TULSIRAMJI GAIKWAD-PATIL College of Engineering & Technology

Mohgaon, Wardha Road, Nagpur - 441 108

An Autonomous Institute

Department
of
Biotechnology Engineering

B.Tech. Biotechnology Engineering

Teaching Scheme and Syllabus
of
3rd Semester B.Tech Biotechnology

National Education Policy 2020

From

AcademicYear2026-27

Vision of Institute

To emerge as a learning Center of Excellence in the National Ethos indomains of Science, Technology and Management.

Mission of Institute

1. Tostriveforrearingstandardandstatureofthestudentsbypracticinghigh standards of professional ethics, transparency and accountability.
2. To provide facilities and services to meet the challenges of Industry and Society.
3. To facilitate socially responsive research, innovation and entrepreneurship.
4. Toascertainholisticdevelopmentofthestudentsandstaffmembersbyinculcating knowledge and profession as work practices.

Vision of the Department

"To produce competent Entrepreneurs, Researchers and industry ready Professionals in Biotechnology through quality education."

Mission of the Department

- To impart quality technical education and unique interdisciplinary research by merging science and technology
- To make students aware about techniques of modern biotechnology and industrial advancements
- To Inculcate Social and Ethical values in the students and empower them through imparting of knowledge and skills in biotechnology

Program Education Objectives(PEO)

PEO1: Develop Biotechnology graduates as human resource with technical competencies and strong foundation of science and engineering.

PEO2: Acquire fundamental knowledge of mathematics, Biosciences and engineering to analyze, design and implement solutions to the Biotechnological problems.

PEO3: Understand emerging concepts and trends in Biotechnology and allied fields

PEO4: Apply various tools to develop innovative systems for the bioprocesses

Program Outcomes(PO)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/ components/ processes to meet identified needs with considerationforthepublichealthandsafety,whole-lifecost,netzerocarbon,culture,society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes(PSO)

PSO1:	Ability to apply the acquired knowledge and recent techniques to come up with ideas in the domains of Bioprocess Engineering, Bioinformatics and Biopharmaceuticals
PSO2:	Ability to utilize their proficiency and skills in solving real life problems in Diagnostics Genetic Engineering and Fermentation Technology using recent technologies.
PSO3:	Analyzing the impact of Biotechnology Engineering solutions in the societal and human context to create productive human resource for the country.

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SCHEMEOFINSTRUCTIONS &SYLLABI

Programme: Biotechnology Engineering

Scheme of Instructions: Second YearB.Tech.in Biotechnology Engineering

Semester--III

Sr. No.	Course Category	Course Code	Course Title	T/P	Contact Hours				Credits	ExamScheme			ESE Duration (Hours)	Total Marks
					L	P	SL	Hrs.		CT/IA	CA	ESE		
1	**PCC**	BBT32301	Microbiology	T	3	-	-	3	3	30	10	60	3	100
2	**PCC**	BBT32302	Molecular Biology	T	3	-	-	3	3	30	10	60	3	100
3	**MDM**	BSH423	Bioprocess Calculations	T	2	-		2	2	14	6	30	2	50
4	**OEC**	BEC3230X	Open Elective I	T	4	-		4	4	30	10	60	3	100
5	**HSSM**	BSH32307	Entrepreneurship and Startups	T	2	-		2	2	14	6	30	2	50
6	**VEC**	BSH32308	Analytical Techniques Lab	P	-	4		4	2	14	6	30	2	50
7	**PCC**	BBT32303	Microbiology Lab	P	-	2		2	1	-	25	25	2	50
8	**PCC**	BBT32304	Molecular Biology Lab	P	-	2		2	1	-	25	25	2	50
9	**PCC**	BBT32308	Sustainable Development Goals	T				2	2		20	30	2	50
10	**CEP**	BBT32309	Field Project (Micro project)	P	-	4		4	2	-	50	50	2	100
11	**AEC**	BBT32305	Liberal Learning Module-III	P	-	2		2	1	50	-	-	2	50
			Total	-	**14**	**14**		**31**	**23**	**182**	**168**	**400**	**25**	**750**

Course Category	BSC/ESC (BasicScience Course/Engineering Science Course.)	PCC (ProgrammeCore courses)	PEC (Programme Electivecourses)	OEC (Open Elective Course)	Multi-disciplinary courses	VSEC (SkillCourse)	VEC (Value EducationCourses)	HumanitiesSocial Science &Management		Experiential Learning Courses	CC(Liberal Learning Courses)
								AEC(Ability Enhancement Course)	IKS(IndianKnowledge System)		
Credits	-	10	-	4	2	-	2	3		2	-
CumulativeSum	16/13	12	-	4	2	4	2	5		2	4

PROGRESSIVETOTALCREDITS:43+23=66

Chairperson	Vice-Principal /Director Academics	Director Administration	Principal	June,2026 Dateof Release	1.00 Version	Applicablefor AY 2026-27

Director Academics
Tulsiramji Gaikwad-Patil College Of Engineering And Technology, Nagpur

Dr. Premanand Naktode
Principal
TGPCET, Nagpur

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SCHEMEOFINSTRUCTIONS &SYLLABI

Program: Biotechnology Engineering

List of Electives offered by

Biotechnology Engineering

Course Code	Professional Elective-I Semester V	Course Code	Professional Elective-II Semester VI	Course Code	Professional Elective-III Semester VI
BBT33507	Bioinformatics	BBT33605	Enzyme Technology	BBT33608	Biosimilars Technology
BBT33508	Biofertilizer and Biopesticide Technology	BBT33606	Precision Medicine Technology	BBT33609	Stem cell Technology
BBT33509	Pharmaceutical Technology	BBT33607	Synthetic Biology	BBT33610	Metagenomics

Course Code	Professional Elective- IV Semester VII	Course Code	Professional Elective-V Semester VII
BEC44704	Instrumentation & Bioprocess Control	BEC44707	Good Manufacturing and Laboratory Practices
BEC44705	Tissue Engineering and organ Printing	BEC44708	Biosensors
BEC44706	Network Biology	BEC44709	Blockchain in Biotechnology

List of Open Electives offered by Biotechnology Engineering

Course Code	Subject
BBT32309(OE-I)	Food and Nutrition
BBT32408(OE-II)	Waste Management
BBT35310 (OE-III)	Bioterrorism and National Security

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Second Year B.Tech (Third Semester)					
BBT32301: Microbiology					
Teaching Scheme			**Examination Scheme**		
Lectures	3 Hr / Week		**ESE**	60 Marks	
Tutorial	-		**CIE**	40 Marks	
Practical	-		**Total**	100 Marks	
Theory Credits: 3			**Duration of Exam:** 3 Hours		

Course Objectives	
The Objectives of this course is:	
1.	To understand the definition, history, and contributions of key figures in the development of microbiology, as well as the classification and concepts of microorganisms.
2.	To learn the nutritional requirements of microorganisms, taxonomy, evolution, and ecological distribution of microorganisms in different environments. types of culture media, and techniques for isolation, characterization, and preservation of pure cultures.
3.	To study the growth patterns of microorganisms, factors affecting growth, and methods for measuring and evaluating microbial populations and antimicrobial activity.

Course Contents	
Unit I	**Basics of Microbiology & Cell Structure:** Introduction to Microbiology (History and Scope- Role of Microbes in agriculture, public health, medicine, and industry) Organization of Prokaryotic and Eukaryotic Cell Structure and Function. Diversity of the Microbial World (Microbial Evolution, Taxonomy, Microbial Diversity) Microbial Ecology.
Unit II	**Microbial Nutrition & Culture Methods:** Nutritional requirements of microorganisms. Autotrophic & heterotrophic mode of Nutrition. Composition and classification of different types of Nutrient media. Methods of isolation & characterization of pure culture and methods of storage of pure culture.
Unit III	**Microbial Growth & Measurement:** Growth of microorganisms. Phases of growth curve. Specific growth rate and Generation Time. Growth inhibitors and methods of evaluation of antimicrobial agents. Nutritional classification of bacteria (phototrophs, chemotrophs, autotrophs, heterotrophs, prototrophs, auxotrophs).
Unit IV	**Microbial Control Methods:** Definition of terms, factors influencing antimicrobial activity, mechanism of cell injury, physical control of growth (moist-heat, dry-heat, osmotic pressure, radiation, filtration, etc.) Chemical control (heavy metals, detergents, gracious sterilization, etc.). Effect of heat, water activity, and irradiation on growth of microorganisms.
Unit V	**Virology & Microbial Genetics:** Viruses-Introduction, structure, and classification. DNA and RNA viruses, plant and animal viruses. Structure of Bacteriophage, Viral reproduction- lytic and lysogenic cycle. Virus cultivation and assay. Microbial genetics– Transformation, conjugation and transduction.

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Text Books	
T.1	Prescott's Microbiology by Joanne M. Willey, Linda S. Sherwood, and Christopher J. Woolverton.
T.2	Microbiology, Pelzer M.J. Chan ECS & Krieg NR, Tata Mc Graw Hill.
Reference Books	
R.1	Microbiology by Michael J. Pelczar, E.C.S. Chan, and Noel R. Krieg
R.2	Textbook of microbiology- R. Ananthanarayana CKJ Paniker.

Useful Links	
1	https://microbenotes.com/
2	https://link.springer.com/journal/284

Course Outcomes		**CL**	**Hours**
BBT32301.1	**Explain** the microbiology concepts and the functions of different cell organelles of microorganisms.	**2**	9
BBT32301.2	**Explain** microbiological techniques for isolation of pure cultures of microorganisms design the composition of different media and optimum conditions for their growth.	**2**	9
BBT32301.3	**Determine** the growth and control of microbes & different bacteriological techniques involved in microbiology.	**3**	9
BBT32301.4	**Demonstrate** the broader perspective of the Sterilization techniques and its implementation in research.	**3**	9
BBT32301.5	**Classify** types of plant and animal viruses along with their characteristics, genetics, and assay techniques.	**4**	9

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Second Year B.Tech (Third Semester)				
BBT32302: Molecular Biology				
Teaching Scheme			**Examination Scheme**	
Lectures	3 Hr / Week		**ESE**	60 Marks
Tutorial	-		**CIE**	40 Marks
Practical	-		**Total**	100 Marks
Theory Credits: 3			**Duration of Exam:** 3 Hours	

Course Objectives	
The Objectives of this course is:	
1.	To understand the fundamental concepts of molecular biology, including the central dogma, DNA replication in prokaryotes and eukaryotes, and mechanisms of transcription and translation.
2.	To explore genetic variations and regulation, including mutations, DNA damage and repair mechanisms, mutagens, and gene regulation in prokaryotic and eukaryotic systems.
3.	To learn and apply modern molecular biology techniques such as PCR, RT-PCR, microarray, gene silencing, and CRISPR technology.

Course Contents	
Unit I	**Prokaryotic Replication**: Central dogma: Prokaryotic Replication, Transcription (Initiation, elongation, termination) and Translation (mechanism of protein synthesis and protein folding).
Unit II	**Eukaryotic Replication:** Eukaryotic DNA replication, enzymes (types of polymerases, Pol α-primase) and accessory proteins involved in DNA replication, Multiple origins, Pre-replicative complex formation, Process of replication (Initiation, Elongation, Termination), Models of Replication: theta, rolling circle.
Unit III	**Mutation:** Genetic code, types of mutation, types of DNA damage and mechanism of DNA repair. Mutagens: Physical (Ionizing radiation, Non-ionizing radiation), chemical (Base analogs, Deaminating agents, Alkylating agents, Intercalating agents).
Unit IV	**Prokaryotic gene regulation:** Structure and organization of prokaryotic genome, operons – (lactose, tryptophan and arabinose) Eukaryotic gene regulation: ALU sequences, telomerase, transposons, RNA in gene regulation.
Unit V	**Molecular Techniques:** Polymerase Chain reaction, RT- PCR, SNP, SSR, microarray, gene silencing (RNAi), micro- RNA, introduction to CRISPR technology.

Text Books	
T.1	Basic Molecular Biology by Avinash Upadhyay, Kakoli Upadhyay, Himalaya Publication.
Reference Books	
R.1	B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts and Walter, Molecular Biology of the Cell, 6th Ed., Garland Publishing, 2015
R.2	Molecular Cell Biology (6th Edition), Lodish et al, W.H Freeman.

Useful Links	
1	https://www.genome.jp/kegg/
2	https://brenda-enzymes.org/

Course Outcomes		CL	Hours
BBT32302.1	**Explain** the process of replication, transcription and translation (Central Dogma of Cell).	**2**	9
BBT32302.2	**Determine** molecular processes of prokaryotic DNA replication.	**3**	9
BBT32302.3	**Analyze** the different types of mutation caused and its repair mechanism.	**4**	9
BBT32302.4	**Analyze** the mechanism of gene regulation in prokaryotes and eukaryotes.	**4**	9
BBT32302.5	**Summarize** and apply the different molecular techniques.	**5**	9

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Second Year B.Tech (Third Semester)				
BSH32307: Bioprocess Calculations				
Teaching Scheme			**Examination Scheme**	
Lectures	2 Hr / Week		**ESE**	30 Marks
Tutorial	-		**CIE**	20 Marks
Practical	-		**Total**	50 Marks
Theory Credits: 2			**Duration of Exam: 2** Hours	

Course Objectives	
The Objectives of this course is:	
1.	To understand and apply numerical methods, including Gauss elimination and iterative methods such as Gauss-Seidel and Jacobi's method.
2.	To learn the fundamentals of set theory and probability, including the definitions of random experiments, events, and theorems of probability.
3.	To explore probability distributions and statistical concepts, including measures of central tendency, skewness, variance, standard deviation, covariance, and correlation.

Course Contents	
Unit I	**Numerical Methods**: Numerical Solution of Algebraic and Transcendental equations: Newton–Raphson Gauss elimination method, Iterative Methods Gauss Seidal and Jacobi's Method ,
Unit II	**Probability Distributions & Mathematical Expectation:** Random variables, discrete and continuous random variable, joint distributions. **Mathematical Expectations:** Definition of mathematical expectation, the variance and standard deviations, moment generating function
Unit III	**Sampling Techniques:** Population, sample, standard error, confidence intervals, Testing a hypothesis, Null hypothesis, Alternative hypothesis, t-test and Chi-square test, Z-test **.**

Text Books	
T.1	Numerical Methods by B.S. Grewal
T.2	Introduction to Set Theory by J.P. Tremblay and R. Manohar
Reference Books	
R.1	Computer Oriented Numerical Methods by V. Rajaraman
R.2	Fundamentals of Mathematical Statistics by S.C. Gupta and V.K. Kapoor

Useful Links	
1	https://web.northeastern.edu/ding/statlab/lab.html
2	https://nptel.ac.in/courses/111102111

Course Outcomes		CL	Hours
BSH32307.1	Apply Gauss elimination, Gauss-Seidel, and Jacobi iterative methods to solve systems of linear equations.	**3**	8
BSH32307.2	Analyze probability problems by defining random experiments, sample spaces, and using addition and multiplication theorems.	**4**	8
BSH32307.3	Evaluate statistical data by computing measures of central tendency, skewness, variance, standard deviation, and interpreting probability distributions such as binomial, Poisson, and normal distributions.	**5**	8

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Second Year B.Tech (Third Semester)				
OE I- BBT23206: Food and Nutrition				
Teaching Scheme			**Examination Scheme**	
Lectures	4 Hr / Week		**ESE**	60 Marks
Tutorial	-		**CIE**	40 Marks
Practical	-		**Total**	100 Marks
Theory Credits: 4			**Duration of Exam:** 3 Hours	

Course Objectives	
The Objectives of this course is:	
1.	To understand the microorganisms associated with food, their growth factors, and spoilage mechanisms.
2.	To learn principles and techniques of food preservation emphasizing inactivation, inhibition, and recontamination prevention.
3.	To explore the production processes of commercially important organic acids and understand their significance in food technology.

Course Contents	
Unit I	**Food Microbiology:** Micro-organisms associated with food, factors affecting growth of micro-organisms in food, food spoilage. Enzymatic and nonenzymatic changes in food spoilage.
Unit II	**Food Preservation Techniques:** Principles of different modes of food preservation; Preservation methods with emphasis on inactivation, inhibition, and avoiding recontamination.
Unit III	**Production of Primary and Secondary Metabolites:** The process of production of some commercially important organic acids: citric acid, lactic acid, acidic acid, gluconic acid, amino acids and alcohol.
Unit IV	**Food composition and nutrients present in foods:** Nutrition terminologies, Food pyramid, energy value of food, factors affecting and calorie needs for Basal Metabolic Energy, physical activity and diet induced thermogenesis; energy imbalance and body weight regulation.
Unit V	**Human Nutrition:** Role of carbohydrate, lipids and protein in human nutrition. Digestion and absorption of nutrients in human body, Fortification: chemical & biofortification.

Text Books	
T.1	Fundamental Food Microbiology (3rd Edition) – by Bibek Ray. CRC Press: ISBN - 0-8493-1610-3
T.2	Toledo, R.T. Fundamentals of Food Process Engineering, Chapman and Hall; 2000
Reference Books	
R.1	Shakuntala, N., & Many, O. Food: Facts and Principles, New Age International; 2001.
R.2	Food, Nutrition and Diet Therapy by Krause and Mahan 1996, Publisher- W.B.Saund

Useful Links	
1	https://nptel.ac.in/courses/103107088
2	https://nptel.ac.in/courses/126105013
3	https://nptel.ac.in/courses/126105027

Course Outcomes		CL	Hours
BBT23206.1	**Discuss** the fundamentals of microbes associated with food and factors responsible for food spoilage.	**2**	8
BBT23206.2	**Analyze** the different methods in food preservation technology	**3**	9
BBT23206.3	**Demonstrate** process of production of industrially important microbial metabolites.	**3**	7
BBT23206.4	**Analyze** the effects of food in various factors like BMR and physical activity.	**4**	7
BBT23206.5	**Outline** the role of different food components in the human nutrition	**4**	8

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Second Year B.Tech (Third Semester)				
BBA32305: Entrepreneurship and Startups				
Teaching Scheme			**Examination Scheme**	
Lectures	2 Hr / Week		**ESE**	30 Marks
Tutorial	-		**CIE**	20 Marks
Practical	-		**Total**	50 Marks
Theory Credits: 2			**Duration of Exam: 2** Hours	

Course Objectives	
The Objectives of this course is:	
1.	To understand the definitions, traits of an entrepreneur, and the concepts of intrapreneurship and motivation, as well as the differences and similarities between entrepreneurs and managers.
2.	To explore the process of transforming an idea into a startup, including ideation, incubation, designing product-market fit (PMF), technology readiness levels, market analysis, competition evaluation, strategy development, marketing, accounting, and risk analysis.
3.	To learn about funding options for startups, including angel funding, venture funding, and private equity, and understand the differences between these funding sources.

Course Contents	
Unit I	**Introduction to Entrepreneurship and Start – Ups:** Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation. Types of Business Structures, Similarities/differences between entrepreneurs and managers.
Unit II	**Idea to Start-up:** Concept of Ideation and incubation, Designing PMF, Technology Readiness Levels, Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Marketing and accounting, Risk analysis.
Unit III	**Funding for Startups:** Introduction, angel funding, venture funding, difference between angel and venture funding, private equity fund

Text Books	
T.1	Entrepreneurship Development by S.S. Khanka
T.2	The Startup Mindset: How Government Can Help Entrepreneurs Create Jobs by Rajiv Chimanlal Shah
Reference Books	
R.1	The Entrepreneurial Mindset: From Opportunity to Execution by Rita Gunther McGrath and Ian MacMillan
R.2	Startup Compass by Ujwal Kalra and Shobhit Shubhankar

Useful Links	
1	https://nptel.ac.in/courses/107101092
2	https://nptel.ac.in/courses/110106141

Course Outcomes		CL	Hours
BBA32305.1	**Describe** the definitions, traits, and motivation of entrepreneurs and intrapreneurs, and compare different business structures and roles of entrepreneurs and managers	**2**	8
BBA32305.2	**Analyze** the process from ideation to startup, including PMF design, market analysis, competition evaluation, strategy development, marketing, accounting, and risk analysis	**4**	8
BBA32305.3	**Evaluate** various funding options for startups, including angel funding, venture funding, and private equity, and understand their differences	**4**	8

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Second Year B. Tech Biotechnology (Third Semester)				
BBT32308: Analytical Techniques Lab				
Teaching Scheme			**Examination Scheme**	
Lectures	2 Hr/Week		**ESE**	25 Marks
Tutorial	-		**CIE**	25 Marks
Practical	-		**Total**	50 Marks
Practical Credits: 2			**Duration of Exam:** 2Hours	

Course Objectives	
The Objectives of this course is:	
1.	To prepare solutions of specified molarity and normality, calibrate a pH meter, and measure the pH of various solutions.
2.	To determine the isoelectric point of proteins, absorption spectra of solutions, and solute concentrations using spectrophotometry.
3.	To perform protein fractionation, amino acid separation by paper chromatography, lipid separation by TLC, and protein purification using gel filtration chromatography.

Sr. No.	**Experiments**
1.	Study of different kinds of microscopes.
2.	Calibration of pH meter and measurement of pH of various solutions.
3.	Cell Size Estimation Through Centrifugal Sedimentation.
4.	Preparation of Buffers- PBS, TAE.
5.	Quantification of DNA/RNA/Protein by UV Visible Spectroscopy.
6.	Separation of plant pigments by thin layer chromatography.
7.	Separation of DNA using gel electrophoresis.
8.	Separation of protein using SDS page.
9.	Fractionation of proteins by salt precipitation.
10.	Estimation of proteins by Bradford method.
11.	Separation of Amino Acids by Paper Chromatography
12.	Determination of Hardness of Water by EDTA Titration Method.
13.	Determination of Acidity/Alkalinity of Water Sample.
14.	Preparation of Solutions of Known Molarity and Normality.
15.	Estimation of Vitamin C by titration.

Text Books	
T.1	Analytical Biotechnology 01 Edition: Thomas
T.2	Biophysical Chemistry: Upadhyay and Upadhyay Nath
Reference Books	
R.1	Basic Microscopy: A Practical Approach by L. Alison Wright and J. Brian Rendall
R.2	Protein Purification Techniques by Robert H. Harris and Suzanne Angal

Useful Links	
1	https://biotech01.vlabs.ac.in/
2	https://nptel.ac.in/courses/102103015

Course Outcomes		CL	Hours
BBT32308.1	**Prepare** and standardize solutions of specific molarity and normality, and identify components of microscopes for specimen observation	3	4
BBT32308.2	**Calibrate** pH meters and measure the pH of solutions, and determine the isoelectric point of proteins in experimental samples.	4	4
BBT32308.3	**Analyze**absorption spectra and determine solute concentrations using spectrophotometry for quantitative analysis.	4	4
BBT32308.4	**Perform** fractionation of proteins using salt precipitation and separate amino acids using paper chromatography techniques.	3	4
BBT32308.5	**Execute** TLC for lipid separation and apply gel filtration chromatography to purify proteins for downstream applications	4	4

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Second Year B.Tech (Third Semester)				
BBT32303:MicrobiologyLab				
Teaching Scheme			**Examination Scheme**	
Lectures	2 Hr/ Week		**ESE**	25 Marks
Tutorial	-		**CIE**	25 Marks
Practical	-		**Total**	50 Marks
Practical Credit:1			**Duration of Exam:** 2 Hours	

Course Objectives	
The Objectives of this course is:	
1.	To understand the preparation, sterilization, and disinfection of media, along with methods for Determining total and viable microbial counts.
2.	To learn techniques for microbial staining, isolation, and preservation of pure cultures, as well as the Determination of microbial growth curves.
3.	To explore methods for analyzing mitosis phases, isolating plant pigments and genomic DNA, visualizing Cell structures with phase contrast microscopy, and separating blood cells by centrifugation.

Sr. No.	**Experiments**
1.	Introduction to Microbial Good Lab Practices and Biosafety.
2.	Media preparation, sterilization an disinfection.
3.	Preparation of culture media/agar slants/plates.
4.	Staining of bacteria (simple and Gram's stain)and fungi.
5.	Isolation of pure culture and its preservation.
6.	Microbial Growth Curve Determination.
7.	Analyzing the different phases of mitosis.
8.	Isolation of plant pigments.
9.	Isolation genomic DNA from plant.
10.	Visualization of cell structure using phase contrast microscopy.
11.	Separation of blood cells by centrifugation.
12.	Antibiotic Sensitivity Test by Kirby-Bauer Method.
13.	Motility Test of Bacteria (Hanging Drop Method).
14.	Thequantitativebacteriologicalexaminationofwater/milkbySPCmethod.
15.	Biochemical tests for microbial identification.

Text Books	
T.1	Prescott's Microbiology by Joanne M.Willey, Linda S.Sherwood,andChristopherJ. Woolverton
T.2	Microbiology, Pelzer M.J. ChanECS & KriegNR, Tata McGraw Hill
Reference Books	
R.1	Microbiology by Michael J.Pelczar ,E.C.S. Chan, and Noel R. Krieg
R.2	Text book of microbiology-R. Ananthanarayana CKJ Paniker

Useful Links	
1	https://mvi-au.vlabs.ac.in/
2	https://cbi-au.vlabs.ac.in/

Course Outcomes		CL	Hours
BBT32303.1	**Explain** the microbiology concepts and **describe** the functions of different cell organelles of microorganism	**2**	4
BBT32303.2	**Explain** microbiological techniques for isolation of pure cultures of microorganisms design the composition of different media and optimum conditions for their growth.	**2**	4
BBT32303.3	**Determine** the growth and control of microbes & different bacteriological techniques involved in microbiology.	**3**	4
BBT32303.4	**Describe** the broader perspective of the Sterilization techniques and its implementation in research.	**3**	4
BBT32303.5	**Classify** types of plant and animal viruses along with their characteristics, genetics, and assay techniques.	**4**	4

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Second Year B.Tech (Third Semester)				
BBT32304:Molecular Biology Lab				
Teaching Scheme			**Examination Scheme**	
Lectures	2 Hr/ Week		**ESE**	25 Marks
Tutorial	-		**CIE**	25 Marks
Practical	-		**Total**	50 Marks
PracticalCredit:1			**Duration of Exam:** 2 Hours	

Course Objectives	
TheObjectives ofthis courseis:	
1.	To conduct qualitative and quantitative estimations of RNA, and DNA using Various biochemical methods.
2.	To understand and apply advanced analytical techniques such as gel electrophoresis, restriction digestion, Western blotting, and DNA fingerprinting for characterization of biomolecules.
3.	To perform advanced molecular biology techniques including restriction digestion, plasmid DNA isolation, and southern blotting.

Sr. No.	**Experiments**
1.	Extraction of DNA from bacterial cell/plant cell.
2.	Estimation of DNA by Diphenylamine(DPA) method
3.	Estimation of RNA by orcinol method.
4.	Quantification of DNA by spectrophotometry.
5.	Isolation and identification of PCR product.
6.	Preparation of microscopic slide for dicotleaf section.
7.	Study of mitosis in onion root tips.
8.	Polyacryl amide gel electrophores is and estimation of MW of proteins
9.	Restriction digestion of DNA using restriction enzymes.
10.	Western Blotting.
11.	Demonstration of Reverse Transcriptase PCR.
12.	Isolation of prokaryotic DNA (E.coli).
13.	Isolation of Eukaryotic DNA(Yeast).
14.	Determination of molecular weight of DNA and visualization by agarose gel electrophoresis.
15.	DNA fingerprinting.

TextBooks	
T.1	Basic Molecular Biology by Avinash Upadhyay,Kakoli Upadhyay, Himalaya Publication.
ReferenceBooks	
R.1	B.Alberts, A.Johnson,J.Lewis, M.Raff, K. Robertsand Walter, MolecularBiologyof the Cell, 6th Ed., Garland Publishing, 2015
R.2	Molecular Cell Biology(6thEdition), Lodishetal, W.H Freeman.

Useful Links
1

Course Outcomes		**CL**	**Hours**
BBT32304.1	**Explain** the process of replication, transcription and translation (Central Dogma of Cell).	**2**	4
BBT32304.2	**Demonstrate** molecular processes of prokaryotic DNA replication.	**3**	4
BBT32304.3	**Analyze** the different types of mutation caused and its repair mechanism.	**4**	4
BBT32304.4	**Analyze** the mechanism of gene regulation in prokaryotes and eukaryotes.	**4**	4
BBT32304.5	**Summarize** and apply the different molecular techniques.	**5**	4

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An Autonomous Institute affiliated to RTMNU Nagpur

Third Year(Semester-III)B.Tech. Biotechnology Engineering

BBT32308 :Sustainable Development Goals

Teaching Scheme		Examination Scheme	
Lectures	2Hrs./week	**CIE**	20Marks
Tutorial	-	**ESE**	30Marks
TotalCredit	2	**Total**	50Marks
		DurationofESE:01Hrs.00 Min.	

Course Objectives:

1.	TodevelopacomprehensiveunderstandingoftheUNSustainableDevelopment Goals(SDGs) and their interconnections.
2.	To analyze the global challenges addressed by the SDGs and their impact on various sectors.
3.	ToexploreinnovativesolutionsandbestpracticesforimplementingtheSDGs.
4.	ToevaluatetheprogressmadetowardsachievingtheSDGsatnationalandinternationallevels.
5.	To foster a sense of global citizenship and social responsibility among students.

Course Contents		Hours
Unit I	**Introduction to Sustainable Development Goals(SDGs):** Definition of Sustainability, Aspects of sustainability, historical perspective of sustainable development, Climate Change Conferences and Summits, the Brundtl and CommissionReport,transitionfromMillenniumDevelopmentGoals(MDGs)toSDGs, the role of UN and the need for SDGs and Adoption by the World, scope and inclusion of the 2030 Agenda for Sustainable Development.	**(7)**
Unit II	**Framework & Structuring of the17SDGs:** SDG 1:No Poverty, SDG 2:Zero Hunger,SDG3: Good Health and Well-being, SDG 4: Quality Education, SDG 5: Gender Equality, SDG 6: Clean Water and Sanitation, SDG 7: Affordable and Clean Energy, SDG 8: Decent Work and Economic Growth, SDG 9: Industry, Innovation and Infrastructure, SDG 10: Reduced Inequalities, SDG 11: Sustainable Cities and Communities, SDG 12: Responsible Consumption and Production, SDG 13: Climate Action, SDG 14: Life below Water, SDG 15: Life on Land,SDG16:Peace,JusticeandStrongInstitutions,SDG17: Partnerships for the Goal	**(7)**
Unit III	**SDGs Implementation and Future Perspectives:** Interconnections between the SDGs, the role of technology and innovation in SDG implementation, financing the SDGs, measuring SDG progress, future challenges and opportunities, Climate change and its impact on sustainable development, Case studies of successful SDG implementation – India, World	**(7)**

TextBooks

1	Hazra, Somnath., Bhukta, Anindya (2020)Sustainable Development Goals AnIndian Perspective, Springer International Publishing, Switzerland
2	Ziai, Aram(2016)Development Discourse and Global History from colonialism to the sustainable development goals. Routledge, London & New York

Reference Books	
1	Sachs,J.,Schmidt-Traub,G.,Kroll,C.,Lafortune,G.,Fuller,G.,Woelm,F.2020.TheSustainable DevelopmentGoalsandCOVID-19.SustainableDevelopmentReport2020.Cambridge:Cambridge UniversityPress.
2	OECD (2019),Sustainable Results in Development: Using the SDGs for Shared Results and Impact, OECD Publishing, Paris, https://doi.org/10.1787/368cf8b4-en.

Useful Links
1.https://nptel.ac.in/courses/109106200
2.https://www.un.org/sustainabledevelopment/

BCE32408	Course Out comes	CL
CO1	To explore the historical origins and evolution of the UN-SDGs.	2
CO2	Toanalyzethe17SDGsandtheirinterlinkages.	2
CO3	To analyze the role of technology and innovation in achieving the SDGs along with future challenges and opportunities.	2

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Department of Biotechnology

Second Year (Semester-III) B. Tech Biotechnology Engineering

BBT42305: Micro Project

2nd Year- (3rd Semester)

BBT42305: Micro Project

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/week	**CA**	50 Marks
Total Credit	1	**ESE**	-
		Total	50 Marks
		Duration of ESE: -	

Course Outcomes (CO)

Students will be able to

1	Work in a team of 4 students to complete the project work.
2	Do the experimentation and/or computational work ethically.
3	Complete the works within the deadline.
4	Prepare neat and neat project report without any errors.
5	Communicate effectively in English during project demonstration, orals and viva-voce.

Instructions:

- The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study.
- Every project work shall have a guide who is the member of the faculty of the institution.
- Sixteen periods per week

shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

- Each student shall finally produce a comprehensive report covering back ground information, literature survey, problem statement, project work details and conclusion.
- This final report shall be typewritten form as specified in the guidelines.
- The continuous assessment shall be made as prescribed by the regulation TGPECT, Nagpur.

BAE42305	Course Outcomes	CL	Class Sessions
CO1	**Understand** the project managements and team leadership.	**3**	**9**
CO2	**Analyze** Know about the concept of the mini project.	**3**	**9**
CO3	**Understand and analyze** functioning of projects	**3**	**9**
CO4	**Evaluate** the cost and materials of the projects.	**4**	**9**
CO5	**Estimate** the performance of the projects, study their application and Classification.	**2**	**9**

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