TULSIRAMJI GAIKWAD-PATIL College of Engineering and Technology
Wardha Road, Nagpur - 441108
Accredited with NAAC A+ Grade
Approved by AICTE, New Delhi, Govt. of Maharashtra
(**An Autonomous Institution Affiliated to RTM Nagpur University**)
Department of Biotechnology

Structure and Curriculum

B.Tech Biotechnology

(From Academic Year 2021-22)

TULSIRAMJI GAIKWAD-PATIL College of Engineering and Technology
Wardha Road, Nagpur - 441108
Accredited with NAAC A+ Grade
Approved by AICTE, New Delhi, Govt. of Maharashtra
(**An Autonomous Institution Affiliated to RTM Nagpur University**)
Department of Biotechnology

Vision of Institute

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

Mission of Institute

1. To strive for rearing standard and stature of the students by practicing high 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. To ascertain holistic development of the students and staff members by inculcating 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

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

Program Education Objectives (PEO)

1. Develop Biotechnology graduates as human resource with technical competencies and strong foundation of science and engineering.
2. Acquire fundamental knowledge of mathematics, Biosciences and engineering to analyze, design and implement solutions to the Biotechnological problems.
3. Understand emerging concepts and trends in Biotechnology and allied fields.
4. Apply various tools to develop innovative systems for the bioprocesses.

TULSIRAMJI GAIKWAD-PATIL College of Engineering and Technology
Wardha Road, Nagpur - 441108
Accredited with NAAC A+ Grade
Approved by AICTE, New Delhi, Govt. of Maharashtra
(**An Autonomous Institution Affiliated to RTM Nagpur University**)
Department of Biotechnology

Program Outcomes (PO)

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze 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 software 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, and 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. **Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

PSO-1: Ability to apply the acquired knowledge and recent techniques to come up with ideas in the domains of Bioprocess Engineering, Bioinformatics and Biopharmaceuticals.
PSO-2: Ability to utilize their proficiency and skills in solving real life problems in Diagnostics Genetic Engineering and Fermentation Technology using recent technologies.
PSO-3: Analyzing the impact of Biotechnology Engineering solutions in the societal and human context to create productive human resource for the country.

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Scheme of Instructions and Syllabus

Scheme of Instructions: Second Year B. Tech in Biotechnology

Semester III

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME				
									CT-1	CT-2	CA	ESE	TOTAL
1	BS	BBT2301	Microbiology	3	-	-	3	3	15	15	10	60	100
2	PCC	BBT2302	Bioprocess Engineering	3	1	-	4	4	15	15	10	60	100
3	BS	BBT2303	Biochemistry	3	-	-	3	3	15	15	10	60	100
4	PCC	BBT2304	Analytical Techniques	3	-	-	3	3	15	15	10	60	100
5	HSMC	BBT2305	Effective Technical Communication	2	1	-	3	3	-	-	25	25	50
6	PCC	BBT2306	Bioprocess Calculations	3	-	-	3	3	15	15	10	60	100
7	BS	BBT2307	Microbiology Lab	-	-	2	2	1	-	-	25	25	50
8	BS	BBT2308	Biochemistry Lab	-	-	2	2	1			25	25	50
9	PCC	BBT2309	Analytical Techniques Lab	-	-	2	2	1			25	25	50
10	MCC	BAU2303	Environmental Science	2	-	-	2	Audit	-	-	-	-	-
			TOTAL	19	2	6	27	22	75	75	150	400	700

L- Lecture T-Tutorial P-Practical CT1- Class Test 1 CT2- Class Test 2 CA- Continuous Assessment

ESE- End Semester Examination (For Laboratory: End Semester Performance)

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg.,Sc.)	BS (Biological Sc.)	PCC (Professional Core courses)	PEC (Professional Elective Courses)	OEC (Biological Sc.)	PROJECT (Project /Seminar/ Industrial Training)	MCC (Mandatory Courses)
Credits	3	-	-	8	11	--	--	--	Yes
Cumulative Sum	6	18	14	8	11	--	--	--	--

Progressive Total Credits: 35+22+ 57

BoS Chairman
Head
Department Of Biotechnology
Tulsiramji Gaikwad Patil Collage Of
Engineering & Technology, Nagpur

Dean Academics
Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur

Vice-Principal
Vice Principal
Tulsiramji Gaikwad-Patil
College Of Engineering &
Technology, Nagpur.

Principal
Principal
Tulsiramji Gaikwad Patil College Of
Engineering and Technology, Nagpur

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Scheme of Instructions and Syllabus

Scheme of Instructions: Second Year B. Tech in Biotechnology

Semester IV

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME				
									CT-1	CT-2	CA	ESE	TOTAL
1	BS	BBT2401	Cell & Molecular Biology	3	-	-	3	3	15	15	10	60	100
2	BS	BBT2402	Biochemistry Metabolism	3	-	-	3	3	15	15	10	60	100
3	PCC	BBT2403	Green Biotechnology and Pollution Abetment	3	-	-	3	3	15	15	10	60	100
4	PCC	BBT2404	Bioinformatics And Computational Biology	3	-	-	3	3	15	15	10	60	100
5	PCC	BBT2405	Immunology and Immunotechnology	3	-	-	3	3	15	15	10	60	100
6	HSMC	BBT2406	Engineering Economics	3	-	-	3	3	15	15	10	60	100
7	BS	BBT2407	Cell & Molecular Biology Lab	-	-	2	2	1	-	-	25	25	50
8	BS	BBT2408	Biochemistry Metabolism Lab	-	-	2	2	1	-	-	25	25	50
9	PCC	BBT2409	Bioinformatics And Computational Biology Lab	-	-	2	2	1	-	-	25	25	50
10	PROJECT	BBT2410	Micro Project	-	-	2	2	1	-	-	25	25	50
11	MCC	BAU2404	Group Reading of Classics	2	-	-	2	Audit	-	-	-	-	-
			Total	20	0	8	28	22	90	90	160	460	800

L- Lecture T-Tutorial P-Practical CT1- Class Test 1 CT2- Class Test 2 CA- Continuous Assessment

ESE- End Semester Examination (For Laboratory: End Semester Performance)

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	BS (Biological Sc.)	PCC (Professional Core courses)	PEC (Professional Elective Courses)	OEC (Biological Sc.)	PROJECT (Project /Seminar/ Industrial Training)	MCC (Mandatory Courses)
Credits	3	-	-	8	10	--	--	1	Yes
Cumulative Sum	9	18	14	16	21	--	--	1	--

Progressive Total Credits: 57+22= 79

BoS Chairman
Head
Department Of Biotechnology
Tulsiramji Gaikwad Patil Collage Of Engineering & Technology, Nagpur

Dean Academics
Dean Academics
Tulsiramji Gaikwad-Patil College Of Engineering and Technology, Nagpur

Vice-Principal
Vice Principal
Tulsiramji Gaikwad-Patil College Of Engineering & Technology, Nagpur.

Principal
Principal
Tulsiramji Gaikwad Patil College Of Engineering and Technology, Nagpur

Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road, Nagpur-441 108
NAAC Accredited with A+ Grade
(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Program: B. Tech. Biotechnology

Semester	Course Code	Name of Course	L	T	P	Credits
III	**BBT2301**	**Microbiology**	3	-	-	3

Teaching Scheme		Examination Scheme	
Theory	**3 Hrs/week**	CT-I	15 Marks
Tutorial	**-**	CT-II	15 Marks
Total Credits	**3**	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks

Course Contents

Unit I	**Historical Background of Microbiology**: Introduction to Microbiology, History of Microbiology (Robert Hooke, Antony van Leeuwenhoek, Francesco Redii, Louis Joblot, H. Schroder and Von Dusch, Louis Pasteur, John Tyndall, Robert Koch, Joseph Lister, Alexander Fleming, Edward Jenner). Applied Microbiology: Industrial, Medicinal, pharmaceutical
Unit II	**Microbial Taxonomy:**Prokaryotes and eukaryotes, bacteria types and cell components Classification of microorganisms, bacterial classification and identification methods. Fungal classification and key identification characters. Algalcharacteristics, groups, and classification. Viruses: types, classification, and characters. Anaerobic and aerobic bacteria
Unit III	**Microbial Nutrition and Metabolism**: Nutritional Requirement of Microbes, Micro-nutrients and Macro-Nutrients. Types of Media: Defined media, Differential Media, Complex Media, Growth curveand different methods to quantify bacterial growth; aerobic and anaerobic bioenergetics andutilization of energy for the biosynthesis of important molecules
Unit IV	**Control of Microorganisms:** Physical and chemical control of microorganisms; microbial interactions; anti-bacterial,anti-fungal, and anti-viral agents, mode of action and resistance to antibiotics, clinically important microorganisms.
Unit V	**Applied Microbiology**: Primary metabolites, secondary metabolites and their applications; Food Preservation Methods; Production of enzymes by microbes, production of penicillin, alcohol, and vitamin B-12.

Text Books	
1	The textbook of Microbiology (Pawar and Daginawala)
2	Microbiology: An Introduction, 13th Edition. Authors: Gerard J. Tortora
Reference Books	
1	Overview of Microbiology, James D. Dick
2	Microbiology, Nina Parker, Mark Schneegurt
Useful Links	
1	https://nptel.ac.in/courses/102103015
2	https://microbiologysociety.org/
3	https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/industrial-microbiology

Course Code	Course Outcomes	CL	Class Sessions	Lab Sessions
BBT2301.1	**Demonstrate** the microbiology regarding origin of life	3	9	-
BBT2301.2	**Analyze** of microbial taxonomy	4	9	-
BBT2301.3	**Choose** the composition for classification of different type of nutrient media	5	9	-
BBT2301.4	**Apply** appropriate methods for control of the growth of microorganisms	3	9	-
BBT2301.5	**Test** the appropriate methods for the production of microbial products	4	9	-

Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road, Nagpur-441 108
NAAC Accredited with A+ Grade
(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Program: B. Tech. Biotechnology

Semester	Course Code	Name of Course	L	T	P	Credits
III	BBT2302	Bioprocess Engineering	3	1	-	4

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	CT-I	15 Marks
Tutorial	1	CT-II	15 Marks
Total Credits	4	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks

Course Contents

Unit I	**Isolation, preservation and improvement of industrial microorganism:** The isolation of industrially important microorganisms and Cell Banks, The preservation of industrially important microorganisms, The improvement of industrial microorganisms.
Unit II	**Media for industrial fermentations; optimization and sterilization:** Media design and formulation, Media sterilization, disposal of media. Optimization of parameters: physical parameters like temperature, pressure, surface tension, viscosity of the medium, etc. Chemical parameters like pH, salt concentration, dissolved oxygen. Medium optimization (Factorial Design)
Unit III	**Inocula development and fermentation kinetics:** The development of inocula for bacterial, streptomycete, yeast, fungal processes. The aseptic inoculation of plant fermenters, Fermentation Kinetics - Microbial Growth Kinetics (Development of growth equation, Quantifying cell concentration, Growth patterns and Kinetics), Substrate consumption kinetics, Product formation kinetics
Unit IV	**Aspects of Bioprocesses:** Introduction to GMP, QC and QA. Sterility, Toxicity and Product testing
Unit V	**Applications of Bioprocess Engineering:** Production of citric acid, amino acids, antibiotics, brewing of alcoholic products

Text Books	
T.1	Pauline Doran, Bioprocess engineering principles
T.2	Michael Shuler, FikretKargi, Matthew DeLisa, Bioprocess Engineering: Basic Concepts, 3rd Edition
Reference Books	
R.1	Colin Ratledge, Bjorn Kristiansen, Basic Biotechnology, 2nd Edition, Cambridge University Press, 2001
R.2	Bioreaction Engineering, Bioprocess Monitoring (Bioreaction Engineering) by Karl Schügerl

Useful Links	
1	https://nptel.ac.in/courses/102105064
2	https://www.researchgate.net/publication/281716235_Industrial_fermentation
3	https://www.sciencedirect.com/topics/engineering/inoculum-development
4	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7466055/#:~:text=During%20fermentation%2C%20yeast%20cells%20convert,influence%20beer%20flavor%20%5B9%5D.

	Course Outcomes	CL	Class Sessions	Lab Sessions
BBT2302.1	**Analyze** the procuring and handling industrial microorganisms	4	8	-
BBT2302.2	**Formulate** the media for fermentations	6	9	-
BBT2302.3	**Illustrate** the concepts involved in upstream processes	4	9	-
BBT2302.4	**Test** the aspects of Bioprocesses in industry	5	9	-
BBT2302.5	**Break Down** the production of fermented products	4	8	-

Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC Accredited with A+ Grade

(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Program: B. Tech. Biotechnology

Semester	Course Code	Name of Course	L	T	P	Credits
III	**BBT2303**	**Biochemistry**	3	-	-	3

Teaching Scheme		Examination Scheme	
Theory	**3 Hrs/week**	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	**3**	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks

Course Contents

Unit I	**Water and buffers**: Properties of water- solubility, ionization property and water as a reactant, pH and buffers and their importance.
Unit II	**Carbohydrates**: Classification, structure and function of carbohydrates. Chemical reaction of carbohydrate, physical and chemical properties of sugars, starch, pectin.
Unit III	**Amino Acids and proteins** Classification, structure of amino acids, Classification and structure of protein (primary, tertiary and quaternary). Denaturation and renaturation of protein. Nucleic acid: structure and type of DNA and RNA
Unit IV	**Enzymes, kinetics and inhibition**: Classification and nomenclature, concept of enzyme activity, Kinetics of single substrate enzyme catalyzed reaction- Michaelis-Menten equation, significance of Km and Vmax, turnover number, catalytic efficiency, modifications of Michaelis-Menten plot, allosteric enzymes, enzyme inhibition- reversible and irreversible inhibition, kinetics of inhibition
Unit V	**Fatty acids and lipids**: Classification, structure, properties, function of fatty acids. Classification, structure, properties and biological function of simple lipids – triacylglycerol, phospholipids and glycolipids. Cholesterol- structure, properties

Text Books	
1	David L. Nelson and Michael M. Cox. 2017. Lehninger Principles of Biochemistry: International Edition. 7th edition, W.H. Freeman. USA.
2	Victor W. Rodwell, David A. Bender,Kathleen M. Botham, Peter J. Kennelly and P. Anthony Weil, 2015. Harpers Illustrated Biochemistry. 30th Edition, McGraw-Hill companies, Inc. USA
Reference Books	
1	Enzymes, Second edition, Travor Palmer and Philip Bonner, Horwood Publishing Series
2	Text Book of Biochemistry- Rao Rama V.S.S.; Narosa Pub. House, New Delhi

Useful Links	
1	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4576142/pdf/main.pdf
2	https://www.nature.com/scitable/topicpage/discovery-of-dna-structure-and-function-watson-397/
3	https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch450-and-ch451-biochemistry-defining-life-at-the-molecular-level/chapter-2-protein-structure/

Course Code	Course Outcomes	CL	Class Sessions	Lab Sessions
BBT2303.1	**Analyze** the properties of water molecule	4	9	-
BBT2303.2	**Classify** the structure and function of carbohydrate	4	9	-
BBT2303.3	**Predict** the structure of amino acid and nucleic acid	3	9	-
BBT2303.4	**Asses** the enzyme kinetics.	4	9	-
BBT2303.5	**Formulate** the Fatty acids and lipid structure, properties, function	6	9	-

Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road, Nagpur-441 108
NAAC Accredited with A+ Grade
(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Program: B. Tech. Biotechnology

Semester	Course Code	Name of Course	L	T	P	Credits
III	**BIT2304**	**Analytical Techniques**	3	-	-	3

Teaching Scheme		Examination Scheme	
Theory	**3 Hrs/week**	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	**3**	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks

Course Contents

Unit I	**Microscopy introduction type function**: Principles of light microscopy Electron microscopy Multi-photon microscopy Fluorescent microscopy Confocal microscopy Atomic force microscopy absoption microscopy.
Unit II	**Cetrifugation and Electrophoresis**: Sedimentation type of centrifugation type of rotors swing vertical fixed angle Ultracentrifugation and its application. Theory of electrophoresis technique electrophoresis of nucleic acids and protein blotting technique. Northen Blotting Western blotting pulsed field electrophoresis capillary electrophoresis.
Unit III	**Spectroscopy**: Introduction to principles and application of spectroscopic methods Beers Lambert Law single beam and double beam spectroscopy UV-Vsisible spectroscopy, Atomic adsoptionspectroscopy , IR ,FTIR, Raman ,Fluorescences spectroscopy, ESR spectroscopy .
Unit IV	**Chromatography**: Introduction to chromatographic techniques Theoretical basis of chromatographic separations. Column Thin layer, paper chromatography Normal phase and reveres phase chromatography , Ion –exchange, Affinity , Gas chromatography and High performance liquid chromatography, gel filtration &Hydrophobic ,gas chromatography.
Unit V	**Protein Analysis**: solution and solid state NMR spectroscopy , X-ray crystallography, X-ray diffraction method , Mass spectroscopy –MALDI,LC-MS,GC-MS, proteomics introduction & basics..

Text Books	
1	Analytical Biotechnology 01 Edition: Thomas
2	Biophysical Chemistry : Upadhyay and Upadhyay Nath
Reference Books	
1	Biochemical Methods of analysis: Theory and Applications by Saroj Dua
2	Molecular and Biochemical analysis of Calreticulin by LezzeikFatme
Useful Links	
1	http://nptel.iitm.ac.in
2	https://www.sciencedirect.com/topics/engineering/fourier-transform-infrared-spectroscopy

Course Code	Course Outcomes	CL	Class Sessions	Lab Sessions
BBT2304.1	**Evaluate** the microscopy results.	5	9	-
BBT2304.2	**Classify** the centrifugation and electrophoresis.	4	9	-
BBT2304.3	**Predict** spectroscopy results.	3	9	-
BBT2304.4	**Assess** chromatographic techniques.	5	9	-
BBT2304.5	**Formulate** Protein Analysis.	6	9	-

Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road, Nagpur-441 108
NAAC Accredited with A+ Grade
(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Program: B. Tech. Biotechnology

Semester	Course Code	Name of Course	L	T	P	Credits
III	BBT2305	Effective Technical Communication	2	1	-	3

Teaching Scheme		Examination Scheme	
Theory	2 Hrs/week	CT-I	-
Tutorial	1	CT-II	-
Total Credits	3	CA	25 Marks
Duration of ESE: 3Hrs		ESE	25 Marks

Course Contents

Unit I	**Communication Skills:** Importance of communication, types, barriers of communication, effective communication, Listening Skills- Empathic listening, Avoid selective listening, social understanding, behaviors traits, teamwork.
Unit II	**Formal Correspondence:** Business Letters, e-mail etiquettes [Orders, Complaints, Enquiries, Job applications and Resume Writing, Writing Memorandum, Circulars, notices], Analytical comprehension.
Unit III	**Technical Writing:** Features of Technical Writing, Writing Scientific Projects, Technical Report writing, Writing Manuals, Writing Project Proposals, Writing Research papers.
Unit IV	**Presentation Skills:** Importance of oral presentation, planning the presentation, preparing the presentation, organizing your presentation, rehearsing presentation, checklist for making presentation. Leadership skills, decision making, negotiation skills, business etiquette, problem solving skills
Unit V	**Self-Development and Assessment:** Self-assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, taking notes; Complex problem solving; Creativity.

Text Books	
1	Effective technical Communication by Barun K.Mitra,Oxford University Press
2	Technical Communication-Principles and Practice by Meenakshi Raman & Sharma, Oxford University Press,2011, ISBN-13-978-0-19-806529-
Reference Books	
1	Organizational Behavior by Don Hellriegel, Jhon W. Slocum,Richard W. Woodman Meenakshi Raman “Technical Communication: Principles and practice”Oxfored University press, India
2	Meenakshi Raman “Technical Communication: Principles and practice”Oxfored University press, India
Useful Links	
1	https://nptel.ac.in/courses/109104031
2	https://www.coursera.org/learn/business-english-skills-how-to-navigate-tone-formality-directness-in-emails
3	https://www.skillsyouneed.com/presentation-skills.html
4	https://in.indeed.com/career-advice/career-development/how-to-write-official-letter

Course Code	Course Outcomes	CL	Class Sessions	Lab Sessions
BBT2305.1	**Determine** the barriers of communication and overcome those	3	9	-
BBT2305.2	**Justify** their messages through formal correspondence	5	8	-
BBT2305.3	**Categorize** their technical work	4	9	-
BBT2305.4	**Choose** the skills required for effective presentation	5	8	-
BBT2305.5	**Assess** themselves and **solve** the problems	5	9	-

Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC Accredited with A+ Grade

(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Program: B. Tech. Biotechnology

Semester	Course Code	Name of Course	L	T	P	Credits
III	BBT2306	Bioprocess Calculations	3	-	-	3

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks

Course Contents

Unit I	**Introduction to Engineering Calculations:** Units and Conversions, Density, Specific Gravity; specific volume, Mole Concept, chemical composition, Pressure, Temperature, standard Conditions, physical and chemical data, stoichiometry, atomic mass, molar mass, Equivalent mass, Normality, Molarity and Molality of micro and macromolecules.
Unit II	Ideal gases, partial pressure, vapour pressures, application of ideal gas laws, volume changes with changes of composition, dissociating gases, humidity and saturation, solubility and crystallization.
Unit III	Material balance without chemical reaction, separation, mixing, drying, crystallization. Basic concepts of recycle, bypass and purge streams. Recycle, purge and bypass calculations.
Unit IV	Material balance with chemical reaction, conversion and yield, Biochemical stoichiometry: Limiting and excess reactants conversion, degree of completion, selectivity, yields problems
Unit V	Fundamentals of energy balances, Law of conservation of energy, Heat capacity, sensible heat, latent heat, calculation of enthalpy changes. General energy balance equation and Energy balance calculations with and without reactions.

Text Books	
1	Bioprocess Engineering Principles: Pauline M. Doran
2	Unit Operations of Chemical Engineering: Warren L. McCabe, Julian C. Smith, 5th Edition
Reference Books	
1	Chemical Process Principles: Hougen and Watson, Vols I & II
2	Stoichiometry: B I Vora and Bhatt
3	Stoichiometry: Williams and Johnson
Useful Links	
1	https://nptel.ac.in/courses/102103015
2	https://www.engr.colostate.edu/CBE101/topics/energy_balances.html
3	https://www.sciencedirect.com/topics/engineering/ideal-gas

Course Code	Course Outcomes	CL	Class Sessions	Lab Sessions
BBT2306.1	**Apply** different units and conversions in bioprocess	3	8	-
BBT2306.2	**Illustrate** ideal gases and analyze their properties	4	9	-
BBT2306.3	**Assess** the methods of separation, mixing and crystallization	5	10	-
BBT2306.4	**Categories** material balance and biochemical stichometry	4	10	-
BBT2306.5	**Use** the energy balance calculations for the process with and without reactions	3	9	-

Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC Accredited (A+ Grade)

(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Program: B.TechBiotechnology

Semester	Course Code	Name of Course	L	T	P	Credits
III	**BBT2307**	**Microbiology Lab**	-	-	2	1

Teaching Scheme		Examination Scheme	
Practical	**2 Hrs/week**	CT-I	-
Tutorial	-	CT-II	-
Total Credits	**1**	CA	25 Marks
		ESE	25 Marks

Sr. No.	List of Experiment
1	Media preparation, sterilization and disinfection
2	Microscopic examination of different groups of microorganisms
3	Total count and viable count determination
4	Microbial simple and differential staining methods
5	Isolation of pure culture and its preservation
6	Microbial Growth Curve Determination
7	Effect of physical and chemical environment on growth
8	Biochemical tests for microbial identification
9	Antibiotic Sensitivity of Microorganisms

Text Books/Reference Books

1	Prescott's Microbiology by Willey, Sherwood and Woolverton
2	Brock Biology of Microorganisms by Madigan, Martinko, Stahl and Clark
3	General Microbiology by Stanier, Ingraham, Wheelis and Painter.
4	Microbiology, M. Pelczar, E. Chan, N. Kreig, 5th ed, MGH.

Useful Links

1.	https://nptel.ac.in/courses/102/103/102103015/

Course Code	Course Outcomes	CL	Class Sessions	Lab Sessions
BBT2307.1	**Classify** prepration of media and sterlization, disinfection techniquies	4	-	4
BBT2307.2	**Illustrate** Isolation of pure culture and its preservation microbial growth curve Determination.	4	-	4
BBT2307.3	**Evaluate** the Antibiotic Sensitivity of Microorganisms	5	-	4
BBT2307.4	**Analyze**of Microbial Indentifiaction	4	-	4
BBT2307.5	**Asses** the isolation and its determination techniquies	5	-	4

Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC Accredited with A+ Grade

(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Program: B. Tech Biotechnology

Semester	Course Code	Name of Course	L	T	P	Credits
III	**BBT2308**	**Biochemistry Lab**	-	-	2	1

Teaching Scheme		Examination Scheme	
Practical	**2 Hrs/week**	CT-I	-
Tutorial	-	CT-II	-
Total Credits	**1**	CA	25 Marks
		ESE	25 Marks

Sr. No.	List of Experiments
1	Laboratory practices in biochemistry and reagent preparation (calculations)
2	Preparation of buffers
3	Quantitative estimation of amino acids
4	Quantitative and qualitative estimation of lipids
5	Quantitative estimation of proteins.
6	Estimation of RNA by orcinol reagent
7	Estimation of DNA by diphenylamine reagent method
8	Analyze the presence of carbohydrate both qualitatively and quantitatively.
9	To perform the enzyme immobilization by entrapment in alginate beads or by any other methods.

Text Books/

1	David L. Nelson and Michael M. Cox. 2017. Lehninger Principles of Biochemistry: International Edition. 7th edition, W.H. Freeman. USA.
2	Victor W. Rodwell, David A. Bender,Kathleen M. Botham, Peter J. Kennelly and P. Anthony Weil, 2015. Harpers Illustrated Biochemistry. 30th Edition, McGraw-Hill companies, Inc. USA.

Reference Books

1	Enzymes, Second edition, Travor Palmer and Philip Bonner, Horwood Publishing Series
2	Text Book of Biochemistry- Rao Rama V.S.S.; Narosa Pub. House, New Delhi

Useful Links

1.	https://nptel.ac.in/courses/102/103/102103015/

Course Code	Course Outcomes	CL	Class Sessions	Lab Sessions
BBT2308.1	**Illustrate** the light microscopy	4	-	4
BBT2308.2	**Classify** Centrifugation and Electrophoresis	4	-	4
BBT2308.3	**Analyse** the protein characterization	4	-	4
BBT2308.4	**Asses** chromatographic techniques	5	-	4
BBT2308.5	**Formulate** Protein Analysis	6	-	4

Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road, Nagpur-441 108
NAAC Accredited (A+ Grade)
(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Program: B. Tech Biotechnology

Semester	Course Code	Name of Course	L	T	P	Credits
III	**BBT2309**	**Analytical Techniques Lab**	-	-	2	1

Teaching Scheme		Examination Scheme	
Practical	**2 Hrs/week**	CT-I	-
Tutorial	-	CT-II	-
Total Credits	**1**	CA	25 Marks
		ESE	25 Marks

Sr. No.	List of Experiment
1	Understanding components of different kinds of microscopes.
2	Analysis of proteins by western blotting techniques.
3	Determination of adsorption spectrum and extinction coefficient.
4	Purifications of proteins by salting out method.
5	Size determination of yeast cell by centrifugal method.
6	Demonstration of Electrophoresis (Proteins and Nucleic acid).
7	Separation of amino acids by paper chromatography
8	Separation of amino acids by thin layer chromatography

Text Books/Reference Books

1	Analytical Biotechnology 01 Edition: Thomas
2	Biophysical Chemistry: Upadhyay and Upadhyay Nath

Useful Links

1.	https://nptel.ac.in/courses/102/103/102103015/

Course Code	Course Outcomes	CL	Class Sessions	Lab Sessions
BBT2309.1	**Evaluate** the microscopy results.	5	-	4
BBT2309.2	**Classify** Centrifugation and Electrophoresis	4	-	4
BBT2309.3	**Predict** Spectroscopy:	3	-	4
BBT2309.4	**Asses**. chromatographic techniques	5	-	4
BBT2309.5	**Formulate** Protein Analysis	6	-	4

BoS Chairman

Head
Department Of Biotechnology
Tulsiramji Gaikwad Patil Collage Of
Engineering & Technology, Nagpur

Dean Academics

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur

Vice Principal

Vice Principal
Tulsiramji Gaikwad-Patil
College Of Engineering &
Technology, Nagpur.

Principal

Principal
Tulsiramji Gaikwad Patil College O
Engineering and Technology, Nagpu

Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road, Nagpur-441 108
NAAC Accredited with A' Grade
(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Program: B. Tech. (Audit Course)

Semester	Course Code	Name of Course	L	T	P	Credits
III	BAU2303	Environmental Science	2	-	-	Audit

Teaching Scheme	
Theory	2Hrs/week
Tutorial	-
Total Credits	Audit
Duration of ESE: 2 Hrs	

Examination Scheme	
CT-I	-
CT-II	-
CA	-
ESE	50 Marks (MCQ)

Course Contents	
Unit I	**Natural Resources:** Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Energy resources: Growing energy needs, use of alternate energy sources. Forest resources: Use and over-exploitation, deforestation, mining, dams and their effects on forest. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.
Unit II	**Ecosystems:** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem, Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems.
Unit III	**Environmental Pollution:** Definition, Cause, effects and control measures of: - a. Air pollution, b. Water pollution, c. Noise pollution, d. nuclear hazards. E-Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Text Books	
1	Ecology and Environmental Science, Rana S.V.S, PHI Learning Private Ltd.
2	Environmental Science and Engineering, Anjali Bagad, PHI Learning Private Ltd.
3	Environmental Science, Fundamentals, Ethics & Laws, Shulka, Ashish &Others,I. K. International P. Ltd.
Reference Books	
1	Environmental Science and Demystified, William Linda, Tata MCgraw Hill
2	Essential of Ecology and Environmental Science, Rana SVS, Prentice Hall Of India.

3	Environmental Pollution Control Engineering, C S Rap, New Age International Publishers.
Useful Links	
1	https://youtu.be/NRoFvz8Ugeo
2	https://youtu.be/iMSwvJhIIA8
3	https://youtu.be/eIs4M2QG0

	Course Outcomes	CL	Class Sessions
BAU2303.1	**Examine** natural resources and their importance	3	8
BAU2303.2	**Illustrate** the energy flow in the ecosystem	3	8
BAU2303.3	**Predict** the causes of environmental pollution and preventive measures.	3	8

BOS Chairman

Dean Academics

Vice-Principal

Principal

Dean Academics
Tulsiramji Gaikwad-Patil College Of Engineering and Technology, Nagpur

Vice-Principal
TulsiRamji Gaikwad Patil College Of Engineering & Technology, Nagpur

Principal
Tulsiramji Gaikwad Patil College O
Engineering and Technology, Nagpu