



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



Teaching Scheme and Syllabus

of

4th Semester B.Tech Biotechnology

(From Academic Year 2024-25)



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.



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 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 Institution Affiliated to RTM Nagpur University, Nagpur)
SCHEME OF INSTRUCTION & SYLLABI
 Programme: B. Tech Biotechnology
 Scheme of Instructions: Second Year B. Tech. in Biotechnology (As Per NEP 2020)
 Semester-IV

SN	Sem	Type	BoS/Dept	Sub Code	Subject	T/P	Contact Hours			Credits	% Weightage			ESE Duration	Total Marks
							L	P	Hrs		CT/IA	CA	ESE		
1	IV	PCC	BT	BBT32401	Biochemistry Metabolism	T	3	0	3	3	30	10	60	3 Hrs	100
2	IV	PCC	BT	BBT32402	Immunology	T	3	0	3	3	30	10	60	3 Hrs	100
3	IV	PCC	BT	BBT32403	Biochemistry Metabolism Lab	P	0	2	2	1	-	25	25	-	50
4	IV	PCC	BT	BBT32404	Immunology Lab	P	0	2	2	1	-	25	25	-	50
5	IV	MDM	S&H	BSH32405	Unit Operations	T	2	0	2	2	14	6	30	-	50
6	IV	OEC		BSS32XX	Open Elective II	T	2	0	2	2	14	6	30	2 Hrs	50
7	IV	VSEC	BT	BBT32406	Bioinformatics Lab	P	0	4	4	2	-	50	50	-	100
8	IV	AEC	BT	BBT32407	Analytical Techniques Lab	P	0	4	4	2	-	50	50	-	100
9	IV	HSSM	S&H	BSH32404	Leadership and Team Dynamics	P	0	4	4	2	-	50	50	-	100
10	IV	VEC	S&H	BSH32403	Human Values for Professional Society	T	2	0	2	2	14	6	30	2 Hrs	50
Total							12	16	28	20	102	238	410	10 Hrs	750

Course Category	BSC/ESC (Basic Science Course/Engineering Science Course.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	Multidisciplinary courses	SEC (Skill Course)	Humanities Social Science & Management	Experiential Learning Courses	CC (Liberal Learning Courses)
Credits	--	08	--	02	--	04	02	--
Cumulative Sum	29	10	--	06	04	08	02	04

PROGRESSIVE TOTAL CREDITS: 43+20=63

				Dec, 2024	1.00	Applicable for AY 2024-25 Onwards
Chairperson	Dean Academics	Vice Principal	Principal	Date of Release	Version	

Head
 Department of Biotechnology, Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur
Dean Academics
 Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur
Dr. Dr. Pragati Patil
 Vice-Principal
Dr. Premanand Naktode
 Principal
 JGPCET, Nagpur


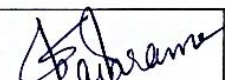
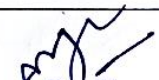

Programme: B.Tech Biotechnology
List of Program Electives offered by The Biotechnology Department

Program Elective-I	Program Elective-II	Program Elective-III	Program Elective-IV	Program Elective-V
Semester V	Semester VI	Semester VI	Semester VII	Semester VIII
BBT33507- Bioprocess Calculations	BBT33605- Enzyme Technology	BBT33608- Biosimilars Technology	BBT34703- Biological Fuel Cell Technology	BBT34706- Good Manufacturing and Laboratory Practices
BBT33508- Biofertilizer and Biopesticide technology	BBT33606- Animal and Plant Biotechnology	BBT33609- Stem cell Technology	BBT34704- Enzyme Technology	BBT34707- Biosensors
BBT33509- Bioinformatics and Computational Biology	BBT33607- Epigenetics and Genomic Variations	BBT33610- Big Data in Biology	BBT34705- Systems Biology	BBT34708- Artificial Intelligence and Machine Learning

Program: B.Tech Biotechnology
List of Open Electives offered by Biotechnology Department

Open Elective-I	Open Elective-II	Open Elective-III
Semester-III	Semester-IV	Semester-V
BBT32309: Food and Nutrition	BBT32408: Waste Management	BBT35310: Bioterrorism and National Security

Course Category	BSC (Basic Science Course)	ESC (Engineering Science Course.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	Multi-disciplinary courses	VSEC (Skill Course)	Humanities Social Science & Management	Experiential Learning Courses	CC (Liberal Learning Courses)	Semester Wise Credits
Sem -I	10	5	2	--	--	2	--	--	2	21
Sem -II	8	8	--	--	--	2	2	--	2	20
Sem -III	--	--	8	--	6	1	4	2	--	20
Sem -IV	--	--	8	--	4	2	6	--	--	22
Sem -V	--	--	11	4	6	--	--	--	--	21
Sem -VI	--	--	8	8	2	2	--	--	--	20
Sem -VII	--	--	4	2	2	--	--	12	--	20
Sem -VIII	--	--	4	6	2	--	--	8	--	20
Cumulative Sum	18	13	47	20	22	9	12	20	4	163

				December, 2024	1.00	Applicable for AY2024-25 Onwards
Chairperson	Dean Academics	Vice-Principal	Principal	Date of Release	Version	



Department of Biotechnology

Second Year B.Tech (Fourth Semester)

BBT32401: Biochemistry Metabolism

Teaching Scheme		Examination Scheme	
Lectures	3Hr / 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 pathways and regulatory mechanisms of carbohydrate, lipid, nucleic acid, and protein metabolism, including gluconeogenesis, glycolysis, beta oxidation, and amino acid transformations.
2. To explore the synthesis and metabolism of biomolecules such as fatty acids, phospholipids, purines, and pyrimidines, and analyze associated metabolic disorders.
3. To learn the principles of biochemical energetics, including energy-yielding reactions, oxidation-reduction processes, ATP production, and ATP pumps.

Course Contents

Unit I	Carbohydrate Metabolism: Gluconeogenesis, glycolysis and TCA cycle, Glycogen metabolism, Hormonal regulation of carbohydrate metabolism. Electron transport chain.
Unit II	Lipid Metabolism: Beta oxidation, oxidation of saturated and unsaturated fatty acids, fatty acid biosynthesis, ketone bodies. Synthesis of phospholipids.
Unit III	Nucleic Acid metabolism: De novo synthesis path way, Salvage pathway, disorders of purine and pyrimidine metabolism.
Unit IV	Protein Metabolism: Protein and amino acid metabolism (aromatic and sulfur), Mechanism of transamination, deamination and decarboxylation of amino acids
Unit V	Biochemical Energetics: Energy- Yielding and Energy Requiring Reactions, Oxidation-Reduction Reactions, ATP Yield, ATP pump

Text Books

- | | |
|-----|---|
| T.1 | Principles of Biochemistry-AlbertL. Lehninger CBS Publishers & Distributors |
| T.2 | Biochemistry - Lubertstryer Freeman International Edition |

Reference Books

- | | |
|-----|---|
| R.1 | Fundamentals of Biochemistry- J.L.JainS.Chand and Company |
| R.2 | Biochemistry by U. Satyanarayana and U. Chakrapani |

UsefulLinks

- | | |
|---|---|
| 1 | https://nptel.ac.in/courses/104/105/104105076/ |
| 2 | https://www.biology.arizona.edu/biochemistry/biochemistry.html |
| 3 | http://www.metpathways.org/ |



Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC Accredited **A+ Grade**

Approved by AICTE, New Delhi, Govt. of Maharashtra

(An Autonomous Institution Affiliated to RTM Nagpur University)

Department of Biotechnology

Course Code	Course Outcomes	CL	Hours
BBT32401.1	Summarize different biochemical pathways like Gluconeogenesis, glycolysis and TCA cycle	2	9
BBT32401.2	Explain the pathways for lipid metabolism	2	9
BBT32401.3	Illustrate the processes of nucleic acid synthesis	3	9
BBT32401.4	Interpret the protein synthesis mechanism and metabolism	2	8
BBT32401.5	Outline the Oxidation-Reduction Reactions and ATP Yield	4	9

Head

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

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



Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC Accredited **A+ Grade**

Approved by AICTE, New Delhi, Govt. of Maharashtra

(An Autonomous Institution Affiliated to RTM Nagpur University)



Department of Biotechnology

Second Year B.Tech (Fourth Semester)

BBT32402: Immunology

Teaching Scheme			Examination Scheme	
Lectures	3Hr / 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 give students basic knowledge about immune system.
2. To understand structure and function of cells and organs of immune system.
3. To gain knowledge about different types of immune response and Ag-Ab interaction.

Course Contents

Unit I	Basic of Immunology: definition of immunology and immunity, basic concept of immune system, classification of Immunity- Natural(innate) immunity and Acquired immunity, mechanism of Natural immunity-different Barriers and their function, types of Acquired Immunity, Introduction to cancer Biology, Carcinogenesis and carcinogenic agents, Oncogenes.
Unit II	Organ and cells of immune system: Organs of immune system-Primary lymphoid organ and secondary lymphoid organ, different cells of immune system-B cell, T cell, Natural Killer(NK) cell, Mast cell, dendritic cells, phagocytic cells and their functions.
Unit III	Antigen and Antibody: Concept of Antigen, different types of Antigens, Allergens and their types, structure of antigen and concept of epitome, Antibody (Immunoglobulin) structure, different classes of Immunoglobulin- IgA, IgD, IgE, IgG and IgM. Epitope-Paratope binding and interaction.
Unit IV	Immune Response: Immune response and its implementation, Role of different cytokines in Immune response, different types of cytokines, major pathway of immune response- Antibody mediated or Humoral Immune response and Cell mediated Immune response, complement system-Classical pathway and Alternate Pathway.
Unit V	Antigen and Antibody interaction: Different types of Ag-Ab reactions- Agglutination, Precipitation, Immunodiffusion, Immunofluorescence, ELISA, RIA, blood group determination, Immuno-electrophoresis, Neutralization reaction, Concept of Vaccine and Vaccination, different Types of Vaccine.



Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC Accredited **A+ Grade**

Approved by AICTE, New Delhi, Govt. of Maharashtra

(An Autonomous Institution Affiliated to RTM Nagpur University)

Department of Biotechnology

Text Books

T.1	Textbook of Immunology kuby- R.A.goldsby.
T.2	Fundamental of Immunology-Paul W.E.-Raven Press New York.
Reference Books	
R.1	Essential Immunology-Peter J.delves, Blackwell publishing.
R.2	Immunology and immunotechnology-B.annadurai-S.chand Publication.
R.3	Essentials of Immunology- Ivan Riot-Blackwell1997, 4 th edition.

Useful Links

1	https://nptel.ac.in/courses/109106198
2	https://nptel.ac.in/courses/102101068

Course Code	Course Outcomes	CL	Hours
BBT32402.1	Understand basic concept of Immunity and working of Immune system.	2	8
BBT32402.2	Acquire Knowledge about organs and cells involve in Immune system.	2	8
BBT32402.3	Understand concept of Antigen and Antibody and their interaction.	2	8
BBT32402.4	Summarize different types of Immune response and its implementation.	2	9
BBT32402.5	Outline different types of antigen-Antibody Interaction and serological reactions.	4	8

Pant

Head

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

Kararam

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



Department of Biotechnology

Second Year B.Tech(Fourth Semester)

BBT32403: Biochemistry and Molecular Biology Lab

Teaching Scheme			Examination Scheme	
Lectures	2Hr / 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 determine the Michaelis constant and study the activity of various enzymes, including amylase, phosphatase, lactate dehydrogenase, succinate dehydrogenase, and alanine/aspartate aminotransferase.
2.	To isolate and crystallize enzymes, such as urease from jack beans, and investigate the effects of inhibitors on enzyme activity.
3.	To estimate enzymatic activities, including lysozyme and aspartate aminotransferase, in given samples.

Sr. No.	Experiments
1	Determination of Michaelis constant of enzymes.
2	Assay of amylase enzyme activity from sweet potato.
3	Assay of phosphatase enzyme activity from potato.
4	Assay of lactate dehydrogenase enzyme activity.
5	Assay of succinate dehydrogenase activity.
6	Assay of alanine aminotransferase activity/aspartate aminotransferase activity.
7	Isolation and crystallization of enzyme urease from jack beans.
8	Determining the effect of inhibitors on enzyme activity
9	Assay of aspartate amino transferase activity
10	Estimate the lysozyme enzymatic activity of the given sample.

Text Books

T.1	Fudamental of Biochemistry- Dr.A.C.DeB
-----	--

Reference Books

R.1	Principles of Biochemistry -AlbertL.Lehninger CBS Publishers & Distributors
-----	---



Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC Accredited **A+ Grade**

Approved by AICTE, New Delhi, Govt. of Maharashtra

(An Autonomous Institution Affiliated to RTM Nagpur University)

Department of Biotechnology

Useful Links

1 <https://nptel.ac.in/courses/102/106/102106087>

Course Code	Course Outcomes	CL	Hours
BBT32403.1	Determine the enzymes and their presence	3	4
BBT32403.2	Assess the activity of enzymes	5	4
BBT32403.3	Examine the activity of succinate Dehydrogenase and aminotransferase	3	4
BBT32403.4	Derive and crystallize the urease and enzyme inhibition	6	4
BBT32403.5	Evaluate the amino transferase and lysozyme activity	5	4

Patil
Head

Department Of Biotechnology
Tulsiramji Gaikwad Patil College Of
Engineering & Technology, Nagpur

Ramesh

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



Department of Biotechnology

Second Year B.Tech (Fourth Semester)

BBT32404: Immunology Lab

Teaching Scheme			Examination Scheme	
Lectures	2Hr / 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 perform techniques for determining ABO blood group types, detecting antigens and antibodies, and studying antigen-antibody interactions using methods such as agglutination, precipitation, and ELISA.			
2.	To conduct quantitative and qualitative immunological assays, including Widal test, HCG detection, and differential leucocyte counting using a hemocytometer.			
3.	To demonstrate advanced immunological techniques, including double diffusion, immunoelectrophoresis, rocket immunoelectrophoresis, and Western blotting.			

Sr. No.	Experiments
1	Determination of ABO blood group types (Agglutination Reaction).
2	Quantitative estimation of Antigen in sample-Widal test.
3	Study of reaction pattern of Antigen and Antibody by double Diffusion technique.
4	Differential Leucocytes count by Hemocytometer.
5	Estimation of Antigen in given sample by ELISA.
6	Qualitative detection of Human Chorionic Gonadotropin (HCG) in Urine.
7	Qualitative estimation of Antigen and Antibody by Precipitation Reaction.
8	Demonstration of Immunoelectrophoresis.
9	Demonstration of Rocket Immunoelectrophoresis.
10	Western blotting Technique.

Text Books	
T.1	Textbook of Immunology kuby- R.A.goldsby.
T.2	Fundamental of Immunology-Paul W.E.-Raven Press New York.
Reference Books	
R.1	Essential Immunology-Peter J.delves, Blackwell publishing.
R.2	Immunology and immunotechnology-B.annadurai-S.chand Publication.



Department of Biotechnology

Useful Links	
1	https://nptel.ac.in/courses/109106198
2	https://nptel.ac.in/courses/102101068

Course Code	Course Outcomes	CL	Hours
BBT32404.1	Perform ABO blood grouping using agglutination reactions and analyze the results for identifying blood group compatibility.	3	4
BBT32404.2	Evaluate antigen concentrations in samples through Widal test and ELISA techniques for diagnostic applications.	4	4
BBT32404.3	Demonstrate and interpret antigen-antibody interactions using double diffusion and precipitation reactions.	4	4
BBT32404.4	Conduct differential leukocyte counts using a hemocytometer and assess their significance in clinical diagnostics.	3	4
BBT32404.5	Execute advanced immunological techniques such as immunoelectrophoresis, rocket immunoelectrophoresis, and Western blotting to detect specific proteins.	5	4

Patil

Head

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

Kabram

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



Department of Biotechnology

Second Year B.Tech (Fourth Semester)

BSH32405: Unit Operations

Teaching Scheme			Examination Scheme	
Lectures	2Hr / 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 engineering calculations involving units, conversions, density, specific gravity, mole concepts, and concentration measures such as normality, molarity, and molality.
2. To explore the properties and behavior of ideal gases, including partial pressure, vapor pressure, humidity, saturation, solubility, and crystallization.
3. To learn the fundamentals of material and energy balances, including calculations involving conversion, yield, recycle, bypass, and purge streams in processes with or without chemical reactions.

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	Basis of material balance with or without chemical reaction, Basic concepts of recycle, bypass and purge streams. Recycle, purge and bypass calculations. Conversion and yield, General energy balance equation and Energy balance calculations with and without reactions.

Text Books

T.1	Bioprocess Engineering Principles: Pauline M. Doran
T.2	Unit Operations of Chemical Engineering: Warren L. McCabe, Julian C. Smith, 5 th Edition

Reference Books

R.1	Chemical Process Principles: Hougen and Watson, Vols I&II
R.2	Stoichiometry 4th Edition: B I Bhatt, S M Vora, Publisher: Mcgrawhill HED
R.3	Stoichiometry for Chemical Engineers: Edwin T. Williams and Curtis Johnson Publisher-McGraw-Hill Book Company, Inc.



Department of Biotechnology

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	Hours
BSH32307.1	Apply different units and conversions in bioprocess	3	10
BSH32307.2	Illustrate ideal gases and analyze their properties	4	10
BSH32307.3	Assess the methods of material balance and energy balance in different unit operations.	5	10

Patil
Head

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

Patil

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



Department of Biotechnology

Second Year B.Tech (Fourth Semester)			
BBT32408: Waste Management			
Teaching Scheme		Examination Scheme	
Lectures	2Hr / 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 sources and types of air pollution, including particulate and gaseous pollutants, and their environmental impact		
2.	To Understand the sources of water pollution and the principles of primary and secondary water treatment methods, including physical, chemical, and biological processes.		
3.	To learn sustainable waste management practices, focusing on recycling, landfill management, health and safety in waste handling, and promoting community participation and public awareness.		
Course Contents			
Unit 1	Air Pollution: Sources of Air Pollution, Particulate emission control by mechanical separation and electrostatic precipitation, wet gas scrubbing, gaseous emission control by absorption and adsorption, Design of cyclones, ESP, fabric filters and absorbers.		
Unit 2	Water Pollution: Sources of Water Pollution, Primary Treatment and Secondary Treatment: Physical treatment, pre-treatment, solids removal by setting and sedimentation, filtration centrifugation, coagulation and flocculation. Biological Treatment: Anaerobic and aerobic treatment biochemical kinetics, trickling filter, activated sludge and lagoons, aeration systems, sludge separation and drying.		
Unit 3	Solids Waste Pollution: Sources of Solid Waste Solids waste disposal - composting, landfill, briquetting / gasification and incineration, Recycling and Reuse of Solid Waste.		

Text Books	
T.1	O.P. Gupta, "Elements of Solid & Hazardous Waste Management", Khanna Publishing House, New Delhi, 2019.
T.2	George Tchobanoglous et.al., "Integrated Solid Waste Management", McGraw-Hill Publishers, 1993
T.3	Vallero D;"Fundamentals of Air Pollution", 4 th Ed; Academic Press.
T.4	Pichtel J;"Waste Management Practices: Municipal, Hazardous and Industrial", CRC



Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC Accredited **A+ Grade**

Approved by AICTE, New Delhi, Govt. of Maharashtra

(An Autonomous Institution Affiliated to RTM Nagpur University)

Department of Biotechnology

Reference Books

R.1	B.Bilitewski, G.HardHe, K.Marek, A. Weissbach, and H.Boeddicker, "Waste Management", Springer, 1994
R.2	Upcycling: A New Perspective on Waste Management in a Circular Economy by R. Jayasinghe et al.

Useful Links

1	https://nptel.ac.in/courses/105107207
2	https://nptel.ac.in/courses/103107217

Course Code	Course Outcomes	CL	Hours
BBT32301.1	Explain the various sources of air pollution and their impact on the environment and human health	2	8
BBT32301.2	Demonstrate the use of physical and biological treatment methods to optimize water treatment systems, including sedimentation, filtration, coagulation, trickling filters, and activated sludge processes	3	9
BBT32301.3	Evaluate the effectiveness of various solid waste disposal methods, such as composting, landfill, briquetting, gasification, and incineration, in managing waste sustainably.	4	9

Fehf

Head

Department Of Biotechnology
Tulsiramji Gaikwad Patil Collage Of
Engineering & Technology. Nagpur

Padman

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



Second Year B.Tech (Fourth Semester)			
BBT32406: Bioinformatics Lab			
Teaching Scheme		Examination Scheme	
Lectures	4Hr / Week	ESE	25 Marks
Tutorial	-	CIE	25 Marks
Practical	-	Total	50 Marks
Practical Credit: 2		Duration of Exam: 2 Hours	
Course Objectives			
The Objectives of this course is:			
1.	To learn how to access databases from NCBI and extract protein and nucleotide sequences using various search tools.		
2.	To perform similarity searches using BLAST, conduct multiple sequence and pairwise alignments, and analyze conserved domains.		
3.	To construct phylogenetic trees, identify protein-protein interactions using STRING, analyze pathways through KEGG, and visualize complex networks using Cytoscape.		

Sr. No.	Experiments
1	Accessing databases from NCBI.
2	Extracting protein and nucleotide sequences from NCBI.
3	Database Search Tools.
4	Similarity search using BLAST.
5	Multiple sequence alignment & Pairwise sequence alignment.
6	Conserved domain analysis.
7	Construction of Phylogenetic trees.
8	Identification of Protein-Protein Interactions (PPI) using STRING.
9	Analysis of pathways using KEGG
10	Visualizing complex networks by Cytoscape

Text Books	
T.1	Bioinformatics: A practical guide to Analysis of Genes & Proteins by A. D. Baxevanis John Willey and sons, 2005
T.2	Fundamental Concepts of Bioinformatics by D. E. Krane and M. L. Raymer, Pearson Publication, 2006.
Reference Books	
R.1	Bioinformatics: Tools & Applications by D. Edward and J. Stajich, Springer, 2009.



Useful Links	
1	www.ncbi.nlm.nih.gov/genbank/
2	https://pymol.org/
3	https://www.perl.org/
4	https://www.ebi.ac.uk/embl/

Course Code	Course Outcomes	CL	Hours
BBT32406.1	Apply NCBI databases to access, extract, and analyze protein and nucleotide sequences for biological research.	3	8
BBT32406.2	Perform similarity searches using BLAST, and conduct multiple and pairwise sequence alignments to study sequence homology.	4	8
BBT32406.3	Analyze conserved domains in proteins and interpret the results to understand protein function and evolutionary relationships.	4	8
BBT32406.4	Construct and interpret phylogenetic trees to visualize evolutionary relationships between species or genes.	5	8
BBT32406.5	Utilize tools like STRING for protein-protein interaction analysis, KEGG for pathway analysis, and Cytoscape for visualizing complex biological networks.	5	8

Head

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

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



Department of Biotechnology

Second Year B.Tech (Fourth Semester)

BBT32407: Analytical Techniques Lab

Teaching Scheme			Examination Scheme	
Lectures	2Hr / 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 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.

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



Department of Biotechnology

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

Course Code	Course Outcomes	CL	Hours
BBT32407.1	Prepare and standardize solutions of specific molarity and normality, and identify components of microscopes for specimen observation.	3	4
BBT32407.2	Calibrate pH meters and measure the pH of solutions, and determine the isoelectric point of proteins in experimental samples.	4	4
BBT32407.3	Analyze absorption spectra and determine solute concentrations using spectrophotometry for quantitative analysis.	4	4
BBT32407.4	Perform fractionation of proteins using salt precipitation and separate amino acids using paper chromatography techniques.	3	4
BBT32407.5	Execute TLC for lipid separation and apply gel filtration chromatography to purify proteins for downstream applications.	4	4

P. H. T.

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

K. S. Ramani

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



Department of Biotechnology

Second Year B.Tech (Fourth Semester)			
Leadership and Team Dynamics - BSH32404 (BT)			
Teaching Scheme		Examination Scheme	
Theory	2 Hrs/week	CT-I	7 Marks
Tutorial	-	CT-II	7 Marks
Total Credits	2	CA	6 Marks
		ESE	30 Marks
		Total	50 Marks
		Duration of ESE: 2Hrs	
Course Objectives:			
1.	To provide a framework for the students to understand the importance of Leadership and team effectiveness in organizations.		
2.	To develop an understanding of the interpersonal processes and group dynamics.		
3.	To provide a theoretical understanding of leadership practices in organizations.		
Course Contents			
Unit I	Introduction to Leadership & Team Management: Leadership Myths; Interactional Framework for analyzing leadership; Leadership Development: The First 90 Days as a Leader; Leader Development- The Action-Observation-Reflection Model, LMX Theory and Normative Decision Model; Situational Leadership Model; Contingency Model and Path Goal Theory; Emotional Approach Charismatic and Transformational Leadership; Leadership for Tomorrow		
Unit II	Leadership Attributes: Personality Traits and Leadership: Personality Types and Leadership; Intelligence and Leadership; Emotional Intelligence and Leadership, Power and Leadership: The art of influence in leadership: Leadership and "Doing the Right Things: Character-Based Approach to Leadership; Role of Ethics and Values in Organisational Leadership		
Unit III	Leadership Behaviour: Leadership Pipeline, Assessing Leadership Behaviors: Multi-rater Feedback Instruments: The Dark Side of; Leadership- Destructive Leadership; Managerial Incompetence and Derailment Conflict Management, Negotiation and Leadership, Leadership under a crisis situation: The Situation and the Environment: Culture and Leadership: Global Leadership.		
Text Books			
T.1	Leadership: Enhancing the lessons of experience by Hughes, R.L., Ginnett, R.C., & Curphy, G.J. (2019), 9th Edition, McGraw Hill Education, Chennai, India.		
T.2	Robbins, S.P. Judge, T.A. & Vohra, N., "Organizational Behavior," 18th Ed, Pearson Education. (2019)		



Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC Accredited **A+ Grade**

Approved by AICTE, New Delhi, Govt. of Maharashtra

(An Autonomous Institution Affiliated to RTM Nagpur University)

Department of Biotechnology

Reference Books	
R.1	Baron R. A. and Byrne D., "Social Psychology", 10th Ed., Pearson Education, Inc. (2004)
R.2	Luthans F., "Organizational Behavior", 10th Ed., McGraw-Hill Companies. (2004)
Useful Links:-	
1	https://onlinecourses.nptel.ac.in/noc22_mg39/preview
2	https://nptel.ac.in/courses/110107159

Course Code	Course Outcomes	CL	Class Sessions
BSH32404.1	Explain how global leadership skills contribute to leadership effectiveness.	2	10
BSH32404.2	Understand the leader's role in team-based organizations.	2	10
BSH32404.3	Classify the potential contribution of outdoor training to the development of team leadership.	2	10

Pohit
Head

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

Rabane

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



Department of Biotechnology

Second Year B.Tech (Fourth Semester)

Semester-IV		Human Values for Professional Society: BSH32403 (BT)			
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	2Hrs./ Week	CT-I	7 Marks	-	-
Practical(P)	-	CT-II	7 Marks	-	-
Total Credits	2(Th)	CA	6 Marks	-	-
Duration of ESE: 2Hrs.		ESE	30 Marks	-	-
		Total Marks	50 Marks	-	-
Pre-Requisites:					
Course Objectives:					
1.	To explain the difference between values and ethics and to ensure sustained happiness and prosperity, Which are the core aspirations of all human beings.				
2.	To understand harmony in the Family and Society-Human Relationship.				
3.	To apply in the professional and ethical life.				
Course Contents					
Unit-I	Need, Content and Process for Value Education:- Meaning and importance of Value Education, Types of Values -Personal Values, Social Values, and Moral Values & Spiritual Values, Relevance of Human values: Integrity, Empathy,				
Unit-II	Harmony in the Human Life:- Define Harmony and significance of Harmony, Importance of - Harmony in the family, society and human relationship, and understand Harmony with self and Nature.				
Unit-III	Ethics in the Professional Society:- Nature, characteristics and scope of professional ethics; Types of Professional Ethics, Professional Values: Trusteeship, Inclusiveness, Commitment, Sustainability, Accountability, Transparency, Impartiality.				
Text Books:-					
1	R.R. Gaur, R Sangal, G.P. Bagaria (2009): A Foundation Course in Human Values and Professional Ethics, Excel Books				
2	D.R. Kiran (2014) Professional Ethics and Human Values, McGraw Hill Education (India).				
Reference Books:-					
1	LaFollette, Hugh, ed. Ethics in Practice: An Anthology. Cambridge: Blackwell,1997				
2	Vivian L Vignoles (2017): Identity: Personal and Social, Chapter to appear in Oxford Handbook of Personality and Social Psychology (2nded.), edited by Kay Deaux and Mark Snyder.				
3	Happiness and Well-Being, NIOS Module V (Health and well-being)				
Useful Links:-					
1.	https://onlinecourses.nptel.ac.in/noc23_hs89/preview				
2.	https://archive.nptel.ac.in/courses/109/104/109104068				



Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC Accredited **A+ Grade**

Approved by AICTE, New Delhi, Govt. of Maharashtra

(An Autonomous Institution Affiliated to RTM Nagpur University)



Department of Biotechnology

Course Code	Course Outcomes	CL	Class Session
BSH32403.1	Students will be able to explain the importance of values education in life.	2	10
BSH32403.2	Students will be able to understand the significance of harmony in family and society.	2	10
BSH32403.3	Students will be able to apply ethics in personal and professional life.	3	10

Head

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

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