GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Deemed to be University)

VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A^{++} Grade

GITAM School of Technology

CURRICULUM AND SYLLABUS

4 Year Undergraduate Programme
UBTEN01: B.Tech. Biotechnology

w.e.f. 2024-25 admitted batch

(Updated on May 2024)

Academic Regulations

Applicable for the Undergraduate Programmes in the School of Technology (except B.Tech.CSBS)

https://www.gitam.edu/academics/academic-regulations

GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT

Vision

GITAM will be an exceptional knowledge-driven institution advancing on a culture of honesty and compassion to make a difference to the world.

Mission

- Build a dynamic application-oriented education ecosystem immersed in holistic development.
- Nurture valuable futures with global perspectives for our students by helping them find their ikigai.
- Drive impactful integrated research programmes to generate new knowledge, guided by integrity, collaboration, and entrepreneurial spirit.
- Permeate a culture of kindness within GITAM, fostering passionate contributors.

Quality Policy

To achieve global standards and excellence in teaching, research, and consultancy by creating an environment in which the faculty and students share a passion for creating, sharing and applying knowledge to continuously improve the quality of education.

VISION AND MISSION OF THE SCHOOL

VISION

To become a global leader in holistic engineering education and research

MISSION

- To impart a strong academic foundation and practical education through a flexible curriculum, state-of-the-art infrastructure, and best learning resources
- To actively pursue academic and collaborative research with industries and research institutions, both in India and abroad
- To build a congenial and innovative eco system by enabling the latest technologies, thus helping the students, to solve the challenges of societal importance
- To provide our students with the appropriate leadership, management, communication skills and professional ethics for career success and to continuously impact the global lives

VISION AND MISSION OF THE DEPARTMENT

VISION

To become a global leader in holistic engineering education and research

MISSION

- To enhance the efficiency of education for the empowerment of human resources that can stimulate innovations related to food security, environment and health.
- To foster a collaborative ecosystem that integrates engineering and biological sciences, that enables and motivates our youth to address societal challenges for the benefit of humanity.
- To support and advance food processing, biotech and biomedical industries through cutting-edge research capabilities that catalyze groundbreaking discoveries
- To develop innovative technological solutions for bioprocesses, biomaterials and biomedical devices, based on translational research, and deploy them to facilitate commercialization for economic advancement.

UBTEN01: B.Tech. Bio Technology
(w.e.f. academic year 2024-25 admitted batch)

Programme Educational Objectives (PEOs)

PEO 1	To develop a strong foundation in biotechnology, enabling the application of innovative scientific approaches to solve complex challenges in healthcare, agriculture, and environmental sustainability.
PEO 2	To foster engagement in cutting-edge research and development, advancing biotechnology through interdisciplinary knowledge and innovation.
PEO 3	To promote continuous professional growth, ensuring adaptability to emerging technologies and readiness for leadership roles in industry, academia, and research.
PEO 4	To instill ethical and societal responsibility, applying biotechnology expertise to address societal needs and contribute to sustainability and social well-being.

Establish consistency of PEOs with Mission of the Department

PEOs	Aligned with Mission	Justification
PEO 1	Mission 1: Enhance biotechnology education and innovations.	This PEO aligns with the mission to strengthen educational foundations and drive innovation in key areas such as healthcare, agriculture, and sustainability.
PEO 2	Mission 4: Develop research capabilities and commercialize discoveries.	This PEO supports the mission by focusing on developing research skills and encouraging students to contribute to innovative discoveries and their commercialization.
PEO 3	Mission 2: Foster a collaborative ecosystem integrating engineering and biological sciences.	This PEO encourages leadership and collaboration, directly supporting the mission to create an integrated ecosystem for addressing societal challenges through teamwork and innovation.
PEO 4	Mission 3: Support biotech industries and promote sustainable solutions.	This PEO emphasizes ethical responsibility, aligning with the mission to advance biotechnology for societal benefit, promoting sustainable practices and solutions.

PEO Articulation

	PEO1	PEO2	PEO3	PEO4
M1	H	M	M	L
M2	L	M	H	H
M3	M	M	L	M
M4	M	H	M	L

H – High, M – Medium, L – Low

Programme Outcomes (POs) and Programme Specific Outcomes (PSOs):

At the end of the Programme the students would be able to:

PO1	**Engineering knowledge**: Apply knowledge of mathematics, science, engineering fundamentals, and biotechnology to the solution of complex problems in the field of biotechnology.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex biotechnological problems using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design innovative solutions for complex biotechnology-related problems and systems, considering public health, safety, cultural, societal, and environmental concerns.
PO4	**Investigations of complex problems**: Use research-based knowledge and research methods, including designing experiments, analyzing and interpreting data, and synthesizing information to provide valid conclusions.
PO5	**Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and biotechnological tools, including prediction and modeling, to complex activities with an understanding of their limitations.
PO6	**The Engineer and Society**: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues and the responsibilities relevant to the professional biotechnology practice.
PO7	**Environment and Sustainability**: Understand the impact of biotechnological solutions in societal and environmental contexts and demonstrate the knowledge needed for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the biotechnological practice.
PO9	**Individual and Teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex biotechnological activities with the engineering community and society at large, including writing effective reports, designing documentation, making presentations, and giving and receiving clear instructions.
PO11	**Project management and Finance**: Demonstrate knowledge and understanding of biotechnology and engineering management principles, and apply these to manage projects in multidisciplinary environments.
PO12	**Life-long Learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broad context of technological change
PSO1	Apply biotechnological principles to design, optimize, and scale up industrial processes for the production of biofuels, biopolymers, biopharmaceuticals,

	enzymes, vaccines and other bio-based products, ensuring environmental sustainability and efficiency
PSO2	Utilize molecular biology, genetic engineering, and recombinant DNA technology to develop innovative solutions in healthcare, agriculture, and environmental management, addressing challenges such as disease treatment, crop improvement, and ecosystem conservation
PSO3	Develop and implement biotechnological interventions for environmental conservation, including bioremediation, waste management, and the production of eco-friendly bio-products, contributing to sustainable development goals

Mapping of Program Outcomes and Program Specific Outcomes with Department Mission

	Mission			
	M1	**M2**	**M3**	**M4**
Program Objectives				
PO1	H	H	H	H
PO2	H	H	H	H
PO3	H	H	H	H
PO4	M	H	H	H
PO5	M	H	H	H
PO6	M	M	H	L
PO7	M	H	H	L
PO8	L	M	L	L
PO9	L	L	L	H
PO10	M	L	L	H
PO11	L	H	L	H
PO12	H	L	M	H
Program Specific Objectives				
PSO1	H	H	H	H
PSO2	H	H	H	H
PSO3	H	H	H	M

Curriculum Structure

(Flexible Credit System)

Minimum Credit Requirements for the Award of Degree

S.No.	Course Category and Category Code	Minimum Credits	% of credits in the Programme
1.	University Core (UC)	19	11.87
2.	Faculty Core (FC)	53	33.13
3.	Programme Core (PC)	49	30.62
4.	Programme Electives (PE)	15	9.38
5.	Open Electives (OE)	24	15.00
	Total	**160**	**100**

University Core (UC) : 19 Credits								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
Ability Enhancement Courses								
LANG1201	100	Critical Thinking	2	0	0	0	0	2
LANG1241	100	Communicative English - I	0	0	4	0	0	2
LANG1251	100	Communicative English - II	0	0	4	0	0	2
IENT1051	100	Fundamentals of Entrepreneurship	2	0	0	0	0	2
Skill Enhancement Courses								
CLAD1041	100	Art of Persuasive Communication	0	0	2	0	0	1
CLAD1051	100	Competence in Communication	0	0	2	0	0	1
CLAD1061	100	Life Skills	0	0	2	0	0	1
CLADXXXX	100	Soft Skills - 4	0	0	2	0	0	1
Value Added Courses								
ENVS1003	100	Environmental Studies	3	0	0	0	0	3
POLS1051	100	The Indian Constitution	1	0	0	0	0	1
Pass / Fail Courses (Mandatory)								
FINA1081	100	Personal Financial Planning *	1	0	0	0	0	1
PHPY1011	100	Gandhi and the Contemporary World *	1	0	0	0	0	1
Pass / Fail Courses (Any one course to be chosen)								
DOSP1181	100	Yogasana	0	0	0	2	0	1
MFST1002	100	Health and Wellbeing *	0	0	2	0	0	1
DOSL1081	100	Student Life Activities (Participant)	0	0	0	2	0	1
DOSL1091	100	Student Life Activities (Organizer)	0	0	0	2	0	1
DOSL1101	100	Student Life Activities (Competitor)	0	0	0	2	0	1
DOSL1111	100	Foundations of Student (Leadership)	0	0	0	2	0	1
DOSL1042	100	Community Services – Volunteer	0	0	2	0	0	1
DOSL1052	100	Community Services – Mobilizer	0	0	2	0	0	1
DOSP1003	100	Badminton	0	0	0	2	0	1
DOSP1033	100	Football	0	0	0	2	0	1
DOSP1043	100	Volleyball	0	0	0	2	0	1
DOSP1053	100	Kabaddi	0	0	0	2	0	1
DOSP1073	100	Table Tennis	0	0	0	2	0	1
DOSP1083	100	Handball	0	0	0	2	0	1
DOSP1093	100	Basketball	0	0	0	2	0	1
DOSP1113	100	Throw ball	0	0	0	2	0	1
DOSP1142	100	Cricket	0	0	0	2	0	1
DOSP1132	100	Functional Fitness	0	0	0	2	0	1
DOSP1171	100	Martial Arts/Self Defence	0	0	0	2	0	1

* Massive Open Online Course (MOOC)

FACULTY CORE (FC) : 53 credits								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
MATH1351/ 24BTEN1001	100	Trigonometry and Geometry / Biology for Engineers	4 3	0 1	0 0	0 0	0 0	4 4
MATH1361	100	Linear Algebra and calculus	4	0	0	0	0	4
MATH2611	200	Vector calculus and Differential equations	4	0	0	0	0	4
MATH2621	200	Complex Analysis, Series and Transform Techniques	4	0	0	0	0	4
PHYS1311	100	Essential Physics for Bioengineering	3	0	2	0	0	4
CHEM1111	100	Engineering Chemistry	2	1	2	0	0	4
24CSEN1031	100	Programming for Problem Solving - 1 (Programming with Python)	0	0	6	0	0	3
24CSEN1041	100	Programming for Problem Solving - 2 (Programming with C)	0	0	6	0	0	3
24xxxxxxxx	xxx	Engineering Basket - Choice 1	2	0	2	0	0	3
24xxxxxxxx	xxx	Engineering Basket - Choice 2	2	0	2	0	0	3
MECH1011	100	Engineering Visualization and Product Realization	0	0	4	0	0	2
MECH1041	100	Technology Exploration and Product Engineering	0	0	4	0	0	2
24PROJ4777	400	Capstone Project - Introduction	0	0	0	0	2	1
24IENT3777	300	Internship-1	0	0	0	0	2	1
24PROJ4888 / 24IENT4888 / 24RESH4888	400	Capstone Project - Final / Internship-2 / Research	0	0	0	0	16	8
HSMCH102	100	Universal Human Values 2: Understanding Harmony	2	1	0	0	0	3

Engineering Basket 1 & 2

Six credits have to be chosen from the basket other than Parent Department course.

Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
24EECE2221	200	Fundamentals of Sensors and Internet of Things	2	0	2	0	0	3
24EECE 2211	200	Fundamentals of Electrical and Electronics Engineering	2	0	2	0	0	3
24EECE2231	200	Foundations of Electrical and Electronics Engineering	3	0	2	0	0	4
24MECH1001	100	Introduction to Mechanical Engineering	2	0	2	0	0	3
24CIVL1001	100	Introduction to Civil Engineering	2	0	2	0	0	3
24BTEN1021	100	Biotechnology and Bioengineering	2	0	2	0	0	3
24BTEN1031	100	Introduction to Biomedical Engineering	2	0	2	0	0	3
24CSEN2261	200	Data Structures and Algorithms	2	0	2	0	0	3

Programme Core (PC) : 49 credits								
49 credits to be earned through programme core courses.								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
24BTEN2001	200	Biochemistry	2	0	2	0	0	3
24BTEN2011	200	Process Calculations	2	1	0	0	0	3
24BTEN2021	200	Cellular and Molecular Biology	3	0	2	0	0	4
24BTEN2031	200	Fluid Mechanics and Mechanical Operations	2	1	2	0	0	4
24BTEN2041	200	Microbiology and Genetics	3	0	2	0	0	4
24BTEN2051	200	Biochemical Thermodynamics	3	0	0	0	0	3
24BTEN3001	300	Instrumental Methods of Analysis	3	0	0	0	0	3
24BTEN3011	300	Fundamentals of Heat and Mass Transfer	2	1	2	0	0	4
24BTEN3021	300	Genetic Engineering and its applications	3	0	2	0	0	4
24BTEN3031	300	Bioprocess Engineering	3	0	2	0	0	4
24BTEN3041	300	Principles of Bioinformatics	2	1	0	0	0	3
24BTEN3051	300	Biochemical Reaction Engineering	3	0	0	0	0	3
24BTEN2061	200	Immunoengineering	2	0	2	0	0	3
24BTEN3061	300	Plant & Animal Biotechnology	3	0	2	0	0	4

Programme Elective (PE) : 15 credits								
A minimum of 15 credits from any one of the tracks								
Track # : Industrial Biotechnology								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
24BTEN3071	300	Environmental Biotechnology	3	0	0	0	0	3
24BTEN3081	300	Bioprocess Technology	3	0	0	0	0	3
24BTEN3091	300	Process Dynamics and Control	3	0	0	0	0	3
24BTEN4001	400	Bioprocess Plant Design	3	0	0	0	0	3
24BTEN3101	300	Modelling and Simulation in Bioprocesses	3	0	0	0	0	3
24BTEN4011	400	Synthetic Biology	3	0	0	0	0	3
24BTEN3111	300	Applied Biocatalysis and Biotransformation	3	0	0	0	0	3
24BTEN3121	300	Downstream Processing	3	0	0	0	0	3
24BTEN3131	300	Essentials of Marine Biotechnology	3	0	0	0	0	3
24BTEN3141	300	Metabolomics and Metabolic Engineering	3	0	0	0	0	3
Track # : Food Processing Technology								
24BTEN3151	300	Food Processing Technology	3	0	0	0	0	3
24BTEN3161	300	Food Safety and Quality Management	3	0	0	0	0	3
24BTEN3171	300	Sea and Dairy Food processing	3	0	0	0	0	3
24BTEN3181	300	Food Handling, Packaging and Storage	3	0	0	0	0	3
24BTEN3191	300	Nutrigenomics	3	0	0	0	0	3
24BTEN3201	300	Microbes in Food and Sustainable Agriculture	3	0	0	0	0	3
24BTEN3211	300	Cell Culture for Edible Products	3	0	0	0	0	3
24BTEN3221	300	Genetically Engineered Foods	3	0	0	0	0	3
24BTEN3231	300	Biotechnology of Fermented Foods	3	0	0	0	0	3
24BTEN4021	400	Experimental Design and Optimization in Food Processing	3	0	0	0	0	3
24BTEN3241	300	Enzymes in Food and Feed Industry	3	0	0	0	0	3
24BTEN4031	400	Food Process and Equipment Design	3	0	0	0	0	3
Track # : Computer Aided Drug Design								
24BTEN3251	300	Chemoinformatics	3	0	0	0	0	3
24CSEN4101	400	Computational genomics	2	1	0	0	0	3

24BTEN3261	300	Pharmacogenetics and Pharmacogenomics	3	0	0	0	0	3
24BTEN4041	400	Systems Biology	3	0	0	0	0	3
24BTEN3271	300	Molecular Modeling and Computational Drug Design	3	0	0	0	0	3
24BTEN3281	300	Proteomics and Protein Engineering	3	0	0	0	0	3
24BTEN3291	300	Engineering immune system for cancer therapy	3	0	0	0	0	3
24BTEN3301	300	Genomics and Genome Engineering	3	0	0	0	0	3
24BTEN3311	300	Pharmaceutical Biotechnology	3	0	0	0	0	3
General Electives								
Course code	**Level**	**Course Title**	L	T	P	0	0	C
24BTEN2071	200	Concepts in Biophysics	3	0	0	0	0	3
24BTEN3321	300	Nanobiotechnology	3	0	0	0	0	3
24BTEN3331	300	Introduction to Nuclear Magnetic Resonance	3	0	0	0	0	3
24BTEN4051	400	Biological NMR Spectroscopy	3	0	0	0	0	3
24BTEN3341	300	Molecular Diagnostics and its applications	3	0	0	0	0	3
24BTEN3351	300	Biopesticides and Biofertilizers	3	0	0	0	0	3
24BTEN3361	300	Evolutionary biology and genetics	3	0	0	0	0	3
24BTEN3371	300	Advanced Cell Biology	3	0	0	0	0	3
24BTEN3381	300	Developmental Biology	3	0	0	0	0	3
24BTEN3391	300	Clinical trial design	3	0	0	0	0	3
24BTEN3401	300	Quality control	3	0	0	0	0	3
24BTEN3411	300	Pharmacovigilance	3	0	0	0	0	3

Open Electives (OE)

A minimum of 24 credits are to be earned under this category of courses, out of which 9 credits are from other departments from the School of Technology and the remaining 15 credits are from schools other than the School of Technology.

The current list of courses offered under OE will be available through the registration portal. Refer here for the tentative list of courses offered under OE category

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