TULSIRAMJI GAIKWAD-PATIL College of Engineering and Technology

W

ardha Road, Nagpur - 441108

Accredited with NAAC A+ Grade

Approved by AICTE, New Delhi, Govt. of Maharashtra

(**An Autonomous Institution Affiliated to RTM Nagpur University**)

Teaching Scheme and Syllabus

of

4th Semester B.Tech Biotechnology

(From Academic Year 2026-27)

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.

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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.

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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 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.
7. **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws
8. **PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
9. **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
10. **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.
11. **PO11: Life-LongLearning:**Recognizetheneedfor, 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.

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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.

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SCHEME OF INSTRUCTION& SYLLABI

Programme: B.Tech Biotechnology

Scheme of Instructions: Second Year B.Tech. in Biotechnology (As Per NEP 2020) Semester–IV

Sr. No.	Course Category	Course Code	Course Title	T/P	Contact Hours			Credits	ExamScheme			ESE Duration (Hours)	Total Marks
					L	P	Hrs.		CT/IA	CA	ESE		
1	**PCC**	BBT42401	Biochemistry Metabolism	T	3	-	3	3	30	10	60	3	100
2	**PCC**	BBT42402	Immunology	T	3	-	3	3	30	10	60	3	100
3	**MDM**	BCS42411	Design Thinking	T	2	-	2	2	14	6	30	2	50
4	**OEC**	BBT424X	Open Elective II	T	2	-	2	2	14	6	30	2	50
5	**VSEC**	BBT42405	Analytical Techniques Lab	P	-	4	4	2	-	50	50	-	100
6	**HSSM**	BSH42404	Leadership and Team Dynamics	T	2	-	2	2	14	6	30	2	50
7	**VEC**	BSH42403	Human Values for Professional Society	T	2	-	2	2	14	6	30	2	50
8	**PCC**	BBT42403	Biochemistry Metabolism Lab	P	-	2	2	1	-	25	25	-	50
9	**PCC**	BBT42404	Immunology Lab	P	-	2	2	1	-	25	25	-	50
10	**AEC**	BBT42406	Liberal Learning Module-IV	P	-	2	2	1	50		-	-	50
			Total	-	**14**	**10**	**24**	**19**	**166**	**144**	**340**	**14**	**650**

Course Category	BSC/ ESC (Basic Science Course/ Engineering Science Course.)	PCC (Programme Core courses	(MDM) Multidisciplinary Minor/ (OEC) Open Elective Course	VSEC (Skill Course)	Humanities Social Science & Management		Experiential Learning Courses	CC (Co-Curricular Courses)
					AEC(Ability Enhancement Course)	IKS(Indian Knowledge System)		
Credits	00	50	10	6	0	0	0	0
Cumulative Sum	29	66	12	8	8	2	2	4

PROGRESSIVE TOTAL CREDITS : 104+19=123

Head Department Of Biotechnology Tulsiramji Gaikwad Patil College O Engineering & Technology, Nagpu	Vice Principal (Academics) TGPCET NAGPUR	Director Administration Dr. Pragati Director (Administration) Tulsiramji Gaikwad - Patil College Of Engineering Technology, Nagpur.	Principal Tulsiramji Gaikwad Patil College Of Engineering and Technology, Nagpur	October,2026	1.00	Applicable for AY 2026-27 Onwards
Chairperson	Dean Academics/Vice Principal	Director Administration	Principal	Date of Release	Version	

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**
BBT42309: Food and Nutrition	**BBT42408:** Waste Management	**BBT45310:**Bioterrorism and National Security

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Second Year B.Tech (Fourth Semester)

BBT42401: Biochemistry Metabolism

Teaching Scheme			Examination Scheme	
Lectures	3Hr/Week		CIE	40 Marks
Tutorials	-		ESE	60 Marks
Practical	-		Total	100 Marks
Total Credits	3		Duration of Exam: 3 Hours	

The Objectives of this course are:

1	To understand the structure, classification, and biological functions of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids.
2	To study the major metabolic pathways, their regulation, and their role in cellular biochemical processes.
3	To understand biochemical energetics, electron transport, oxidative phosphorylation, and ATP generation in living systems.

Course Contents

Unit I	**Fundamentals of Biomolecules:** Introduction to biochemistry, Classification, structure, properties, **Carbohydrate Classifications & Metabolism:** Gluconeogenesis, glycolysis and TCA cycle, Glycogen metabolism, Hormonal regulation of carbohydrate metabolism. Electron transport chain.
Unit II	**Lipid Metabolism:** Classification, structure, and biological functions of lipids. Beta oxidation, oxidation of saturated and unsaturated fatty acids, fatty acid biosynthesis, ketone bodies. Synthesis of phospholipids.
Unit III	**Protein Metabolism:** Classification and biochemical properties of amino acids. Protein and amino acid metabolism (aromatic and sulfur), Mechanism of transamination, deamination and decarboxylation of amino acids.
Unit IV	**Nucleic Acid metabolism:** Structure and biological functions of purines, pyrimidines, nucleosides, and nucleotides. De novo synthesis pathway, Salvage pathway, disorders of purine and pyrimidine metabolism.
Unit V	**Biochemical Energetics:** Basic concepts of bioenergetics, free energy, and energy changes in biochemical reactions. Energy- Yielding and Energy Requiring Reactions, Oxidation-Reduction Reactions, ATP Yield, ATP pump.

Text Books

1	Nelson, D. L., and Cox, M. M. Lehninger Principles of Biochemistry. W. H. Freeman / Macmillan Learning.
2	Berg, J. M., Tymoczko, J. L., Gatto, G. J., and Stryer, L. Biochemistry. W. H. Freeman / Macmillan Learning.
3	Rodwell, V. W., Bender, D. A., Botham, K. M., Kennelly, P. J., and Weil, P. A. Harper's Illustrated Biochemistry: Study Guide and Review. McGraw Hill.

Reference Books

1	2. Murray, R. K., Bender, D. A., Botham, K. M., Kennelly, P. J., Rodwell, V. W., and Weil, P. A. Harper's Illustrated Biochemistry. McGraw Hill.

2	Satyanarayana, U., and Chakrapani, U. Biochemistry. Elsevier.
3	Voet, D., Voet, J. G., and Pratt, C. W. Fundamentals of Biochemistry: Life at the Molecular Level. Wiley.
Useful Links	
1	https://nptel.ac.in/courses/102106087
2	https://nptel.ac.in/courses/104105139

Course Outcomes		CL	Hours
BBT42401.1	**Explain** the structure, classification, and biological functions of biomolecules and the major pathways of carbohydrate metabolism.	2	9
BBT42401.2	**Apply** the principles of biochemical reactions to describe lipid metabolism, including fatty acid oxidation, biosynthesis, and ketone body formation.	3	9
BBT42401.3	**Analyze** the metabolic pathways of amino acids and nucleotides, including their synthesis, degradation, regulation, and associated metabolic disorders.	4	9
BBT42401.4	**Analyze** the electron transport chain, oxidative phosphorylation, and ATP generation in relation to carbohydrate, lipid, and protein metabolism.	4	8
BBT42401.5	**Evaluate** the energy yield and metabolic significance of major biochemical pathways based on oxidation–reduction reactions, ATP utilization, and cellular energy requirements.	5	9

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Second Year B.Tech Biotechnology (Fourth Semester)

BBT42402: Immunology

Teaching Scheme		Examination Scheme	
Lectures	**3Hr/Week**	**CIE**	40 Marks
Tutorials	-	**ESE**	60 Marks
Practical	-	**Total**	100 Marks
Total Credits	3	Duration of Exam: 3 Hours	

The Objectives of this course are:

1	To give students basic knowledge about the immune system.
2	To understand the structure and function of cells and organs of the 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 carcino organic 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, Immuno flourescence, ELISA, RIA, blood group determination, Immunoelectrophoresis, Neutralization reaction, Concept of Vaccine and Vaccination, different Types of Vaccine.

Text Books

1	Goldsby, R. A., Kindt, T. J., Osborne, B. A., and Kuby, J. Kuby Immunology. W. H. Freeman.
2	Paul, W. E. Fundamental Immunology. Raven Press, New York.
3	Murphy, K., and Weaver, C. Janeway's Immunobiology. Garland Science.

Reference Books

1	Delves, P. J. Essential Immunology. Blackwell Publishing.
2	Annadurai, B. Immunology and Immunotechnology. S. Chand Publishing.

3	Roitt, I. M. Essential Immunology. Blackwell Science, 4th Edition, 1997.
Useful Links	
1	https://nptel.ac.in/courses/109106198
2	https://nptel.ac.in/courses/102101068

Course Outcomes		CL	Hours
BBT42402.1	**Explain** the basic concepts of immunity and the functioning of the immune system.	**2**	9
BBT42402.2	**Describe** the organs and cells involved in the immune system and their functions.	**2**	9
BBT42402.3	**Apply** the concepts of antigens, antibodies, and antigen–antibody interactions.	**3**	9
BBT42402.4	**Analyse** the mechanisms of humoral and cell-mediated immune responses.	**4**	9
BBT42402.5	**Evaluate** different antigen–antibody interactions and serological techniques used in immunological analysis.	**5**	9

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Second Year B.Tech Biotechnology (Fourth Semester)

BCS42411: Design Thinking

Teaching Scheme		Examination Scheme	
Lectures	**2Hr/Week**	**CIE**	20 Marks
Tutorials	-	**ESE**	30 Marks
Practical	-	**Total**	50 Marks
Total Credits	2	Duration of Exam: 2 Hours	

The Objectives of this course are:

1	Introduce students to the fundamentals of Design Thinking, including creativity, empathy, user needs, problem identification and human-centred design.
2	Develop creative problem-solving skills by applying the Design Thinking process—Empathize, Define, Ideate, Prototype and Test—to biotechnology-related problems.
3	Develop an innovation-oriented mindset by incorporating customer centricity, sustainability, ethics, ergonomics and continuous improvement into biotechnology solutions.

Course Contents

Unit I	**Foundations of Learning and Creativity:** Overview of learning theories, Kolb's learning styles and learning-style assessment, memory process and memory enhancement techniques, creative thinking and problem-solving approaches. **Design Thinking Fundamentals:** Definition, principles, importance and objectives of Design Thinking; human-centered design.
Unit II	**Design Thinking Process:** Empathize, Define, Ideate, Prototype and Test. Techniques for problem identification and problem definition. **Ideation and Creative Problem Solving:** Brainstorming, mind mapping, SCAMPER and other creative problem-solving techniques; generation and evaluation of ideas. **Biotechnology Product Design:** Application of Design Thinking to biotechnology-based products, processes and services; engineering product design process; rapid prototyping; low-fidelity and high-fidelity prototypes; testing methodologies and user experience.
Unit III	**Customer/User-Centric Design:** Individual differences, customer needs and expectations, user-focused design principles, accessibility and ergonomics; addressing customer challenges and enhancing user experience. **Innovation & Sustainability:** Emerging trends and technologies in design; sustainable biotechnology and eco-friendly design; ethical considerations in biotechnology innovation.

Text Books

1	E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company
2	Prof. Karl Ulrich, U. Penn, "Design: Creation of Artifacts in Society by Change", Oct, 2012

Reference Books

1	Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", Kindle edition, 2009.
2	Kumar, V., *101 Design Methods: A Structured Approach for Driving Innovation in Your Organization*, John Wiley & Sons, 2012.

3	Liedtka, J., King, A. and Bennett, K., *Solving Problems with Design Thinking: Ten Stories of What Works*, Columbia University Press, 2013.
Useful Links	
1	https://dschool.stanford.edu/innovate/tools/get-started-with design?utm_source=chatgpt.com
2	https://designthinking.ideo.com/resources?utm_source=chatgpt.com

Course Outcomes		**CL**	**Hours**
BCS42411.1	**Explain** the principles of Design Thinking, creativity, empathy and human-centred design in the context of biotechnology.	2	10
BCS42411.2	**Apply** brainstorming and creative problem-solving techniques to generate innovative biotechnology-based ideas.	4	10
BCS42411.3	**Evaluate and improve** proposed solutions using user feedback, sustainability, ethical considerations and customer requirements.	5	10

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Second Year B.Tech Biotechnology (Fourth Semester)

OE II : BBT42408: Waste Management

Teaching Scheme			Examination Scheme	
Lectures	**2Hr/Week**		**CIE**	20 Marks
Tutorials	-		**ESE**	30 Marks
Practical	-		**Total**	50 Marks
Total Credits	2		Duration of Exam: 2 Hours	

The Objectives of this course are:

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 landfill, learn sustainable waste management practices, focusing on recycling, management, health and safety in waste handling, and promoting community participation and public awareness.

Course Contents

Unit I	**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 II	**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 III	**Solids Waste Pollution:** Sources of Solid Waste Solids waste disposal - composting, landfill, briquetting/ gasification and incineration, Recycling and Reuse of Solid Waste.

Text Books

1	O.P. Gupta, "Elements of Solid & Hazardous Waste Management", Khanna Publishing House, New Delhi, 2019.
2	George Tchobanoglous et.al., "Integrated Solid Waste Management", McGraw-Hill Publishers, 1993

Reference Books

1	B.Bilitewski, G.HardHe, K.Marek, A. Weissbach, and H.Boeddicker, "Waste Management", Springer, 1994
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 Outcomes		CL	Hours
BBT42408.1	**Explain** the various sources of air pollution and their impact on the environment and human health.	2	10
BBT42408.2	**Demonstrate** the use of physical and biological treatment methods to optimize water treatment systems.	4	10
BBT42408.3	**Evaluate** the effectiveness of various solid waste disposal methods in managing waste sustainably.	5	10

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Second Year B.Tech Biotechnology (Fourth Semester)

BBT42405: Analytical Techniques Lab

Teaching Scheme			Examination Scheme	
Lectures	-		**CIE**	50Marks
Tutorials	-		**ESE**	50Marks
Practical	2Hr /Week		**Total**	100 Marks
Total Credits	2		-	

The Objectives of this course are:

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 landfill, learn sustainable waste management practices, focusing on recycling, management, health and safety in waste handling, and promoting community participation and public awareness.

Course Contents

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 biomolecules using column chromatography.
12	Estimation of total phenolic content by the Folin–Ciocalteu method.
13	Determination of enzyme activity using a spectrophotometric assay.
14	Estimation of cell count using a haemocytometer.
15	Amplification of target DNA by PCR.

Text Books

T.1	Fundamentals of Bioanalytical Techniques and Instrumentation — Sabari Ghosal and Anupama Sharma Avasthi, 2nd Edition, PHI Learning.
T.2	Biotechniques: Theory & Practice — S. V. S. Rana, Rastogi Publications.
Reference Books	
R.1	Analytical Techniques in Biochemistry — Mahin Basha, Springer Nature, 2020.
R.2	Fundamental Laboratory Approaches for Biochemistry and Biotechnology — Alexander J. Ninfa, David P. Ballou, and Marilee Benore, 2nd Edition, Wiley.
Useful Links	
1	https://link.springer.com/book/10.1007/978-1-0716-0134-1?
2	https://www.wiley.com/en-in/fundamental-laboratory-approaches-for-biochemistry-and-biotechnology-2nd-edition-p-978111910829

Course Outcomes		CL	Hours
BBT42405.1	Identify the principles and applications of microscopes, pH meters, and analytical instruments used in biotechnology laboratories.	1	9
BBT42405.2	Explain the principles of buffer preparation, chromatography, electrophoresis, spectrophotometry, and molecular biology techniques.	2	9
BBT42405.3	Perform practical procedures for cell counting, biomolecule separation, protein estimation, enzyme activity analysis, and PCR amplification.	3	9
BBT42405.4	Analyze and interpret experimental results obtained from spectrophotometric assays, chromatographic separation, electrophoresis, and cell counting.	4	9
BBT42405.5	Evaluate the accuracy and reliability of experimental results to draw scientifically valid conclusions from analytical investigations.	5	9

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Second Year B.Tech Biotechnology (Fourth Semester)

BSH42404: Leadership & Team Dynamics

Teaching Scheme			Examination Scheme	
Lectures	**4Hr/Week**		**CIE**	20 Marks
Tutorials	-		**ESE**	30 Marks
Practical	-		**Total**	50 Marks
Total Credits	2		Duration of Exam: 2 Hours	

The Objectives of this course are:

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 Organizational Leadership
Unit III	**Leadership Behavior:** 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

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.
2	Robbins, S.P. Judge, T.A. & Vohra, N., "Organizational Behavior," 18th Ed, Pearson Education. (2019)

Reference Books

1	Baron R. A. and Byrne D., "Social Psychology", 10th Ed., Pearson Education, Inc. (2004)
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 Outcomes		CL	Hours
BSH42404.1	**Explain** how global leadership skills contribute to leadership effectiveness.	2	10
BSH42404.2	**Understand** the leader's role in team-based organizations.	3	10
BSH42404.3	**Classify** the potential contribution of outdoor training to the development of team leadership.	4	10

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Second Year B.Tech Biotechnology (Fourth Semester)

BSH42403 : Human Values for Professional Society

Teaching Scheme			Examination Scheme	
Lectures	**2Hr/Week**		**CIE**	20 Marks
Tutorials	-		**ESE**	30 Marks
Practical	-		**Total**	50 Marks
Total Credits	2		Duration of Exam: 2 Hours	

The Objectives of this course are:

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	Happiness and Well-Being, NIOS Module V (Health and well-being)

Useful Links

1	https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_hs89
2	https://nptel.ac.in/courses/109104068

Course Outcomes		CL	Hours
BSH42403.1	**Explain** the importance of values education in life.	**2**	10
BSH42403.2	**Understand** the significance of harmony in family and society.	**2**	10
BSH42403.3	**Apply** ethics in personal and professional life.	**4**	10

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NAAC Accredited (A+ Grade)

Second Year B.Tech Biotechnology (Fourth Semester)

BBT42403: Biochemistry Lab

Teaching Scheme			Examination Scheme	
Lectures	-		**CIE**	25 Marks
Tutorials	-		**ESE**	25 Marks
Practical	2Hr /Week		**Total**	50 Marks
Total Credits	1		-	

The Objectives of this course are:

1	To understand the principles of enzyme kinetics and determine enzyme activity, Michaelis constant, and the effects of temperature, pH, and inhibitors on enzymatic reactions.
2	To perform qualitative and quantitative analysis of biomolecules, including carbohydrates, proteins, lipids, and glucose, using appropriate biochemical techniques.
3	To isolate, crystallize, and estimate the activity of selected enzymes involved in carbohydrate metabolism, cellular respiration, amino acid metabolism, and biological defense mechanisms.

Course Contents

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.
11	Estimation of glucose concentration in a given sample.
12	Study of the effect of temperature and pH on enzyme activity.
13	Qualitative analysis of carbohydrates, proteins, and lipids using biochemical tests.
14	Quantitative estimation of reducing sugars by the DNS method.
15	Estimation of total protein concentration by the Bradford method.

Text Books	
1	Jayaraman, J. Laboratory Manual in Biochemistry. New Age International Publishers
Reference Books	
2	Sadasivam, S., and Manickam, A. Biochemical Methods. New Age International Publishers.
Useful Links	
1	https://sites.google.com/ignou.ac.in/bscbch-biochemistry/self-learning-material/bbccl-108-enzymes-practical

Course Outcomes		CL	Hours
BBT42403.1	**Perform** qualitative and quantitative analysis of carbohydrates, proteins, lipids, using appropriate biochemical techniques.	3	9
BBT42403.2	**Determine** enzyme activity and kinetic parameters and evaluate the effects of temperature, pH, and inhibitors on enzymatic reactions.	4	9
BBT42403.3	**Perform** enzyme assays for amylase, phosphatase, lactate dehydrogenase, succinate dehydrogenase, alanine/aspartate aminotransferase, and lysozyme.	3	9
BBT42403.4	**Isolate** and crystallize urease from jack beans and estimate protein concentration using suitable biochemical methods.	3	9
BBT42403.5	**Analyze** and interpret experimental results to evaluate enzyme activity, biochemical reactions using appropriate analytical techniques.	4	9

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Second Year B.Tech Biotechnology (Fourth Semester)

BBT42403: Biochemistry Lab

Teaching Scheme		Examination Scheme	
Lectures	-	**CIE**	25 Marks
Tutorials	-	**ESE**	25 Marks
Practical	2Hr /Week	**Total**	50 Marks
Total Credits	1	-	

The Objectives of this course are:

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 hem cytometer.
3	To demonstrate advanced immunological techniques, including double diffusion, immunoelectrophoresis, rocket immunoelectrophoresis, and Western blotting.

Course Contents

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.
11	Demonstration of radial immunodiffusion technique for antigen quantification.
12	Determination of antigen–antibody interaction by the Latex Agglutination Test.
13	Demonstration of the effect of temperature on antigen–antibody reactions using a suitable agglutination test.
14	Determination of total leucocyte count (TLC) using a Neubauer counting chamber.
15	Demonstration of antigen–antibody agglutination using commercially available antigen and antibody reagents.

Text Books	
1	Talib, V. H. A Handbook of Medical Laboratory Technology. CBS Publishers & Distributors.
Reference Books	
2	Jayaram Paniker, C. K. Textbook of Medical Parasitology. Jaypee Brothers Medical Publishers
Useful Links	
1	https://sites.google.com/ignou.ac.in/bscbch-biochemistry/self-learning-material/bbccl-128-immunology
2	https://egyankosh.ac.in/bitstream/123456789/95159/1/BBCCL-128%28English%29.pdf

Course Outcomes		CL	Hours
BBT42404.1	**Perform** ABO blood grouping using agglutination reactions and interpret the results to identify blood groups.	3	9
BBT42404.2	**Apply** Widal test and ELISA techniques to detect antigen–antibody reactions and interpret the results for diagnostic purposes.	3	9
BBT42404.3	**Analyze** antigen–antibody interactions using double immunodiffusion and precipitation reactions.	4	9
BBT42404.4	**Perform** differential and total leukocyte counts using a hemocytometer and interpret their significance in clinical diagnosis.	3	9
BBT42404.5	**Analyze** and interpret immunological results obtained using immunoelectrophoresis, rocket immunoelectrophoresis, and Western blotting techniques.	4	9

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