## **Course Outcomes**

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

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

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

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

distribution in Biotechnology problems-	distribution in Biotechnology problems-	balance of three different phases such
histogram, frequency curve etc.	histogram, frequency curve etc.	as solid, liquid and gas
CO2: Describe about the utilities of	CO2: Describe about the utilities of	CO2: Illustrate material balance
statistics and probability to the biological	statistics and probability to the biological	without chemical reaction in various
data, suitable curve fitting by other	data, suitable curve fitting by other	unit operations
methods.	methods.	CO3: Analyze the material balance
CO3: Apply the concepts relating to	CO3: Apply the concepts relating to	involving in chemical reaction
regression correlation, test of hypothesis	regression correlation, test of hypothesis	CO4: Calculate the energy balance and
for t-test and z-test	for t-test and z-test	heat capacity for different phases and
CO4: Appreciate the concepts of	CO4: Appreciate the concepts of	mixtures
probability, random variables and its	probability, random variables and its	CO5: Infer the stoichiometry principles
distributions	distributions	in bioprocess technology
CO5: Perform modeling and simulations	CO5: Perform modeling and simulations	
experiments for select biological	experiments for select biological	
processes using appropriate data	processes using appropriate data	
1 CDT 42 Dischamigal Tharmodynamics	17DT 12 Dischamissel Thermodynamics	10DT42 Malasslass Dialass
15B142-Biochemical Thermodynamics	1/B142-Biochemical Thermodynamics	18B142-Molecular Biology
(KVM)	(AHV)	(SC)
(KVM)	(AHV)	(SC)
(KVM) CO1: State & describe the concepts of	(AHV) CO1: Discuss the basic concepts of	(SC) CO1: Explain replication in prokaryotes
(KVM) CO1: State & describe the concepts of system, surrounding, process, laws of	(AHV) CO1: Discuss the basic concepts of thermodynamics in process industries	(SC) CO1: Explain replication in prokaryotes and Eukaryotes
(KVM) CO1: State & describe the concepts of system, surrounding, process, laws of thermodynamics and entropy.	(AHV) CO1: Discuss the basic concepts of thermodynamics in process industries CO2: Explain the PVT Behavior and	(SC) CO1: Explain replication in prokaryotes and Eukaryotes CO2: Distinguish transcription process in
CO1: State & describe the concepts of system, surrounding, process, laws of thermodynamics and entropy. CO2: Explain the PVT behavior of fluids	(AHV) CO1: Discuss the basic concepts of thermodynamics in process industries CO2: Explain the PVT Behavior and compressibility charts	(SC) CO1: Explain replication in prokaryotes and Eukaryotes CO2: Distinguish transcription process in prokaryotes and Eukaryotes
CO1: State & describe the concepts of system, surrounding, process, laws of thermodynamics and entropy. CO2: Explain the PVT behavior of fluids & gases, equations of state for real gases	(AHV) CO1: Discuss the basic concepts of thermodynamics in process industries CO2: Explain the PVT Behavior and compressibility charts	(SC) CO1: Explain replication in prokaryotes and Eukaryotes CO2: Distinguish transcription process in prokaryotes and Eukaryotes CO3: Illustrate the process of translation
CO1: State & describe the concepts of system, surrounding, process, laws of thermodynamics and entropy. CO2: Explain the PVT behavior of fluids & gases, equations of state for real gases and heat effects accompanying chemical	(AHV) CO1: Discuss the basic concepts of thermodynamics in process industries CO2: Explain the PVT Behavior and compressibility charts CO3:Illustrate the thermodynamic	(SC) CO1: Explain replication in prokaryotes and Eukaryotes CO2: Distinguish transcription process in prokaryotes and Eukaryotes CO3: Illustrate the process of translation in prokaryotes and Eukaryotes
(KVM) CO1: State & describe the concepts of system, surrounding, process, laws of thermodynamics and entropy. CO2: Explain the PVT behavior of fluids & gases, equations of state for real gases and heat effects accompanying chemical reactions	(AHV) CO1: Discuss the basic concepts of thermodynamics in process industries CO2: Explain the PVT Behavior and compressibility charts CO3:Illustrate the thermodynamic properties of pure fluids	(SC) CO1: Explain replication in prokaryotes and Eukaryotes CO2: Distinguish transcription process in prokaryotes and Eukaryotes CO3: Illustrate the process of translation in prokaryotes and Eukaryotes CO4: Analyze gene regulation in
CO1: State & describe the concepts of system, surrounding, process, laws of thermodynamics and entropy. CO2: Explain the PVT behavior of fluids & gases, equations of state for real gases and heat effects accompanying chemical reactions CO3. Explain the different	(AHV) CO1: Discuss the basic concepts of thermodynamics in process industries CO2: Explain the PVT Behavior and compressibility charts CO3:Illustrate the thermodynamic properties of pure fluids CO4: Compute the properties of	(SC) CO1: Explain replication in prokaryotes and Eukaryotes CO2: Distinguish transcription process in prokaryotes and Eukaryotes CO3: Illustrate the process of translation in prokaryotes and Eukaryotes CO4: Analyze gene regulation in prokaryotes and Eukaryotes
CO1: State & describe the concepts ofsystem, surrounding, process, laws ofthermodynamics and entropy.CO2: Explain the PVT behavior of fluids& gases, equations of state for real gasesand heat effects accompanying chemicalreactionsCO3. Explain the differentthermodynamic properties ,their	(AHV) CO1: Discuss the basic concepts of thermodynamics in process industries CO2: Explain the PVT Behavior and compressibility charts CO3:Illustrate the thermodynamic properties of pure fluids CO4: Compute the properties of solutions and phase equilibria	(SC) CO1: Explain replication in prokaryotes and Eukaryotes CO2: Distinguish transcription process in prokaryotes and Eukaryotes CO3: Illustrate the process of translation in prokaryotes and Eukaryotes CO4: Analyze gene regulation in prokaryotes and Eukaryotes CO5: Elaborate significance of genetic
CO1: State & describe the concepts of system, surrounding, process, laws of thermodynamics and entropy. CO2: Explain the PVT behavior of fluids & gases, equations of state for real gases and heat effects accompanying chemical reactions CO3. Explain the different thermodynamic properties ,their relations and thermodynamic diagrams	(AHV) CO1: Discuss the basic concepts of thermodynamics in process industries CO2: Explain the PVT Behavior and compressibility charts CO3:Illustrate the thermodynamic properties of pure fluids CO4: Compute the properties of solutions and phase equilibria CO5: Employ the knowledge of	(SC) CO1: Explain replication in prokaryotes and Eukaryotes CO2: Distinguish transcription process in prokaryotes and Eukaryotes CO3: Illustrate the process of translation in prokaryotes and Eukaryotes CO4: Analyze gene regulation in prokaryotes and Eukaryotes CO5: Elaborate significance of genetic recombination and gene mapping in
CO1: State & describe the concepts of system, surrounding, process, laws of thermodynamics and entropy. CO2: Explain the PVT behavior of fluids & gases, equations of state for real gases and heat effects accompanying chemical reactions CO3. Explain the different thermodynamic properties ,their relations and thermodynamic diagrams CO4. Determine the partial molar	(AHV) CO1: Discuss the basic concepts of thermodynamics in process industries CO2: Explain the PVT Behavior and compressibility charts CO3:Illustrate the thermodynamic properties of pure fluids CO4: Compute the properties of solutions and phase equilibria CO5: Employ the knowledge of biochemical energetics – to determine the	(SC) CO1: Explain replication in prokaryotes and Eukaryotes CO2: Distinguish transcription process in prokaryotes and Eukaryotes CO3: Illustrate the process of translation in prokaryotes and Eukaryotes CO4: Analyze gene regulation in prokaryotes and Eukaryotes CO5: Elaborate significance of genetic recombination and gene mapping in prokaryotes and Eukaryotes
CO1: State & describe the concepts of system, surrounding, process, laws of thermodynamics and entropy. CO2: Explain the PVT behavior of fluids & gases, equations of state for real gases and heat effects accompanying chemical reactions CO3. Explain the different thermodynamic properties ,their relations and thermodynamic diagrams CO4. Determine the partial molar properties & explain criteria of phase,	<ul> <li>CO1: Discuss the basic concepts of thermodynamics in process industries</li> <li>CO2: Explain the PVT Behavior and compressibility charts</li> <li>CO3:Illustrate the thermodynamic properties of pure fluids</li> <li>CO4: Compute the properties of solutions and phase equilibria</li> <li>CO5: Employ the knowledge of biochemical energetics – to determine the characteristics of energy rich compounds</li> </ul>	(SC) CO1: Explain replication in prokaryotes and Eukaryotes CO2: Distinguish transcription process in prokaryotes and Eukaryotes CO3: Illustrate the process of translation in prokaryotes and Eukaryotes CO4: Analyze gene regulation in prokaryotes and Eukaryotes CO5: Elaborate significance of genetic recombination and gene mapping in prokaryotes and Eukaryotes

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

		(AHV)
CO1: Explain the fundamental	CO1: Explain the fundamental	
principles and function of proteins.	principles and function of proteins.	<b>CO1</b> : Discuss the basic concepts of
CO2: Describe and apply the	CO2: Describe and apply the	thermodynamics in process industries
foundational principles of	foundational principles of	<b>CO2:</b> Explain the PVT Behavior and
macromolecular structure and	macromolecular structure and	compressibility charts
functions.	functions.	
CO3: Apply the diverse techniques for	CO3: Apply the diverse techniques for	<b>CO3:</b> Illustrate the thermodynamic
the structural elucidation of	the structural elucidation of	properties of pure fluids
biomolecules	biomolecules	CO4: Compute the properties of
CO4: Explain and analyze	CO4: Explain and analyze	solutions and phase equilibria
macromolecular interactions and their	macromolecular interactions and their	CO 05: Employ the knowledge of
dynamics.	dynamics.	biochemical energetics – to determine the
		characteristics of energy rich compounds
15BT46-Clinical Biochemistry	17BT46-Clinical Biochemistry	18BT46-Clinical Biochemistry
-		
CO1: Discuss the biochemistry and	CO1: Discuss the biochemistry and	CO1: Understand the basic metabolic
CO1: Discuss the biochemistry and pathophysiology associated with various	CO1: Discuss the biochemistry and pathophysiology associated with various	CO1: Understand the basic metabolic pathways of CHO, Lipids, amino acid and
CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism	CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism	CO1: Understand the basic metabolic pathways of CHO, Lipids, amino acid and nucleic acids and analyze their
CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of	CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of	CO1: Understand the basic metabolic pathways of CHO, Lipids, amino acid and nucleic acids and analyze their regulations
CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function	CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function	CO1: Understand the basic metabolic pathways of CHO, Lipids, amino acid and nucleic acids and analyze their regulations CO2: Discuss the biochemistry and
CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved	CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved	CO1: Understand the basic metabolic pathways of CHO, Lipids, amino acid and nucleic acids and analyze their regulations CO2: Discuss the biochemistry and pathophysiology associated with various
CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved CO3: Assess and analyze the clinical	CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved CO3: Assess and analyze the clinical	CO1: Understand the basic metabolic pathways of CHO, Lipids, amino acid and nucleic acids and analyze their regulations CO2: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism and hormonal
CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved CO3: Assess and analyze the clinical manifestations of hormonal disturbances	CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved CO3: Assess and analyze the clinical manifestations of hormonal disturbances	CO1: Understand the basic metabolic pathways of CHO, Lipids, amino acid and nucleic acids and analyze their regulations CO2: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism and hormonal disturbance
CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved CO3: Assess and analyze the clinical manifestations of hormonal disturbances CO4:Discuss the medical problems	CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved CO3: Assess and analyze the clinical manifestations of hormonal disturbances CO4:Discuss the medical problems	CO1: Understand the basic metabolic pathways of CHO, Lipids, amino acid and nucleic acids and analyze their regulations CO2: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism and hormonal disturbance CO3: Assessment and evaluation of
C01: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism C02: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved C03: Assess and analyze the clinical manifestations of hormonal disturbances C04:Discuss the medical problems associated with blood and mechanism of	CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved CO3: Assess and analyze the clinical manifestations of hormonal disturbances CO4:Discuss the medical problems associated with blood and mechanism of	CO1: Understand the basic metabolic pathways of CHO, Lipids, amino acid and nucleic acids and analyze their regulations CO2: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism and hormonal disturbance CO3: Assessment and evaluation of clinical manifestations of organ function
C01: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism C02: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved C03: Assess and analyze the clinical manifestations of hormonal disturbances C04:Discuss the medical problems associated with blood and mechanism of detoxification	CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved CO3: Assess and analyze the clinical manifestations of hormonal disturbances CO4:Discuss the medical problems associated with blood and mechanism of detoxification	CO1: Understand the basic metabolic pathways of CHO, Lipids, amino acid and nucleic acids and analyze their regulations CO2: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism and hormonal disturbance CO3: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved
C01: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism C02: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved C03: Assess and analyze the clinical manifestations of hormonal disturbances C04:Discuss the medical problems associated with blood and mechanism of detoxification	CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved CO3: Assess and analyze the clinical manifestations of hormonal disturbances CO4:Discuss the medical problems associated with blood and mechanism of detoxification	CO1: Understand the basic metabolic pathways of CHO, Lipids, amino acid and nucleic acids and analyze their regulations CO2: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism and hormonal disturbance CO3: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved <b>18BTL47-Biochemistry Laboratory</b>
CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved CO3: Assess and analyze the clinical manifestations of hormonal disturbances CO4:Discuss the medical problems associated with blood and mechanism of detoxification <b>15BTL47- Cell and Molecular</b> <b>Biology Laboratory</b>	CO1: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism CO2: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved CO3: Assess and analyze the clinical manifestations of hormonal disturbances CO4:Discuss the medical problems associated with blood and mechanism of detoxification <b>17BTL47-Cell and Molecular</b> <b>Biology Laboratory</b>	CO1: Understand the basic metabolic pathways of CHO, Lipids, amino acid and nucleic acids and analyze their regulations CO2: Discuss the biochemistry and pathophysiology associated with various disorders of metabolism and hormonal disturbance CO3: Assessment and evaluation of clinical manifestations of organ function test and enzymes involved <b>18BTL47-Biochemistry Laboratory</b>

CO-1: Prepare and analyze the mitotic	CO-1: Prepare and analyze the mitotic	mathematics necessary to perform tests,
and meiotic cell divisions	and meiotic cell divisions	make dilutions, and
CO-2: Create and interpret somatic cell	CO-2: Create and interpret somatic cell	prepare buffer solutions
fusion	fusion	CO-2: Compare/contrast Qualitative and
CO-3: Generate DNA and run various	CO-3: Generate DNA and run various	quantitative analysis of various
fragments through electrophoresis	fragments through electrophoresis	Biomolecules
15BTL48-Clinical Biochemistry lab	17BTL48-Clinical Biochemistry lab	18BTL48- Immuno technology
		laboratory
CO-1: Demonstrate the basic laboratory	CO-1: Demonstrate the basic laboratory	CO-1: Perform the various
mathematics necessary to perform tests,	mathematics necessary to perform tests,	Immunodiagnostic techniques based on
make dilutions, and	make dilutions, and	agglutination and precipitation
prepare buffer solutions	prepare buffer solutions	CO-2: Examination of
CO2: Compare/contrast Qualitative and	CO2: Compare/contrast Qualitative	qualitative and quantitative analysis such
quantitative analysis of various	and quantitative analysis of various	as ELISA, Lymphocytes count and
Biomolecules	Biomolecules	Immunoblot
		CO-3: Execution of isolation and
		purification of antibodies
		purification of antibodies
15BT51-Bio kinetics and Bio reaction	17BT51-Bio kinetics and Bio reaction	purification of antibodies 18BT51-Biobusiness and
15BT51-Bio kinetics and Bio reaction Engineering	17BT51-Bio kinetics and Bio reaction Engineering	purification of antibodies       18BT51-Biobusiness     and       Entrepreneurship     Image: Content of the second sec
15BT51-Bio kinetics and Bio reaction Engineering	17BT51-Bio kinetics and Bio reaction Engineering	purification of antibodies          18BT51-Biobusiness       and         Entrepreneurship       Image: Comparison of antibodies
<b>15BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different	17BT51-Bio kinetics and Bio reactionEngineeringCO-1:Discussaboutthedifferent	purification of antibodies and the second se
<b>15BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different chemical reactions and analysis of	<b>17BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different chemical reactions and analysis of	purification of antibodies          18BT51-Biobusiness       and         Entrepreneurship       Entrepreneurship
<b>15BT51-Bio kinetics and Bio reaction</b> EngineeringCO-1: Discuss about the differentchemical reactions and analysis ofexperimental reactor data	17BT51-Bio kinetics and Bio reactionEngineeringCO-1: Discuss about the differentchemical reactions and analysis ofexperimental reactor data	purification of antibodies          18BT51-Biobusiness       and         Entrepreneurship       Image: state
<b>15BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data CO-2: Design of performance equations	<b>17BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data CO-2: Design of performance equations	purification of antibodies          18BT51-Biobusiness       and         Entrepreneurship       and         CO-1:       Discuss       about       the       Bio         Entrepreneurship       co-2:       Illustrate       the       importance       of         Business in Agriculture at present era       co-2:       <
<b>15BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data CO-2: Design of performance equations for the different reactors	<b>17BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data CO-2: Design of performance equations for the different reactors	purification of antibodies          18BT51-Biobusiness       and         18BT51-Biobusiness       and         Entrepreneurship       bio         CO-1:       Discuss       about       the       Bio         Entrepreneurship       co-2:       Illustrate       the       importance       of         Business in Agriculture at present era       co-3:       -       Assess       the       entrepreneurship
<b>15BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data CO-2: Design of performance equations for the different reactors CO-3: Discuss the performance and	<b>17BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data CO-2: Design of performance equations for the different reactors CO-3: Discuss the performance and	purification of antibodies          18BT51-Biobusiness       and         Entrepreneurship       and         CO-1:       Discuss       about       the       Bio         Entrepreneurship       about       the       Bio         CO-2:       Illustrate       the       importance       of         Business in Agriculture at present era       CO-3:       -       Assess       the       entrepreneurship         Opportunity in Industrial Biotechnology       Biotechnology       Biotechnology       Biotechnology
<b>15BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data CO-2: Design of performance equations for the different reactors CO-3: Discuss the performance and distinguish between the different types of	<b>17BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data CO-2: Design of performance equations for the different reactors CO-3: Discuss the performance and distinguish between the different types of	purification of antibodies          18BT51-Biobusiness       and         Entrepreneurship       and         CO-1:       Discuss       about       the       Bio         Entrepreneurship       Entrepreneurship       Entrepreneurship       Entrepreneurship         CO-2:       Illustrate       the       importance       of         Business in Agriculture at present era       CO-3:       -       Assess       the       entrepreneurship         opportunity in Industrial Biotechnology       CO-4: Infer the       project Management       IPR
<b>15BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data CO-2: Design of performance equations for the different reactors CO-3: Discuss the performance and distinguish between the different types of ideal and non-ideal reactors	<b>17BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data CO-2: Design of performance equations for the different reactors CO-3: Discuss the performance and distinguish between the different types of ideal and non-ideal reactors	purification of antibodies          18BT51-Biobusiness       and         Entrepreneurship       and         CO-1:       Discuss       about       the       Bio         Entrepreneurship       about       the       Bio         CO-2:       Illustrate       the       importance       of         Business in Agriculture at present era       CO-3:       - Assess       the       entrepreneurship         opportunity in Industrial Biotechnology       CO-4:Infer the       project Management, IPR       and start un schemes
<b>15BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data CO-2: Design of performance equations for the different reactors CO-3: Discuss the performance and distinguish between the different types of ideal and non-ideal reactors CO-4: Determine enzyme activity, to study	<b>17BT51-Bio kinetics and Bio reaction</b> <b>Engineering</b> CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data CO-2: Design of performance equations for the different reactors CO-3: Discuss the performance and distinguish between the different types of ideal and non-ideal reactors CO-4: Determine enzyme activity, to study	purification of antibodies18BT51-BiobusinessandEntrepreneurshipandCO-1:DiscussabouttheBioEntrepreneurshipCO-2:CO-2:IllustratetheimportanceofBusiness in Agriculture at present eraCO-3:-Assesstheentrepreneurshipopportunity in Industrial BiotechnologyCO-4:Infer theproject Management, IPRand start up schemesCO-5:Describethe

kinetics and its stoichiometry	kinetics and its stoichiometry	bioethics, bio safety and Regulatory
CO-5: Describe medium requirements and	CO-5: Describe medium requirements and	norms
media formulation for the optimal bio	media formulation for the optimal bio	
process	process	
15BT52-Genetic Engineering and	17BT52-Genetic Engineering and	18BT52 - Chemical reaction
applications	applications	engineering
CO1. Explain & compare the different	CO1. Evolution & compare the different	CO-1: Discuss about the different
tools & anzymes used in recombinant	tools & anzymes used in recombinant	chemical reactions and analysis of
DNA	DNA	experimental reactor data
CO2: Illustration of techniques such as	$CO_2$ : Illustration of techniques such as	$CO_2$ : Design of performance equations
PCR Blotting & construction of libraries	PCR Blotting & construction of libraries	for the different reactors
CO3: Differentiate and learn the	CO3: Differentiate and learn the	CO-3: Discuss the performance and
gene/DNA transfer techniques between	gene/DNA transfer techniques between	distinguish between the different types of
CO4:Outline the various methods of	CO4:Outline the various methods	ideal and non-ideal reactors
producing transgenic organisms and	of producing transgenic organisms and	CO-4: Determine enzyme activity, to study
Plants	Plants	the fundamentals of Microbial growth
<b>CO-5:</b> Summarize the applications of	<b>CO-5:</b> Summarize the applications of	kinetics and its stoichiometry
genetic engineering for the welfare of	genetic engineering for the welfare of	CO-5: Describe medium requirements
mankind & society producing transgenic	mankind & society	and media formulation for the optimal
organisms		bio process
15BT53-Immuno Technology (RKC)	17BT53-Immuno Technology (RNK)	18BT53-Enzyme technology and
		Biotransformation
CO-1: Outline the basic concept of	CO-1: Outline the basic concept of	
immune system and different types of	immune system and different types of	<b>CO-1:</b> Explain and apply the knowledge to
antibodies	antibodies	select appropriate methods for isolation,
CO-2: Discuss the molecular and cellular	CO-2: Discuss the molecular and cellular	purification and characterization of
mechanisms involved in the development	mechanisms involved in the development	enzymes
and regulation of the	and regulation of the	<b>CO-2:</b> Discuss the catalytic action,
immune response	immune response	mechanism & kinetics

CO-3: Explain the types of	CO-3: Explain the types of	<b>CO-3:</b> Choose and apply scientific method
hypersensitivity and autoimmune	hypersensitivity and autoimmune	to the process of enzyme immobilization
diseases	diseases	techniques
CO-4:	CO-4:	<b>CO-4:</b> Comprehend the applications of
Describe the various methods of	Describe the various methods of	nonconventional media in enzyme
transplantation and role of tumor	transplantation and role of tumor	catalysis and design the methods for the
antigens	antigens	creation of novel enzymes and
CO-5: Apply the major immunological	CO-5: Apply the major immunological	biotransformation of drugs
laboratory techniques and their	laboratory techniques and their	<b>CO-5:</b> Explain and apply uses of enzymes
application to both clinical analysis and	application to both clinical analysis and	in clinical diagnostics and bioprocess
experimental research	experimental research	industries
15BT54-Bioinformatics	17BT54-Bioinformatics	18BT54-Genomics and Proteomics
CO-1: Understand and apply different databases, resource and software tools for sequence alignment CO-2: Apply and analyze the phylogenetic analysis and different predictive methods for DNA and protein CO-3: Apply different tools for genomics analysis CO-4: Design various biomolecules by	CO-1: Understand and apply different databases, resource and software tools for sequence alignment CO-2: Apply and analyze the phylogenetic analysis and different predictive methods for DNA and protein CO-3: Apply different tools for genomics analysis CO-4: Design various biomolecules by	CO-1:Define structural, comparative and functional genomics and proteomics and its uses in various research Fields CO2: Summarize on genomics and genome management CO3: Describe various methods and techniques of Genomics, high throughput DNA sequencing technology, expression
in-silico tools	in-silico tools	profiling, proteome analysis, and its
		applications
15BT553-Animal Biotechnology	17BT553-Animal Biotechnology	18BT55-Bio analytical Techniques
CO1: Explain the basic principles and techniques in genetic engineering, gene	CO1: Explain the basic principles and techniques in genetic engineering, gene	CO1: Define the fundamentals of downstream processing for product
animal cell lines	animal cell lines	CO2. Understand the requirements for
$C_{0,2}$ Coin knowledge shout the recent	$C_{0,2}$ Coin knowledge shout the recent	successful operations of applytical
CO:2 Gain knowledege about the recent	CO.2 Gain knowledege about the recent	succession operations of analytical

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

CO-1:PerformthevariousImmunodiagnostictechniquesbasedonagglutinationand precipitationCO-2:Examination ofqualitativeand quantitative analysissuchasELISA,LymphocytescountandImmunoblotCO-3:ExecutionofgeneticengineeringtechniquesfortheisolationofNA,quantification,puritycheck,amplificationandgenecloning.	CO-1:PerformthevariousImmunodiagnostictechniquesbasedonagglutinationand precipitationCO-2:Examination ofgualitative and quantitative analysissuchqualitativeand quantitative analysissuchasELISA,LymphocytescountImmunoblotCO-3:ExecutionofCO-3:ExecutionofgeneticengineeringtechniquesfortheisolationofNA,quantification,puritycheck,amplificationandgene cloning.	CO1: State and define the nature of the reaction, rate of the reaction, rate constant and enzyme activity CO2: Compose RTD data in MFR and PFR CO3: Describe the batch reactor performance
<b>15BTL58-Bioinformatics Laboratory</b> CO1:Apply and analyze sequence analysis using different tools CO2: Apply online resource tools to solve protein structure CO3: Design and evaluate different biomolecules using online and offline tools	<b>17BTL58-Bioinformatics Laboratory</b> CO1:Apply and analyze sequence analysis using different tools CO2: Apply online resource tools to solve protein structure CO3: Design and evaluate different biomolecules using online and offline tools	18BTL58 Genetic Engineering and cell Culture laboratory
15BT61-Bio-business and entrepreneurs hip	17BT61-Bio-business and entrepreneurs hip	18BT61-Process control and Automation
<ul> <li>CO-1: Discuss about the Bio Entrepreneurship</li> <li>CO-2: Illustrate the importance of Business in Agriculture at present era</li> <li>CO-3: Assess the entrepreneurship opportunity in Industrial Biotechnology</li> </ul>	<ul> <li>CO-1: Discuss about the Bio Entrepreneurship</li> <li>CO-2: Illustrate the importance of Business in Agriculture at present era</li> <li>CO-3: Assess the entrepreneurship opportunity in Industrial Biotechnology</li> </ul>	Understand the basics of process dynamics principles and instrumentation 22Study various types of input functions and its response 22Perform computational modelling to study different types of controllers

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

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

Fermenter and packed bed distillation	column.						
column.							
15BT65-Cell Culture Techniques	17BT653-Cell Culture Techniques	18BT65X- Open Elective-I					
		18BT651: Biology for Engineers					
CO-1: Understand the concepts of	CO-1: Understand the concepts of	18B1652:Biomaterials 18BT653: Nanobiotechnology					
laboratory design and equipments for cell	laboratory design and equipments for cell						
culture techniques	culture techniques						
CO-2:Correlate between different	CO-2:Correlate between different						
biological samples and understand the	biological samples and understand the						
importance of different media in	importance of different media in						
tissue culture	tissue culture						
CO-3: Comprehend the applications of	CO-3: Comprehend the applications of						
plant culture in industrial secondary	plant, animal and microbial cell culture						
metabolites	in industry, healthcare and						
CO-4: Explain the applications of	environment						
animal cell culture in industry and							
environment							
CO-5: Apply and analyze the							
applications of microbial cell culture in							
industry and environment							
15BT662-Nanobiotechnology	17BT662-Nanobiotechnology	18BTL66-Process Control and					
		Automation Laboratory					
CO1: Explain nano-biotechnology as an	CO1: Define nano-biotechnology as an	CO -1: Comprehend the basics of					
emerging field and its scope	emerging field and its scope.	Instrumentation, classification different					
CO2: Apply the principles and	CO2: Understand the principles and	input function of automatic process					
application of techniques in	applications of the technology in various	control system					
characterization of nanomaterials	fields.	CO-2: Illustrate the characteristics of					
CO3: Apply nanotechnology in		transducers based on critical process					
diagnostic, drug delivery system,		parameters					
microfluidic and biomems		CO-3: Demonstrate the working of first					
CO4: Discuss the application of biological		order systems for tanks connected in					

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

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

genome management	genome management	18BT73X-Professional Elective-2				
CO3: Describe structural genomics and	CO3: Describe structural genomics and	18BT731-Process Equipment & Plant Design				
genome analysis.	genome analysis.	18BT732-Bioreactor Design Concepts				
CO4: Describe proteomics and	CO4: Describe proteomics and	18B1/35-Hansport Filenomena				
proteome analysis	proteome analysis					
15BT73-Plant biotechnology	17BT73-Plant biotechnology	18BT74X-Professional Elective-3				
CO-1: State the basic concepts of plant tissue culture and their applications, media preparation, tools of 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 <b>CO-3</b> : Discuss the role, importance & applications of tissue culture in molecular farming <b>CO-4</b> : Explain the mechanism of signal transduction and nitrogen fixation in plants <b>CO-5</b> : Explain the principles, technical requirement, scientific and commercial applications in algal technologies with suitable examples	CO-1: State the basic concepts of plant tissue culture and their applications, media preparation, tools of 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 <b>CO-3</b> : Discuss the role, importance & applications of tissue culture in molecular farming <b>CO-4</b> : Explain the mechanism of signal transduction and nitrogen fixation in plants <b>CO-5</b> : Explain the principles, technical requirement, scientific and commercial applications in algal technologies with suitable examples	18BT741-Bioethics, Biosafety and IPR 18BT742- Agricultural Biotechnology 18BT743-Tissue Engineering				
15BT743-Lab to industrial scaling	18BT74X-Professional Elective-3	18BT75X-Open Elective-B				
CO-1: Discuss fermentation as a basic biochemical process, types of	18BT741-Health Informatics 18BT742- Bioreactor Design Concepts 18BT743-Lab to industrial scaling 18BT744-Food Biotechnology	18BT751-BT for sustainable Environment 18BT752-Forensic Science				

fermentation and fermentation		18BT753-Biological data Management
products		
CO-2: Understand and emphasis on		
scale up media , inoculum and		
sterilization process		
CO-3: Understand the concept of		
rheology and fermenter design		
CO-4:Describe the analytical		
instruments used in fermenter and		
biomass estimation		
CO-5:Explain and infer the process of		
upstream and down stream process		
15BT752-Forensic sciences	18BT75X-Professional Elective-4	18BTL76-Bioprocess Engineering
CO1: Learn about forensic science as a	19PT751 Doing Pictochnology	laboratory
field of study, discuss about history and	18BT752-Forensic Science	
development, role and responsibilities	18BT753-Molecular Diagnostics	
of forensic scientist		
CO2: Analysis of physical evidence,		
biological evidence, firearm evidence,		
and evidence examination		
CO3: Investigation, collection and		
packing of evidence and legal guidelines		
CO4: Learn about ethics in forensic		
science and ethical dilemmas,		
Application of computers in forensic		
science		
CO5: Characterization of the evidence		
and interpretation of the crime scenes		
15BTL76-Fermentation laboratory	17BTL76-Fermentation laboratory	18BTP77-Project Work Phase-I

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

CO-01: Discuss about pharma industry and drug development CO-02: Explain the significance of pharmaco-kinetic models, pharmaco- dynamic principles, various dosage forms and formulation CO-03 :Describe different agents in drug therapy CO-04: Illustrate Bio therapeutics and stem cells application CO-05: Comprehend specific applications of pharmaceutical & clinical Biotechnology	CO-01: Discuss about pharma industry and drug development CO-02: Explain the significance of pharmaco-kinetic models, pharmaco- dynamic principles, various dosage forms and formulation CO-03 :Describe different agents in drug therapy CO-04: Illustrate Bio therapeutics and stem cells application CO-05: Comprehend specific applications of pharmaceutical & clinical Biotechnology	CO 01: Outline the Regulatory Rules and Guidelines for product development CO 02: Describe the safety and quality standards in the biotech industry CO 03: Comprehend the Validation Process in the biotech industry CO 04: Analyze the Product quality and its Implementation CO 05: Describe the concepts of Quality Management System
15BT82-Regulatory affairs in Biotech Industry	17BT82-Regulatory affairs in Biotech Industry	18BT82X- Professional Elective-4
<ul> <li>CO 01: Outline the Regulatory Rules and Guidelines for product development</li> <li>CO 02: Describe the safety and quality standards in the biotech industry</li> <li>CO 03: Comprehend the Validation Process in the biotech industry</li> <li>CO 04: Analyze the Product quality and its Implementation</li> <li>CO 05: Describe the concepts of Quality Management System</li> </ul>	CO 01: Outline the Regulatory Rules and Guidelines for product development CO 02: Describe the safety and quality standards in the biotech industry CO 03: Comprehend the Validation Process in the biotech industry CO 04: Analyze the Product quality and its Implementation CO 05: Describe the concepts of Quality Management System	<ol> <li>Industrial Microbiology</li> <li>Marine Biotechnology</li> </ol>
15BT833-Environmental	17BT83X-Professional Elective-5	18BTP83- Project Work Phase-2
Biotechnology	17BT831-Protein engineering	

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

<b>Note:</b> 1 = Slight 2 = Moderate 3 = Good																
Course outcomes		Program Outcomes PSO														
	PO 1	PO 2	PO 2	PO	PO	PO	PO	PO	PO	P0	P0	P0	POS	POS	POS	POS
	1	Z	3	4	5	6	1	8	9	10	11	12	1	Z	3	4
CO-1	3	2	2	0	0	0	2	2	0	0	0	0	2	1	2	1
CO-2	3	2	2	1	2	0	0	2	0	0	1	0	1	0	2	0
CO-3	3	2	2	0	2	0	0	0	2	0	1	0	2	0	2	0
CO-4	3	2	2	1	2	0	1	1	0	2	0	0	2	1	2	0
CO-5	2	2	2	2	0	0	0	0	2	0	1	0	1	1	2	0

#### Mapping of Course outcomes (COs) and Program Outcomes (POs)

## **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 & amp; 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.