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
UBTEN02: B.Tech. Biomedical Engineering

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.

UBTEN02: Biomedical Engineering
(w.e.f. academic year 2024-25 admitted batch)

Programme Educational Objectives (PEOs)

PEO 1	To provide a strong foundation in biomedical engineering that enables graduates to develop innovative solutions to healthcare challenges by integrating engineering and life sciences.
PEO 2	To foster research and interdisciplinary problem-solving for addressing complex healthcare issues, ensuring graduates can translate innovations into practical medical technologies
PEO 3	To prepare graduates for leadership and professional excellence in biomedical industries, academia, and healthcare by promoting ethical decision-making, adaptability, and teamwork.
PEO 4	To encourage lifelong learning and professional growth so that graduates remain at the cutting edge of biomedical technology and contribute to advancing healthcare systems and patient outcomes.

Establish consistency of PEOs with Mission of the Department

PEOs	Aligned with Mission	Justification
PEO 1	**Mission 1**: Strengthen education in biomedical engineering.	This PEO aligns with the mission to provide a solid educational foundation in biomedical engineering, enabling students to innovate and address healthcare challenges.
PEO 2	**Mission 4**: Promote cutting-edge research and interdisciplinary learning.	This PEO supports the mission by focusing on building research skills and encouraging interdisciplinary approaches to solve complex healthcare problems.
PEO 3	**Mission 2**: Foster leadership and collaborative ecosystem.	This PEO promotes leadership, adaptability, and teamwork, which directly supports the mission to prepare students for leading roles and foster collaboration in multidisciplinary settings.
PEO 4	**Mission 3**: Encourage continuous learning and contribute to healthcare advancement.	This PEO emphasizes lifelong learning, aligning with the mission to keep graduates at the forefront of technological advancements and improve healthcare systems.

PEO Articulation

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

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, and biomedical engineering fundamentals to solve complex engineering problems related to healthcare.
PO2	**Problem Analysis**: Identify, formulate, and analyze complex biomedical engineering problems using principles of engineering, biology, and physiology.
PO3	**Design and Development**: Design and develop biomedical systems, devices, and processes that meet specified needs, considering public health, safety, cultural, societal, and environmental aspects.
PO4	**Investigations of Complex Problems**: Conduct experiments, analyze data, and synthesize information to draw valid conclusions related to biomedical engineering challenges.
PO5	**Modern Tool Usage**: Use appropriate techniques, resources, and modern engineering and IT tools for biomedical engineering applications, 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 relevant to professional biomedical engineering practice.
PO7	**Environment and Sustainability**: Understand the impact of biomedical engineering solutions on society and the environment and demonstrate knowledge of sustainable practices.
PO8	**Ethics**: Adhere to ethical principles and commit to professional ethics and responsibilities in biomedical engineering practices.
PO9	**Individual and Teamwork**: Function effectively as an individual and as a member or leader in diverse teams, especially in multidisciplinary environments.
PO10	**Communication**: Communicate effectively on complex biomedical engineering activities with the engineering community and society at large, including writing reports, preparing documentation, and giving presentations.
PO11	**Project Management and Finance**: Apply engineering and management principles to one's work, as a member or leader of a team, to manage projects in multidisciplinary settings
PO12	**Life-long Learning**: Recognize the need for, and have the ability to engage in, independent and lifelong learning in the context of technological change, particularly in biomedical engineering.

PSO1	Apply engineering principles to design, develop, and maintain medical devices and systems that improve diagnosis, monitoring, and treatment of medical conditions
PSO2	Design, develop and utilize biomedical signal processing, imaging techniques, and computational tools to analyze biological data, aiding in the development of diagnostic, prognostic and therapeutic solutions
PSO3	Implement biomedical engineering solutions in clinical settings, integrating biological knowledge and technology to innovate and improve healthcare practices, rehabilitation systems, and assistive devices

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	M	H
PSO3	H	H	H	H

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**
24BTEN2081	200	Biochemistry and Biophysics	2	1	0	0	0	3
24BTEN2091	200	Human Anatomy and Physiology	3	0	2	0	0	4
24BTEN2101	200	Molecular Biology and Genetic Engineering	3	0	2	0	0	4
24BTEN2111	200	Cell and Tissue Engineering	3	0	0	0	0	3
24MECH2091	200	Biomaterials	3	0	0	0	0	3
24MECH3321	300	Biomechanics	2	1	2	0	0	4
24EECE3651	300	Biomedical optics and lasers	3	0	0	0	0	3
24EECE2251	200	Fundamentals of Analog and Digital Electronics	3	0	2	0	0	4
24EECE2271	200	Biomedical Signals and Systems	3	0	2	0	0	4
24EECE3661	300	Image Processing	3	0	0	0	0	3
24EECE3671	300	Biomedical instrumentation	3	0	2	0	0	4
24MECH4091	400	Rehabilitation engineering	3	0	0	0	0	3
24BTEN3421	300	Biomedical Informatics	3	0	2	0	0	4
24BTEN4061	400	Biomedical regulatory affairs and IPR	3	0	0	0	0	3

Programme Elective (PE) : 15 credits

A minimum of 15 credits from any one of the tracks

Track # : Biomedical Instrumentation

Course code	Level	Course Title	L	T	P	S	J	C
24EECE4251	400	Biomedical MRI	3	0	0	0	0	3
24EECE3681	300	Biomedical Image Analysis	3	0	0	0	0	3
24EECE3041	300	Control systems	2	1	0	0	0	3
24MECH3331	300	Introduction to Robotics	3	0	0	0	0	3
24EECE4261	400	Surgical and endoscopic robots	3	0	0	0	0	3
24EECE4271	400	Radiative surgery and therapeutics	3	0	0	0	0	3
24EECE2031	200	Introduction to IoT and its applications	3	0	0	0	0	3
24EECE2281	200	Biosensors	3	0	0	0	0	3
24EECE3691	300	Portable and Wearable biomedical device engineering	3	0	0	0	0	3
24EECE4281	400	Nanobioelectronics	3	0	0	0	0	3
24MECH4111	400	Bioprinting	3	0	0	0	0	3
24EECE4291	400	Medical Imaging Systems	3	0	0	0	0	3

Track # : **Rehabilitation Engineering**

24MECH4101	400	Finite element analysis for BME	3	0	0	0	0	3
24BTEN3431	300	Physiological modeling	3	0	0	0	0	3
24MECH3331	300	Introduction to Robotics	3	0	0	0	0	3
24MECH3341	300	Robot kinematics and dynamics	3	0	0	0	0	3
24EECE3701	300	Sensors and Actuators for prosthetics	3	0	0	0	0	3
24EECE3041	300	Control systems	3	0	0	0	0	3
24EECE3711	300	Electronic Sensing for perception of vision and sound	3	0	0	0	0	3
24EECE3721	300	Neuroengineering	3	0	0	0	0	3
24EECE4281	400	Nanobioelectronics	3	0	0	0	0	3
24MECH4111	400	Bioprinting	3	0	0	0	0	3

General Electives

Course code	Level	Course Title	L	T	P	S	J	C
24BTEN3441	300	Mechanisms of Aging	3	0	0	0	0	3
24EECE4301	400	Biomedical Lab-On-A-Chip systems	3	0	0	0	0	3
24MECH3351	300	Modeling and simulation of Prosthetic Devices	3	0	0	0	0	3

24EECE4311	400	Haptics for biomedical engineering	3	0	0	0	0	3
24EECE3731	300	Human-Machine Interface Engineering	3	0	0	0	0	3
24CSEN2361	200	Fundamentals of Neural Networks and Deep Learning	3	0	0	0	0	3
24MECH4121	400	Neuromechanics	3	0	0	0	0	3
24MECH4131	400	Biomicrofluidics	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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