# GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Deemed to be University)

VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A$^{++}$ Grade

## GITAM School of Core Engineering

CURRICULUM AND SYLLABUS

## 4 Year Undergraduate Programme
## UBTEN02: B.Tech. Biomedical Engineering

w.e.f. 2025-26 admitted batch

(Updated on July 2025)

# Academic Regulations

## Applicable for the Undergraduate Programmes in the School of Core Engineering

**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 |
| LANG1242 | 100 | Communicative English - I | 0 | 0 | 4 | 0 | 0 | 2 |
| LANG1252 | 100 | Communicative English - II | 0 | 0 | 4 | 0 | 0 | 2 |
| IENT1051 | 100 | Fundamentals of Entrepreneurship | 2 | 0 | 0 | 0 | 0 | 2 |
| Skill Enhancement Courses | | | | | | | | |
| GCGC1001 | 100 | Aptitude and Self-Management Skills | 0 | 0 | 2 | 0 | 0 | 1 |
| GCGC1011 | 100 | Integrated Aptitude and Ethical Communications | 0 | 0 | 2 | 0 | 0 | 1 |
| GCGC1021 | 100 | Applied Communication and Quantitative Skills | 0 | 0 | 2 | 0 | 0 | 1 |
| GCGC1031 | 100 | Placement Preparation and Professional Readiness | 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 in the 'School of Computer Science and Engineering' and 'School of Core Engineering' and the remaining 15 credits are from other schools of the university.

# Minor

Students may opt to enroll in a Minor programme for 20 Credits extra beyond the academic requirement of 160 Credits to obtain the B.Tech. degree.

The list of available Minor Programmes are listed **here**

**GITAM School of Technology**

**GITAM (Deemed to be University)**

Visakhapatnam | Hyderabad | Bengaluru