Koneru Lakshmaiah Education Foundation
(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)
Accredited by NAAC as 'A++' ❖ Approved by AICTE ❖ ISO 9001-2015 Certified
Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA
Phone No. 08645 - 350200, www.klef.ac.in, www.klef.edu.in, www.kluniversity.in
Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002, Ph: +91 - 866 - 3560122, 2577715, 2576129

To
The Addl. Dean/Dean -Academics
K L Deemed University
Vaddeswaram

Dear Sir,

Sub: Minutes of the KLEF/BT/XXXXI BOS meeting-Biotechnology-held on 25/03/2025 in offline mode from 04:00 pm to 05:30 pm Reg.,

We, the Department of Biotechnology, organized the Board of Studies (BOS) meeting for the academic year 2025-26, during which we recommended the Vision, Mission, Programme Outcomes (POs), Programme Specific Outcomes (PSOs), and Program Educational Objectives (PEOs) of the department for the admitted batch of 2025-2026 to the Academic Council. Suggestions were received from various stakeholders, and these inputs were incorporated into refining the Vision, Mission, POs, PSOs, and PEOs for both UG and PG programs for the 2025-2026 admitted batches.

In this context, we would like to submit the BOS meeting minutes and an action taken report from our end.

Thanking You,

Yours sincerely

27/03/25

Dr. V Praveen Kumar
BOS Chairman – BT

Head
Department of Biotechnology
Koneru Lakshmaiah Education Foundation
(Deemed to be University)
VADDESWARAM, Guntur Dt.

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AGENDA and RESOLUTIONS

AGENDA ITEM-I

To consider and approve the resolutions made by XXXXI DAC conducted on 21st March 2025	Approved and recommended to Academic Council

Discussion: The Department Chairman presented the XXXXI DAC meeting minutes to all Board of Studies (BOS) members, and the minutes were thoroughly discussed and approved by all BOS members.

Resolution: The points discussed in the DAC meeting were approved by BoS members and recommended to Academic council. DAC minutes and proofs are mentioned in **Annexure-I.**

AGENDA ITEM-II

To consider and approve the Revised Vision and Mission of the Department	Approved and recommended to Academic Council

Discussion: The Revised Vision and Mission of the department were presented for approval. After a detailed discussion, it was agreed that the current statements align well with the overall objectives of the department and the institution's long-term goals.

Resolution: The revised Vision and Mission statements of the department were unanimously approved as presented and recommended to the Academic Council. The revised Vision and Mission of the department are provided in Annexure-II.

Head
Department of Biotechnology
Koneru Lakshmaiah Education Foundation
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VADDESWARAM, Guntur Dt.

AGENDA ITEM-III

To consider and approve the Revised PEOs (Program Educational Objectives) of the B.Tech and M.Tech Programmes	Approved and recommended to Academic Council

Discussion: The Revised Program Educational Objectives (PEOs) for both the B.Tech and M.Tech programmes were reviewed in detail. It was noted that the PEOs focus on the key aspects of academic excellence, research, industry readiness, and holistic development, aligning with the current trends in biotechnology.

Resolution: The revised PEOs for both the B.Tech and M.Tech Biotechnology programs were approved with minor revisions to enhance clarity in the long-term career objectives and recommended to the Academic Council. Additionally, the PEOs for the B.Tech and M.Tech Biotechnology programs are provided in Annexure-III.

AGENDA ITEM-IV

To consider and approve the Revised Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) of the B.Tech Biotechnology Programme	Approved and recommended to Academic Council

Discussion: The Revised Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) of the B.Tech Biotechnology programme were presented. The POs were aligned with the graduate attributes required by professional bodies such as the NBA (National Board of Accreditation). The PSOs were tailored to meet the specific needs of biotechnology graduates in the modern industry and research sectors.

Resolution: The revised Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) for the B.Tech Biotechnology program were approved and recommended to the Academic Council. The POs and PSOs are provided in **Annexure-IV.**

Head
Department of Biotechnology
Koneru Lakshmaiah Education Founda
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AGENDA ITEM-V

To consider and approve the Revised Programme Outcomes of the M.Tech Biotechnology Programme	Approved and recommended to Academic Council

Discussion: The Revised Programme Outcomes (POs) for the M.Tech Biotechnology programme were reviewed. The focus was on advanced research, innovation, and the application of biotechnology in diverse fields. It was agreed that the POs sufficiently cover the requirements for a post-graduate level education in biotechnology.

Resolution: The revised Programme Outcomes for the M.Tech Biotechnology program were approved without any further changes and recommended to the Academic Council. The POs of the M.Tech Biotechnology program are provided in **Annexure-V.**

AGENDA ITEM-VI

To consider and approve the readmission of the student with Roll No. 1600010145 into the B.Tech Biotechnology program to facilitate the completion of their degree requirements.	Approved and recommended to Academic Council

RESOLUTION: During the BoS meeting, the committee discussed the readmission request of the student with Roll No. 1600010145 into the B.Tech Biotechnology program to complete their degree. The student's academic performance, completed credits, and pending courses were reviewed, along with the reasons for the interruption in their studies. The committee considered the student's eligibility for readmission in accordance with university policies, as well as their ability to complete the remaining requirements within the allowable timeframe. After evaluating the student's commitment and the feasibility of course completion, the committee recommended approval of the readmission, contingent upon the student fulfilling all necessary academic and administrative requirements.

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PHOTOS

The following members have attended the XXXXI Board of studies (BOS) meeting held on 25/03/2025 in offline mode from 04:00 pm to 05:30 pm

S.No	FULL NAME	DESIGNATION	ORGANIZATION	POSITIONIN THE MEETING	SIGNATURE
1	Dr.V.Praveen Kumar	Professor & HOD	K L E F-Biotechnology	Chairman	
2	Dr. M Janaki Ramaiah	Professor	K L E F-Biotechnology	Internal member	
3	Dr.BVLS Prasad	Professor	K L E F-Biotechnology	Internal member	
4	Dr.Nadeem Siddiqui	Assoc. Professor	K L E F-Biotechnology	Internal member	
5	Dr.Bandaru Srinivas	Assoc. Professor	K L E F-Biotechnology	Internal member	
6	Dr.Ragini Singh	Assoc. Professor	K L E F-Biotechnology	Internal member	
7	Dr.M.Maheswara Reddy	Asst. Professor	K L E F-Biotechnology	Internal member	

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8	Dr.G.Siva Reddy	Asst. Professor-Professor incharge Academics	K L E F-Biotechnology	Internal member	
9	Dr.Y V Rajesh	Asst. Professor-R Pac chairman	K L E F-Biotechnology	Internal member	
10	Dr.P Rajasekhar	Asst. Professor	K L E F-Biotechnology	Internal member	
11	Dr. C Chandrasekhar	Alternate Head & Asst. Professor	K L E F-Biotechnology	Internal member	
12	Dr. G Koteswara Reddy	Asst. Professor	K L E F-Biotechnology	Internal member	
13	Dr.M Hemalatha	Asst. Professor	K L E F-Biotechnology	Internal member	
14	Dr.M Nageswara Rao	Asst.Professor	K L E F-Biotechnology	Special Invitee	
15	Dr.T Uday	Asst.Professor	K L E F-Biotechnology	Special Invitee	
16	Dr.P Manasa	Asst.Professor	K L E F-Biotechnology	Special Invitee	
17	Dr.Krishna Samantha	Asst.Professor	K L E F-Biotechnology	Special Invitee	K. Samantha

Department of Biotechnology
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Date: 25/03/2025

DEPARTMENT OF BIOTECHNOLOGY

MINUTES OF XXXXI BOARD OF STUDIES MEETING

The Department Board of Studies meeting was conducted on 25/03/2025 in offline mode from 04:00 pm to 05:30 pm Dr. V Praveen Kumar, HoD-BT, as a chair.

The following members were present for XXXXI BoS meeting

1. Dr. V Praveen Kumar, Professor, HoD-BT, Chairman
2. Dr.M.Janaki Ramaiah, Professor-Member
3. Dr.BVLS Prasad, Professor-Member
4. Dr.Nadeem Siddiqui, Assoc.Professor-Member
5. Dr.Bandaru Srinivas, Assoc.Professor-Member
6. Dr.Ragini Singh, Assoc.Professor-Member
7. Dr.M.Maheswara Reddy, Asst.Professor-Member
8. Dr.G.Siva Reddy, Asst.Professor-Member
9. Dr.P Rajasekhar, Asst.Professor-Member
10. Dr.C Chandrasekhar, Asst.Professor-Member
11. Dr.Y V Rajesh, Asst.Professor-Member
12. Dr.G Koteswara Reddy, Asst.Professor-Member
13. Dr. B Navyatha, Asst.Professor-Member
14. Dr.M Hemalatha, Asst.Professor- Member
15. Dr.M Nageswara Rao- Special Invitee
16. Dr.T Uday- Special Invitee
17. Dr.P Manasa- Special Invitee
18. Dr.Krishna Samantha- Special Invitee

Member's Absent-NIL

Dr. V Praveen Kumar, Chairman of BoS, The meeting commenced with remarks from the internal members, who welcomed everyone and thanked them for their participation. The chairman then presented the agenda items for discussion at the Board of Studies meeting.

The following items of the agenda were placed for consideration before the Board of Studies in Biotechnology at its present meeting.

Head
Department of Biotechnology
Koneru Lakshmaiah Education Foundation
(Deemed to be University)
VADDESWARAM, Guntur Dt.

AGENDA and RESOLUTIONS

AGENDA ITEM-I

To consider and approve the Revised Vision and Mission of the Department	Approved and recommended to Board of studies

Discussion: The Revised Vision and Mission of the department were presented for approval. After a detailed discussion, it was agreed that the current statements align well with the overall objectives of the department and the institution's long-term goals.

Resolution: The revised Vision and Mission statements of the department were unanimously approved as presented and recommended to the board of studies. The revised Vision and Mission of the department are provided in Annexure-I.

AGENDA ITEM-II

To consider and approve the Revised PEOs (Program Educational Objectives) of the B.Tech and M.Tech Programmes.	Approved and recommended to Board of studies

Discussion: The Revised Program Educational Objectives (PEOs) for both the B.Tech and M.Tech programmes were reviewed in detail. It was noted that the PEOs focus on the key aspects of academic excellence, research, industry readiness, and holistic development, aligning with the current trends in biotechnology.

Resolution: The revised PEOs for both the B.Tech and M.Tech Biotechnology programs were approved with minor revisions to enhance clarity in the long-term career objectives and recommended to the board of studies. Additionally, the PEOs for the B.Tech and M.Tech Biotechnology programs are provided in Annexure-II.

Head
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VADDESWARAM, Guntur Dt.

AGENDA ITEM-III

To consider and approve the Revised Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) of the B.Tech Biotechnology Programme	Approved and recommended to Board of studies

Discussion: The Revised Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) of the B.Tech Biotechnology programme were presented. The POs were aligned with the graduate attributes required by professional bodies such as the NBA (National Board of Accreditation). The PSOs were tailored to meet the specific needs of biotechnology graduates in the modern industry and research sectors.

Resolution: The revised Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) for the B.Tech Biotechnology program were approved and recommended to the Board of studies. The POs and PSOs are provided in **Annexure-III.**

AGENDA ITEM-IV

To consider and approve the Revised Programme Outcomes of the M.Tech Biotechnology Programme	Approved and recommended to Board of studies

Discussion: The Revised Programme Outcomes (POs) for the M.Tech Biotechnology programme were reviewed. The focus was on advanced research, innovation, and the application of biotechnology in diverse fields. It was agreed that the POs sufficiently cover the requirements for a post-graduate level education in biotechnology.

Resolution: The revised Programme Outcomes for the M.Tech Biotechnology program were approved without any further changes and recommended to the board of studies. The POs of the M.Tech Biotechnology program are provided in **Annexure-IV.**

Head
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Annexure-II: Vision and Mission of the department

Vision

To be a renowned hub in education, research, and extension activities in emerging areas of biological engineering and related fields.

Mission

M1: To offer educational programs that imparts inventive knowledge, professional excellence with human values

M2: To conduct research in biological engineering and allied sciences, driving innovations for societal impact and sustainability.

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Head
Department of Biotechnology
Koneru Lakshmaiah Education Foundation
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Annexure-III: Programme Educational Objectives of the B.Tech and M.Tech Biotechnology

B.TECH BIOTECHNOLOGY

PEO1 Graduates will be able to Practice engineering in a broad range of industrial, societal and real-world applications.

PEO2 Graduates will be able to Pursue advanced education, research & development, by adapting creative and innovative practices in their professional careers.

PEO3 Graduates will uphold integrity, ethics, and leadership while collaborating in teams, applying biotechnology sustainably and responsibly for societal benefit.

M.TECH BIOTECHNOLOGY

PEO1 Graduates will be able to acquire in-depth knowledge of biotechnology and employ advanced research methodologies to innovate and address complex challenges in healthcare, agriculture, environmental sustainability, and industrial biotechnology.

PEO2 Graduates will be able to develop the ability to integrate bioinformatics and nanotechnology, to create sustainable and impactful solutions for industry and society.

PEO3 Graduates will be able to uphold ethics, collaborate in teams, and apply biotechnology responsibly to tackle societal and environmental challenges.

PEO4 Graduates will be able to develop skills to create novel biotechnological products, pursue entrepreneurship, and translate research into commercialization.

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Head
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KONERU LAKSHMAIAH EDUCATION FOUNDATION			
DEPARTMENT OF BIOTECHNOLOGY			
A.Y. 2025-26			
Name of the Program: B.Tech in Biotechnology			
PO#	**Program Outcomes (POs)**		
PO1	**Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.		
Competency		**Indicators**	
1.1	Demonstrate competence in mathematical modeling and computing for solving engineering problems.	1.1.1	Ability to use software tools (such as MATLAB, Python, or specific bioprocess simulators) to model and simulate biotechnological processes (e.g., fermentation, enzyme kinetics, or bioreactor operations) for optimizing process parameters.
		1.1.2	Proficiency in applying mathematical models (such as differential equations, statistical models, or optimization techniques) to predict, analyze, and optimize biotechnological systems, such as cell growth kinetics, nutrient uptake, and product yield in bioreactors.
1.2	Demonstrate competence in applying natural sciences and engineering fundamentals to solve complex problems.	1.2.1	The ability to apply principles of biology, chemistry, physics, and mathematics to analyze and solve complex problems in biotechnology, such as understanding biochemical reactions or optimizing bioprocesses.
		1.2.2	The capacity to design and optimize biotechnological systems (e.g., fermentation processes, genetic engineering strategies) by applying engineering fundamentals, ensuring that these systems function efficiently and effectively in real-world settings.
1.3	Demonstrate competence in specialized engineering knowledge and interdisciplinary integration to develop innovative solutions.	1.3.1	The ability to combine advanced knowledge in biotechnology (e.g., genetic engineering, bioprocessing) with engineering principles (e.g., process design, systems optimization) to develop innovative solutions for complex biological and technological challenges.
		1.3.2	The capacity to apply specialized engineering knowledge to design, develop, and improve biotechnological products or processes (such as drug production, biofuels, or medical devices), demonstrating creativity and an interdisciplinary approach to solving real-world problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)		
Competency		**Indicators**	
2.1	Demonstrate the ability to identify and analyze complex engineering problems using first principles and research literature.	2.1.1	The ability to break down complex engineering problems in biotechnology into fundamental components, utilizing first principles of science and engineering (such as thermodynamics, kinetics, and molecular biology) to accurately analyze and understand the problem's core.
		2.1.2	The skill to critically review and apply current research literature and scientific advancements to inform problem-solving, ensuring that innovative and evidence-based approaches are used to address complex engineering challenges in biotechnology.

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2.2	Demonstrate the ability to develop models and methodologies for problem-solving and decision-making.	2.2.1	The ability to create and apply mathematical, statistical, or computational models (such as metabolic flux analysis or bioinformatics algorithms) to simulate and predict biological systems or biotechnological processes for effective problem-solving and decision-making.
		2.2.2	The capacity to employ structured methodologies (such as design of experiments, process optimization techniques, or decision analysis frameworks) to systematically approach problem-solving, making data-driven decisions that lead to optimized outcomes in biotechnology processes or product development.
2.3	Demonstrate the ability to apply analytical and computational techniques with sustainability considerations.	2.3.1	Analyze biological data using bioinformatics software to solve complex biotechnological problems while considering energy-efficient and environmentally sustainable methods.
		2.3.2	Use computational tools to design, simulate, and optimize bioprocesses with a focus on minimizing resource consumption, waste production, and carbon footprint, contributing to sustainability in biotechnology applications.
PO3	**Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)		
Competency		**Indicators**	
3.1	Demonstrate the ability to develop innovative and feasible engineering solutions.	3.1.1	Develop innovative bioprocess engineering solutions that optimize yield, reduce waste, and enhance efficiency, ensuring the feasibility of large-scale biotechnological applications in real-world scenarios.
		3.1.2	Apply creative thinking and engineering principles to design biotechnology products or solutions, such as biodegradable materials, renewable bioenergy, or advanced bioreactors, that address industrial and environmental challenges sustainably.
3.2	Demonstrate the ability to design solutions considering public health, safety, and societal needs.	3.2.1	Design biotechnological processes and products, such as vaccines, diagnostic tools, or genetically modified organisms (GMOs), that comply with biosafety regulations and ethical guidelines to ensure public health and safety.
		3.2.2	Develop sustainable biotechnological systems, such as biosurfactant-based bioremediation for hydrocarbon-contaminated soil, that address societal and environmental needs by improving public health outcomes and reducing ecological impact.
3.3	Demonstrate the ability to incorporate whole-life cost, net-zero carbon, and environmental sustainability in design.	3.3.1	Develop bioprocesses by applying life cycle analysis to evaluate whole-life costs, energy usage, and carbon footprint, optimizing resource utilization to achieve net-zero carbon emissions and long-term sustainability.
		3.3.2	Design innovative bio-based products, such as biodegradable plastics, biofuels, or plant probiotics, while considering whole-life costs, minimizing environmental impact, and aligning with the principles of circular bioeconomy and net-zero carbon goals.

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

Competency		Indicators	
4.1	Demonstrate the ability to design experiments for investigating complex engineering problems.	4.1.1	Develop and execute experimental designs, such as response surface methodology (RSM) or factorial designs, to investigate and optimize complex bioprocess parameters, including pH, temperature, substrate concentration, and incubation time.
		4.1.2	Design and conduct experiments to study enzyme kinetics, inhibition patterns, and catalytic efficiency, addressing complex challenges in enzyme engineering and biocatalysis for industrial applications.
4.2	Demonstrate the ability to apply modeling and computational techniques for data analysis.	4.2.1	Use computational software (e.g., MATLAB, Python, or Aspen Plus) to model and simulate bioprocesses, analyze system dynamics, and optimize process efficiency based on experimental or theoretical data.
		4.2.2	Apply bioinformatics techniques, including sequence alignment, homology modeling, and protein-ligand docking, to analyze genomic, proteomic, and structural data, aiding in understanding complex biological systems and interactions.
4.3	Demonstrate the ability to interpret results and draw valid engineering conclusions.	4.3.1	Analyze experimental data from bioprocess optimization studies (e.g., biosurfactant production, enzyme activity, or microbial growth) and draw conclusions regarding optimal conditions, process efficiency, and feasibility for industrial scale-up.
		4.3.2	Apply statistical tools (e.g., ANOVA, t-tests, and regression analysis) to interpret experimental outcomes, validate hypotheses, and ensure the reliability and accuracy of engineering conclusions in biotechnological research.

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

Competency		Indicators	
5.1	Demonstrate the ability to identify and utilize modern engineering and IT tools for problem-solving.	5.1.1	Identify and use modern software tools such as MATLAB, Aspen Plus, or COMSOL Multiphysics to simulate, optimize, and troubleshoot complex bioprocess engineering problems, including fluid dynamics, heat transfer, and reactor design.
		5.1.2	Employ advanced IT tools, such as BLAST, SwissModel, AutoDock, and FlexPepDock, to solve problems related to sequence analysis, protein structure prediction, and molecular docking in enzyme engineering, drug design, and systems biology.
5.2	Demonstrate the ability to apply predictive modeling and simulation techniques.	5.2.1	Apply predictive modeling techniques, such as kinetic modeling and computational simulations, to forecast fermentation performance, optimize process parameters, and enhance product yield in large-scale bioprocess operations.
		5.2.2	Utilize CFD tools to model fluid flow, mixing patterns, and mass transfer in bioreactors, predicting performance outcomes to improve bioreactor efficiency, reduce energy consumption, and ensure uniform nutrient distribution.

Head
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5.3	Demonstrate the ability to assess the accuracy, reliability, and limitations of engineering tools.	5.3.1	Evaluate the accuracy and reliability of computational tools (e.g., MATLAB, Aspen Plus, or BioWin) by comparing model predictions with experimental data, identifying deviations, and assessing the tool's applicability for specific bioprocesses.
		5.3.2	Analyze the limitations of bioinformatics software (e.g., BLAST, SwissModel, or AutoDock) by examining parameters such as algorithm sensitivity, accuracy in sequence alignment, or docking precision, and recommending appropriate usage contexts to improve reliability.
PO6	**The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).		
Competency		**Indicators**	
6.1	Demonstrate the ability to analyze societal, environmental, and sustainability aspects in engineering problem-solving.	6.1.1	Analyze the environmental impact of biotechnological processes (e.g., biofuel production, wastewater treatment, or bioremediation) by evaluating energy consumption, carbon emissions, and waste generation, and proposing sustainable, low-impact alternatives.
		6.1.2	Address societal needs by developing biotechnology solutions, such as affordable vaccines, probiotics, or biodegradable materials, that enhance public health and promote environmental sustainability while considering ethical and regulatory aspects.
6.2	Demonstrate the ability to evaluate the impact of engineering solutions concerning the economy, health, safety, legal framework, and culture.	6.2.1	Evaluate the cost-effectiveness, public health benefits, and potential economic impact of biotechnological solutions (e.g., biosurfactants, biofuels, or genetically modified organisms) on local and global economies, ensuring affordability and accessibility.
		6.2.2	Analyze the legal, safety, and cultural implications of engineering solutions by adhering to biosafety regulations, ethical guidelines, and intellectual property laws, and assessing the acceptance of these solutions in diverse cultural contexts.
PO7	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)		
Competency		**Indicators**	
7.1	Demonstrate the ability to apply ethical principles, professional ethics, human values, diversity, and inclusion in engineering practice.	7.1.1	Apply ethical principles in biotechnology research and practice by adhering to biosafety protocols, ethical guidelines in genetic engineering, and professional integrity while addressing the potential societal impact of biotechnological innovations.
		7.1.2	Foster diversity and inclusion in engineering projects by encouraging collaborative, multicultural teamwork, respecting diverse perspectives, and making ethical decisions that prioritize human values, equality, and societal well-being.

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7.2	Demonstrate adherence to national and international laws, ethical responsibilities, and professional standards in engineering decisions.	7.2.1	Ensure that engineering decisions in biotechnology adhere to national laws (e.g., Environmental Protection Act, Drug and Cosmetic Act) and international guidelines (e.g., Cartagena Protocol on Biosafety, WHO biosafety standards), maintaining ethical and legal compliance in areas like genetic engineering, clinical research, and bioprocess development.
		7.2.2	Uphold professional ethics by making engineering decisions that align with global standards set by organizations like ASME, IEEE, or IBioIC, while addressing ethical responsibilities such as environmental sustainability, public health, and intellectual property rights (IPR).
PO8	**Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.		
Competency		**Indicators**	
8.1	Demonstrate the ability to work independently and take responsibility for individual contributions.	8.1.1	Take responsibility for designing, conducting, and analyzing individual experiments in areas like enzyme purification, microbial screening, or bioinformatics analysis, ensuring accuracy, timely completion, and adherence to scientific protocols.
		8.1.2	Independently identify and address challenges in engineering tasks, such as optimizing bioprocess parameters or troubleshooting equipment issues, while taking accountability for the outcomes and demonstrating initiative in seeking innovative solutions.
8.2	Demonstrate the ability to collaborate and lead effectively in diverse and multi-disciplinary teams	8.2.1	Actively participate in multi-disciplinary engineering projects, such as bioreactor design, synthetic biology, or bioprocess optimization, by contributing domain-specific knowledge, fostering open communication, and supporting team goals.
		8.2.2	Demonstrate leadership by guiding diverse teams in research projects, delegating tasks based on team members' strengths, resolving conflicts, and ensuring the successful integration of inputs from various disciplines, such as chemical, mechanical, and bioengineering.
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		
Competency		**Indicators**	
9.1	Demonstrate the ability to comprehend, write, and document technical reports effectively.	9.1.1	Develop well-structured technical reports that include experimental objectives, methodology, data analysis, results, and conclusions, following standard scientific formats (e.g., IEEE, APA) and ensuring clarity, coherence, and accuracy in documentation.
		9.1.2	Effectively document research findings for technical papers, project reports, and case studies, including literature reviews, statistical analysis, and graphical representations, while ensuring proper citation, ethical reporting, and adherence to journal or industry publication standards.

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9.2	Demonstrate the ability to deliver clear and inclusive presentations considering cultural, language, and learning differences.	9.2.1	Create and deliver presentations that effectively convey complex biotechnological concepts using clear language, visually engaging slides, and multimodal elements (e.g., images, videos, infographics) to accommodate different learning preferences and cultural sensitivities.
		9.2.2	Facilitate interactive sessions by encouraging questions, using culturally inclusive examples (e.g., global case studies in biotechnology), and ensuring that the content is accessible to diverse audiences, including those with varying levels of language proficiency.
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.		
Competency		**Indicators**	
10.1	Demonstrate the ability to apply engineering management principles to individual tasks, teamwork, and leadership roles.	10.1.1	Apply engineering management principles such as task prioritization, resource allocation, and time management to plan, execute, and monitor individual or team-based biotechnology projects, using tools like Gantt charts, Kanban boards, or project tracking software (e.g., Trello, MS Project).
		10.1.2	Lead biotechnology R&D teams by setting clear objectives, delegating tasks effectively, managing interdisciplinary collaborations, and ensuring the project adheres to budget, timeline, and quality control metrics, while fostering a productive and cooperative work environment.
10.2	Demonstrate the ability to manage projects and make economic decisions in multidisciplinary environments.	10.2.1	Manage biotechnology projects by applying project management principles, including cost estimation, budgeting, risk assessment, and resource allocation, while ensuring the project meets economic and technical objectives within multidisciplinary teams (e.g., collaborations involving chemical, environmental, and bioengineering experts).
		10.2.2	Conduct cost-benefit analyses and evaluate the economic feasibility of biotechnological solutions, such as biofuel production, biosurfactant synthesis, or bioreactor design, by considering capital investment, operating costs, potential market value, and sustainability metrics to make informed economic decisions.
PO11	**Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)		
Competency		**Indicators**	
11.1	Demonstrate the ability to engage in independent and life-long learning.	11.1.1	Actively engage in self-directed learning by enrolling in online courses (e.g., NPTEL,Coursera, edX) and participating in webinars, workshops, and conferences to stay updated with emerging trends in biotechnology, such as CRISPR, synthetic biology, or bioinformatics.
		11.1.2	Regularly review scientific journals, research articles, and industry reports to enhance knowledge in biotechnology, critically analyze new findings, and apply the acquired insights to practical engineering challenges and research projects.

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11.2	Demonstrate the ability to adapt to new and emerging technologies.	11.2.1	Adapt to emerging biotechnological advancements by incorporating tools such as CRISPR gene editing, next-generation sequencing (NGS), bioinformatics software, and AI-based modeling into research projects and laboratory experiments.
		11.2.2	Stay updated on emerging technologies like lab-on-a-chip, microfluidics, and synthetic biology platforms, and apply them to develop innovative solutions in areas such as drug discovery, biosensor development, and bioremediation.
11.3	Demonstrate critical thinking skills in the broadest context of technological change.	11.2.1	Critically analyze how emerging technologies, such as artificial intelligence in drug discovery, synthetic biology, or precision agriculture, affect traditional biotechnological processes and assess their ethical, environmental, and societal implications.
		11.2.2	Apply critical thinking to compare the efficacy, sustainability, and scalability of emerging technologies (e.g., CRISPR vs. conventional gene editing, 3D bioprinting vs. traditional tissue engineering) and make evidence-based decisions to address complex biotechnological challenges.
PSO#	**Program Specific Outcomes (PSOs)**		
PSO1	Apply expertise in Bioprocess Technology, Agri Biotechnology, Healthcare Analytics and genetic engineering to address the evolving demands of industry and academia.		
Competency		**Indicators**	
1.1	Demonstrate proficiency in Bioprocess Technology for industrial and academic applications	1.1.1	Apply bioreactor design, optimization, and scale-up techniques to enhance bioprocess efficiency in industrial fermentation, enzyme production, and downstream processing.
		1.1.2	Analyze and optimize bioprocess parameters using statistical tools such as Design of Experiments (DOE) and Response Surface Methodology (RSM) to maximize yield and product quality.
1.2	Utilize advanced tools and techniques in Genetic Engineering	1.2.1	Apply recombinant DNA technology, CRISPR-based genome editing, and cloning techniques to develop genetically modified organisms (GMOs) for applications in agriculture, healthcare, and industrial biotechnology.
		1.2.2	Implement molecular biology techniques, such as PCR, gel electrophoresis, and plasmid transformation, to investigate and manipulate genetic materials for research and innovation.

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1.3	Develop and apply data-driven solutions in Healthcare Analytics and Agri-Biotechnology	1.3.1	Leverage bioinformatics tools, big data analytics, and machine learning algorithms to analyze genomic data and predict disease outcomes or improve agricultural crop traits.
		1.3.2	Utilize precision agriculture technologies, such as sensor-based monitoring, remote sensing, and data-driven decision-making, to enhance crop productivity, pest resistance, and soil health.
PSO2	Demonstrate the ability to collaborate across medical biotechnology and bioinformatics towards industrial and academic research applications.		
Competency		**Indicators**	
2.1	Facilitate Interdisciplinary Research in Medical Biotechnology and Bioinformatics	2.1.1	Collaborate with professionals from diverse disciplines (e.g., molecular biology, computer science, and pharmacology) to develop research projects focusing on drug discovery, genomics, and personalized medicine.
		2.1.2	Integrate bioinformatics tools, such as sequence alignment, molecular docking, and proteomics analysis, with wet-lab research in medical biotechnology to accelerate research outcomes.
2.2	Develop Data-Driven Solutions in Medical Biotechnology and Healthcare	2.2.1	Utilize bioinformatics pipelines and computational modeling to analyze large datasets in genomics, transcriptomics, and metagenomics for applications in disease diagnosis and treatment.
		2.2.2	Apply machine learning and AI techniques to predict disease progression, analyze clinical data, and develop novel biomarkers for healthcare innovations.
2.3	Collaborate in Translational Research for Industrial and Academic Applications	2.3.1	Work on translational research projects that bridge bioinformatics and medical biotechnology to develop real-world solutions, such as diagnostic kits, biopharmaceuticals, and vaccines.
		2.3.2	Engage in collaborative industrial projects by applying interdisciplinary research to solve practical challenges in biotechnology-based healthcare, agriculture, and pharmaceuticals.

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