                                                                                                    |
| <p><b>15BTL58-Bioinformatics Laboratory</b></p> <p>CO1: Apply and analyze sequence analysis using different tools</p> <p>CO2: Apply online resource tools to solve protein structure</p> <p>CO3: Design and evaluate different biomolecules using online and offline tools</p>                                                                                          | <p><b>17BTL58-Bioinformatics Laboratory</b></p> <p>CO1: Apply and analyze sequence analysis using different tools</p> <p>CO2: Apply online resource tools to solve protein structure</p> <p>CO3: Design and evaluate different biomolecules using online and offline tools</p>                                                                                          | <p><b>18BTL58</b></p> <p><b>Genetic Engineering and cell Culture laboratory</b></p>                                                                                                                                                                                                                                |
| <p><b>15BT61-Bio-business and entrepreneurs hip</b></p> <p><b>CO-1:</b> Discuss about the Bio Entrepreneurship</p> <p><b>CO-2:</b> Illustrate the importance of Business in Agriculture at present era</p> <p><b>CO-3:</b> Assess the entrepreneurship opportunity in Industrial Biotechnology</p>                                                                      | <p><b>17BT61-Bio-business and entrepreneurs hip</b></p> <p><b>CO-1:</b> Discuss about the Bio Entrepreneurship</p> <p><b>CO-2:</b> Illustrate the importance of Business in Agriculture at present era</p> <p><b>CO-3:</b> Assess the entrepreneurship opportunity in Industrial Biotechnology</p>                                                                      | <p><b>18BT61-Process control and Automation</b></p> <p>Understand the basics of process dynamics principles and instrumentation</p> <p>Study various types of input functions and its response</p> <p>Perform computational modelling to study different types of controllers</p> <p>Analyse different control</p> |

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| <p><b>CO-4:</b> Infer about the Project Management, IPR and start up schemes</p> <p><b>CO-5:</b> Describe the Importance of bioethics, bio safety and Regulatory norms</p>                                                                                                                                                                                                                                                                                                                                          | <p><b>CO-4:</b> Infer about the Project Management, IPR and start up schemes</p> <p><b>CO-5:</b> Describe the Importance of bioethics, bio safety and Regulatory norms</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <p>algorithms</p>                                                                                                                                                                                                                                                                                                                  |
| <p><b>15BT62-Bioprocess control and automation</b></p> <p>CO1: Discuss the principles of instrumentation of instruments to measure biochemical parameter</p> <p>CO2: Analyze the first order system for various inputs(Step, impulse, sinusoidal)</p> <p>CO3: Examine the different types of controllers and control elements</p> <p>CO4: Illustrate the second order system for various inputs(Step, impulse, sinusoidal)</p> <p>CO5: Determine and compute the concept of controller design and its stability</p> | <p><b>17BT62-Bioprocess control and automation</b></p> <p>CO1: Describe the practical application of instruments used for measuring physical quantities and chemical quantities by using offline and online measurements</p> <p>CO2: Analyze the first order system for various inputs(Step, impulse, sinusoidal)</p> <p>CO3: Compute the second order system with respect to different forcing function and understand concept of damping coefficient</p> <p>CO4: Illustrate the practical applications of pneumatic control wall, controllers and reduction of flow diagrams</p> <p>CO5: Determine and compute the concept of controller design and its stability</p> | <p><b>18BT62-Bioprocess Equipment design and CAED</b></p> <p>CO1. Analyse and enumerate designing concepts of Double Pipe Heat Exchanger.</p> <p>CO2. Solve and practice on design of Shell and tube heat exchanger and condenser.</p> <p>CO3. Examine the concepts of designing Fermenter and packed bed distillation column.</p> |

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| <p align="center"><b>15BT63-Enzyme technology &amp; biotransformation</b></p> <p><b>CO -1:</b> Explain and apply the knowledge to select appropriate methods for isolation, purification and characterization of enzymes</p> <p><b>CO -2:</b> Discuss the catalytic action, mechanism &amp; kinetics</p> <p><b>CO - 3:</b><br/>Choose and apply scientific method to the process of enzyme immobilization techniques</p> <p><b>CO - 4:</b> Comprehend the applications of nonconventional media in enzyme catalysis and design the methods for the creation of novel enzymes and biotransformation of drugs</p> <p><b>CO - 5:</b> Explain and apply uses of enzymes in clinical diagnostics and bioprocess industries</p> | <p align="center"><b>17BT63-Enzyme technology &amp; biotransformation</b></p> <p><b>CO-1:</b> Explain and apply the knowledge to select appropriate methods for isolation, purification and characterization of enzymes</p> <p><b>CO-2:</b> Discuss the catalytic action, mechanism &amp; kinetics</p> <p><b>CO-3:</b><br/>Choose and apply scientific method to the process of enzyme immobilization techniques</p> <p><b>CO-4:</b> Comprehend the applications of nonconventional media in enzyme catalysis and design the methods for the creation of novel enzymes and biotransformation of drugs</p> <p><b>CO-5:</b> Explain and apply uses of enzymes in clinical diagnostics and bioprocess industries</p> | <p align="center"><b>18BT63-Bioinformatics</b></p> <p>CO-1: Understand and apply different databases, resource and software tools for sequence alignment</p> <p>CO-2: Apply and analyze the phylogenetic analysis and different tools for genomics analysis</p> <p>CO-3: Apply and analyses different predictive methods for DNA and protein</p> <p>CO-4: Design various biomolecules by in-silico tools</p> |
| <p align="center"><b>15BT64-Bioprocess equipment design &amp; CAED</b></p> <p>CO1. Analyse and enumerate designing concepts of Double Pipe Heat Exchanger.</p> <p>CO2. Solve and practice on design of Shell and tube heat exchanger and condenser.</p> <p>CO3. Examine the concepts of designing</p>                                                                                                                                                                                                                                                                                                                                                                                                                     | <p align="center"><b>17BT64-Bioprocess equipment design &amp; CAED</b></p> <p>CO1. Analyse and enumerate designing concepts of Double Pipe Heat Exchanger.</p> <p>CO2. Solve and practice on design of Shell and tube heat exchanger and condenser.</p> <p>CO3. Examine the concepts of designing Fermenter and packed bed distillation</p>                                                                                                                                                                                                                                                                                                                                                                       | <p align="center"><b>18BT64X-Professional Elective-I</b></p> <p>18BT641: Food Process Engineering</p> <p>18BT642: Phyto-Chemistry and Phyto-Harmones</p> <p>18BT643: Human Physiology</p>                                                                                                                                                                                                                    |

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| Fermenter and packed bed distillation column.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | column.                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                         |
| <b>15BT65-Cell Culture Techniques</b><br><br>CO-1: Understand the concepts of laboratory design and equipments for cell culture techniques<br>CO-2:Correlate between different biological samples and understand the importance of different media in tissue culture<br>CO-3: Comprehend the applications of plant culture in industrial secondary metabolites<br>CO-4: Explain the applications of animal cell culture in industry and environment<br>CO-5: Apply and analyze the applications of microbial cell culture in industry and environment | <b>17BT653-Cell Culture Techniques</b><br><br>CO-1: Understand the concepts of laboratory design and equipments for cell culture techniques<br>CO-2:Correlate between different biological samples and understand the importance of different media in tissue culture<br>CO-3: Comprehend the applications of plant, animal and microbial cell culture in industry, healthcare and environment | <b>18BT65X- Open Elective-I</b><br><br>18BT651: Biology for Engineers<br>18BT652:Biomaterials<br>18BT653: Nanobiotechnology                                                                                                                                                                                                                                             |
| <b>15BT662-Nanobiotechnology</b><br><br>CO1: Explain nano-biotechnology as an emerging field and its scope<br>CO2: Apply the principles and application of techniques in characterization of nanomaterials<br>CO3: Apply nanotechnology in diagnostic, drug delivery system, microfluidic and biomems<br>CO4: Discuss the application of biological                                                                                                                                                                                                   | <b>17BT662-Nanobiotechnology</b><br><br>CO1: Define nano-biotechnology as an emerging field and its scope.<br>CO2: Understand the principles and applications of the technology in various fields.                                                                                                                                                                                             | <b>18BTL66-Process Control and Automation Laboratory</b><br><br>CO -1: Comprehend the basics of Instrumentation, classification different input function of automatic process control system<br>CO-2: Illustrate the characteristics of transducers based on critical process parameters<br>CO-3: Demonstrate the working of first order systems for tanks connected in |

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| molecules and system in nanotechnology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | series<br>CO-4: Calculate and analyze the output obtained from different systems and perform theoretical validation<br>CO-5: Distinguish the effect of offset in different controllers                                                                         |
| <b>15BTL67-Bioprocess control &amp; automation laboratory</b><br><br>CO -1: Comprehend the basics of Instrumentation, classification different input function of automatic process control system<br>CO-2: Illustrate the characteristics of transducers based on critical process parameters<br>CO-3: Demonstrate the working of first order systems for tanks connected in series<br>CO-4: Calculate and analyze the output obtained from different systems and perform theoretical validation<br>CO-5: Distinguish the effect of offset in different controllers | <b>17BTL67-Bioprocess control &amp; automation laboratory</b><br><br>CO -1: Comprehend the basics of Instrumentation, classification different input function of automatic process control system<br>CO-2: Illustrate the characteristics of transducers based on critical process parameters<br>CO-3: Demonstrate the working of first order systems for tanks connected in series<br>CO-4: Calculate and analyze the output obtained from different systems and perform theoretical validation<br>CO-5: Distinguish the effect of offset in different controllers | <b>18BTL67-Bioinformatics laboratory</b><br><br>CO1:Apply and analyze sequence analysis using different tools<br>CO2: Apply online resource tools to solve protein structure<br>CO3: Design and evaluate different biomolecules using online and offline tools |
| <b>15BTL68-Biokinetics and Enzyme technology laboratory</b><br><br>CO1: State and define the nature of the                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>15BTL68-Biokinetics and Enzyme technology laboratory</b><br><br>CO1: State and define the nature of the                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>18BTMP68-Mini Project</b>                                                                                                                                                                                                                                   |

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| <p>reaction, rate of the reaction, rate constant and enzyme activity</p> <p>CO2: Compose RTD data in MFR and PFR</p> <p>CO3: Describe the batch reactor performance</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>reaction, rate of the reaction, rate constant and enzyme activity</p> <p>CO2: Compose RTD data in MFR and PFR</p> <p>CO3: Describe the batch reactor performance</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                |
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| <p><b>15BT71-Fermentation technology</b></p> <p>CO1: Describe the factors affecting Primary and secondary metabolite production and its industrial importance.</p> <p>CO2: Compute the basic requirements of downstream processing for biochemical product recovery</p> <p>CO-3: Identify and summarize the effect of change in unit's operations and its impact on the bioprocess</p> <p>CO-4: Illustrate how emerging technologies would benefit the bio chemical product recovery and outline the process involving in large scale</p> <p>CO5: Apply product recovery techniques for high-purity protein production</p> | <p><b>17BT71-Fermentation technology</b></p> <p>CO1: Describe the factors affecting Primary and secondary metabolite production and its industrial importance.</p> <p>CO2: Compute the basic requirements of downstream processing for biochemical product recovery</p> <p>CO-3: Identify and summarize the effect of change in unit's operations and its impact on the bioprocess</p> <p>CO-4: Illustrate how emerging technologies would benefit the bio chemical product recovery and outline the process involving in large scale</p> <p>CO5: Apply product recovery techniques for high-purity protein production</p> | <p><b>18BT71-Bioprocess Engineering</b></p>                    |
| <p><b>15BT72-Genomics &amp; Proteomics</b></p> <p>CO1: Discuss on genome database &amp; genome projects</p> <p>CO2: Summarize on genomics and</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p><b>17BT72-Genomics &amp; Proteomics</b></p> <p>CO1: Discuss on genome database &amp; genome projects</p> <p>CO2: Summarize on genomics and</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p><b>18BT72-Clinical and pharmaceutical Biotechnology</b></p> |

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| <p>genome management<br/>CO3: Describe structural genomics and genome analysis.<br/>CO4: Describe proteomics and proteome analysis</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p>genome management<br/>CO3: Describe structural genomics and genome analysis.<br/>CO4: Describe proteomics and proteome analysis</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p><b>18BT73X-Professional Elective-2</b><br/>18BT731-Process Equipment &amp; Plant Design<br/>18BT732-Bioreactor Design Concepts<br/>18BT733-Transport Phenomena</p> |
| <p><b>15BT73-Plant biotechnology</b></p> <p>CO-1: State the basic concepts of plant tissue culture and their applications, media preparation, tools of<br/>CO-2: Describe the applications of plant genetic engineering in production transgenic plants to with stand abiotic and biotic stress and discuss ethical and social issues regarding genetically-modified crops<br/><b>CO-3:</b> Discuss the role, importance &amp; applications of tissue culture in molecular farming<br/><b>CO-4:</b> Explain the mechanism of signal transduction and nitrogen fixation in plants<br/><b>CO-5:</b> Explain the principles, technical requirement, scientific and commercial applications in algal technologies with suitable examples</p> | <p><b>17BT73-Plant biotechnology</b></p> <p>CO-1: State the basic concepts of plant tissue culture and their applications, media preparation, tools of<br/>CO-2: Describe the applications of plant genetic engineering in production transgenic plants to with stand abiotic and biotic stress and discuss ethical and social issues regarding genetically-modified crops<br/><b>CO-3:</b> Discuss the role, importance &amp; applications of tissue culture in molecular farming<br/><b>CO-4:</b> Explain the mechanism of signal transduction and nitrogen fixation in plants<br/><b>CO-5:</b> Explain the principles, technical requirement, scientific and commercial applications in algal technologies with suitable examples</p> | <p><b>18BT74X-Professional Elective-3</b><br/>18BT741-Bioethics, Biosafety and IPR<br/>18BT742- Agricultural Biotechnology<br/>18BT743-Tissue Engineering</p>         |
| <p><b>15BT743-Lab to industrial scaling</b></p> <p>CO-1: Discuss fermentation as a basic biochemical process, types of</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p><b>18BT74X-Professional Elective-3</b><br/>18BT741-Health Informatics<br/>18BT742- Bioreactor Design Concepts<br/>18BT743-Lab to industrial scaling<br/>18BT744-Food Biotechnology</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p><b>18BT75X-Open Elective-B</b><br/>18BT751-BT for sustainable Environment<br/>18BT752-Forensic Science</p>                                                         |

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| <p>fermentation and fermentation products</p> <p>CO-2: Understand and emphasis on scale up media , inoculum and sterilization process</p> <p>CO-3: Understand the concept of rheology and fermenter design</p> <p>CO-4:Describe the analytical instruments used in fermenter and biomass estimation</p> <p>CO-5:Explain and infer the process of upstream and down stream process</p>                                                                                                                                                                                                                |                                                                                                                                                                                 | 18BT753-Biological data Management                      |
| <p><b>15BT752-Forensic sciences</b></p> <p>CO1: Learn about forensic science as a field of study, discuss about history and development, role and responsibilities of forensic scientist</p> <p>CO2: Analysis of physical evidence, biological evidence, firearm evidence, and evidence examination</p> <p>CO3: Investigation, collection and packing of evidence and legal guidelines</p> <p>CO4: Learn about ethics in forensic science and ethical dilemmas, Application of computers in forensic science</p> <p>CO5: Characterization of the evidence and interpretation of the crime scenes</p> | <p><b>18BT75X-Professional Elective-4</b></p> <p>18BT751-Dairy Biotechnology<br/>18BT752-Forensic Science<br/>18BT753-Molecular Diagnostics<br/>18BT744-Big data Management</p> | <p><b>18BTL76-Bioprocess Engineering laboratory</b></p> |
| <b>15BTL76-Fermentation laboratory</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>17BTL76-Fermentation laboratory</b>                                                                                                                                          | <b>18BTP77-Project Work Phase-I</b>                     |

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| <p>CO1: Demonstrate about Product enrichment operation using different methods.</p> <p>CO2: Estimate level of secondary metabolites production in fermented broth</p> <p>CO3: Comprehended analysis of protein</p>                                                                                                                                         | <p>CO1: Describe the techniques involved in downstream process</p> <p>CO2: Analyze the product identification and separation techniques</p> <p>CO3: Study the membrane process</p> <p>CO4: Determine the techniques involved in product enrichment and recovery process</p> <p>CO5: Comprehended the analysis of biomolecules using various techniques</p> |                                                             |
| <p>CO1: Describe the techniques involved in downstream process</p> <p>CO2: Analyze the product identification and separation techniques</p> <p>CO3: Study the membrane process</p> <p>CO4: Determine the techniques involved in product enrichment and recovery process</p> <p>CO5: Comprehended the analysis of biomolecules using various techniques</p> |                                                                                                                                                                                                                                                                                                                                                            |                                                             |
| <p><b>15BTL77-Plant biotechnology laboratory</b></p> <p>CO-1: Preparation of resources and materials for plant tissue culture</p> <p>CO-2: Estimation of secondary metabolites and different biomolecules</p> <p>CO-3: Comprehend the applications of tissue culture</p>                                                                                   | <p><b>17BTL77-Plant biotechnology laboratory</b></p> <p>CO-1: Preparation of resources and materials for plant tissue culture</p> <p>CO-2: Estimation of secondary metabolites and different biomolecules</p> <p>CO-3: Comprehend the applications of tissue culture</p>                                                                                   | <p><b>Internship</b></p>                                    |
|                                                                                                                                                                                                                                                                                                                                                            | <p><b>17BTP78-Project Work Phase-I + Project Work Seminar</b></p>                                                                                                                                                                                                                                                                                          |                                                             |
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| <p><b>15BT81-Clinical &amp; Pharmaceutical Biotechnology</b></p>                                                                                                                                                                                                                                                                                           | <p><b>17BT81-Clinical &amp; Pharmaceutical Biotechnology</b></p>                                                                                                                                                                                                                                                                                           | <p><b>18BT81-Regulatory Affairs in Biotech Industry</b></p> |

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| <p>CO-01: Discuss about pharma industry and drug development</p> <p>CO-02: Explain the significance of pharmaco-kinetic models, pharmacodynamic principles, various dosage forms and formulation</p> <p>CO-03 :Describe different agents in drug therapy</p> <p>CO-04: Illustrate Bio therapeutics and stem cells application</p> <p>CO-05: Comprehend specific applications of pharmaceutical &amp; clinical Biotechnology</p>         | <p>CO-01: Discuss about pharma industry and drug development</p> <p>CO-02: Explain the significance of pharmaco-kinetic models, pharmacodynamic principles, various dosage forms and formulation</p> <p>CO-03 :Describe different agents in drug therapy</p> <p>CO-04: Illustrate Bio therapeutics and stem cells application</p> <p>CO-05: Comprehend specific applications of pharmaceutical &amp; clinical Biotechnology</p>         | <p>CO 01: Outline the Regulatory Rules and Guidelines for product development</p> <p>CO 02: Describe the safety and quality standards in the biotech industry</p> <p>CO 03: Comprehend the Validation Process in the biotech industry</p> <p>CO 04: Analyze the Product quality and its Implementation</p> <p>CO 05: Describe the concepts of Quality Management System</p> |
| <p><b>15BT82-Regulatory affairs in Biotech Industry</b></p> <p>CO 01: Outline the Regulatory Rules and Guidelines for product development</p> <p>CO 02: Describe the safety and quality standards in the biotech industry</p> <p>CO 03: Comprehend the Validation Process in the biotech industry</p> <p>CO 04: Analyze the Product quality and its Implementation</p> <p>CO 05: Describe the concepts of Quality Management System</p> | <p><b>17BT82-Regulatory affairs in Biotech Industry</b></p> <p>CO 01: Outline the Regulatory Rules and Guidelines for product development</p> <p>CO 02: Describe the safety and quality standards in the biotech industry</p> <p>CO 03: Comprehend the Validation Process in the biotech industry</p> <p>CO 04: Analyze the Product quality and its Implementation</p> <p>CO 05: Describe the concepts of Quality Management System</p> | <p><b>18BT82X- Professional Elective-4</b></p> <ol style="list-style-type: none"> <li>1. Environmental biotechnology</li> <li>2. Industrial Microbiology</li> <li>3. Marine Biotechnology</li> </ol>                                                                                                                                                                        |
| <p><b>15BT833-Environmental Biotechnology</b></p>                                                                                                                                                                                                                                                                                                                                                                                       | <p><b>17BT83X-Professional Elective-5</b></p> <p>17BT831-Protein engineering</p>                                                                                                                                                                                                                                                                                                                                                        | <p><b>18BTP83- Project Work Phase-2</b></p>                                                                                                                                                                                                                                                                                                                                 |

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| <p>CO1: Discuss the concepts of pollutants and its accumulation and detoxification</p> <p>CO2: Explain wastewater treatment process and its application in aerobic and anaerobic treatment</p> <p>CO3: Illustrate the biodegradation and bioremediation of xenobiotic compounds</p> <p>CO4: Distinguish the importance of biocatalysts and its mechanism involved in different biological reaction</p> <p>CO5: Explain the process microbial leaching on metal ores</p> | <p>Environmental Biotechnology</p> <p>17BT832-Metabolic Engineering</p> <p>17BT833-Environmental Biotechnology</p> |                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>17BT84-Internship/Professional Practice</b>                                                                     | <b>18BTS84-Technical Seminar</b> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>17BTP85-Project Work-II</b>                                                                                     | <b>18BTI85-Internship</b>        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>17BTS86-Seminar on Current trends in Engineering and technology</b>                                             |                                  |

| <b>Mapping of Course outcomes (COs) and Program Outcomes (POs)</b><br><b>Note: 1 = Slight 2 = Moderate 3 = Good</b> |                         |             |             |             |             |             |             |             |             |              |              |              |              |              |              |              |
|---------------------------------------------------------------------------------------------------------------------|-------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| <b>Course outcomes</b>                                                                                              | <b>Program Outcomes</b> |             |             |             |             |             |             |             |             |              |              |              | <b>PSO</b>   |              |              |              |
|                                                                                                                     | <b>PO 1</b>             | <b>PO 2</b> | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b> | <b>PO 7</b> | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b> | <b>POS 1</b> | <b>POS 2</b> | <b>POS 3</b> | <b>POS 4</b> |
| <b>CO-1</b>                                                                                                         | 3                       | 2           | 2           | 0           | 0           | 0           | 2           | 2           | 0           | 0            | 0            | 0            | 2            | 1            | 2            | 1            |
| <b>CO-2</b>                                                                                                         | 3                       | 2           | 2           | 1           | 2           | 0           | 0           | 2           | 0           | 0            | 1            | 0            | 1            | 0            | 2            | 0            |
| <b>CO-3</b>                                                                                                         | 3                       | 2           | 2           | 0           | 2           | 0           | 0           | 0           | 2           | 0            | 1            | 0            | 2            | 0            | 2            | 0            |
| <b>CO-4</b>                                                                                                         | 3                       | 2           | 2           | 1           | 2           | 0           | 1           | 1           | 0           | 2            | 0            | 0            | 2            | 1            | 2            | 0            |
| <b>CO-5</b>                                                                                                         | 2                       | 2           | 2           | 2           | 0           | 0           | 0           | 0           | 2           | 0            | 1            | 0            | 1            | 1            | 2            | 0            |

## **COLLEGE VISION AND MISSION**

### **VISION**

The vision of the institution is to create and maintain an enabling learning environment for the students to transform them as thorough professionals to meet diverse professional demands of global environments.

### **MISSION**

The mission of the institution is to provide quality education to the students to pursue courses in different engineering disciplines and to transform their professional dreams into reality and to offer competent budding professionals to the society.

## **DEPARTMENTAL VISION AND MISSION**

### **VISION**

To be a Centre of excellence in the field of Biotechnology equipped to create technically strong ethically moral global man power that endeavor for the welfare of mankind.

### **MISSION**

Creating state-of-the-art infrastructure for education and research to induct lifelong professional growth and different career avenues for BT engineers in collaboration with industries, research organizations and academia.

### **PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)**

**PEO1:** Students will be lucrative professionals in different sectors of Biotechnology fields with high proficiency in multidisciplinary tasks.

**PEO2:** Operate technically at competent level in concocting problems of biotechnology and utilize the knowledge to develop Biological processes and bio-techniques.

**PEO3:** Students will endure higher education with harmonious combination of the skills of engineering, management & life science.

**PEO4:** Students will inculcate Scio-ethical values, exhibit professionalism, team spirit for lifelong learning and well-being of society and mankind.

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM**  
**CHOICE BASED CREDIT SYSTEM (CBCS)**  
**BIOTECHNOLOGY ENGINEERING BOARD**  
**BE-CBCS SYLLABUS 2017-18 Scheme**  
**B.E Biotechnology Engineering**

**Program Outcomes (POs)**

At the end of the B.E program, students are expected to have developed the following outcomes.

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and

design documentation, make effective presentations, and give and receive clear instructions.

**11. Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**12. Life-long learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

### **Program Specific Outcomes (PSOs)**

**At the end of the B.E Biotechnology engineering program, the students are expected to have developed the following program specific outcomes.**

#### **PSO1**

The graduates will have the ability to plan, analyse, design, execute and contribute to the field of biotechnology and allied industries designing , developing and providing solutions for product/processes/technology development.

#### **PSO2**

The graduates of Biotechnology engineering program will have the ability to take up employment, entrepreneurship, research and development for sustainable society.

#### **PSO3**

The graduates will be able to pursue opportunities for personal and professional growth, higher studies, demonstrate leadership skills and engage in lifelong learning by active participation in the Biotechnology profession.

#### **PSO4**

The graduates will be able to demonstrate professional integrity and an appreciation of ethical, environmental, regulatory and issues related to Biotechnology.