

**GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)**

(Deemed to be University)

VISAKHAPATNAM \* HYDERABAD \* BENGALURU

Accredited by NAAC with A<sup>++</sup> Grade

**GITAM School of Technology**



**CURRICULUM AND SYLLABUS**

**4 Year Undergraduate Programme**

**UCSEN05: B. Tech. Computer Science and Engineering  
(Data Science)**

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**

### **MISSION**

**UCSEN04: B.Tech. Computer Science and Engineering  
(Data Science)**

(w.e.f. academic year 2024-25 admitted batch)

**Programme Educational Objectives (PEOs)**

<b>PEO 1</b>	
<b>PEO 2</b>	
<b>PEO 3</b>	
<b>PEO 4</b>	
<b>PEO 5</b>	

**PEO Articulation**

	<b>PEO1</b>	<b>PEO2</b>	<b>PEO3</b>	<b>PEO4</b>	<b>PEO5</b>
<b>M1</b>					
<b>M2</b>					
<b>M3</b>					
<b>M4</b>					
<b>M5</b>					

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:

<b>PO1</b>	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO2</b>	Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO3</b>	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.
<b>PO4</b>	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.
<b>PO5</b>	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
<b>PO6</b>	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
<b>PO7</b>	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
<b>PO8</b>	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO9</b>	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO10</b>	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
<b>PO11</b>	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
<b>PO12</b>	Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
<b>PSO1</b>	Identify, formulate and solve engineering problems to provide efficient solutions.
<b>PSO2</b>	Design and develop computer-based applications of varying complexities in emerging areas of Computer Science and Engineering.
<b>PSO3</b>	Apply the principles and techniques of mathematical and statistical models for data analysis to extract the insights in supporting business and scientific processes.

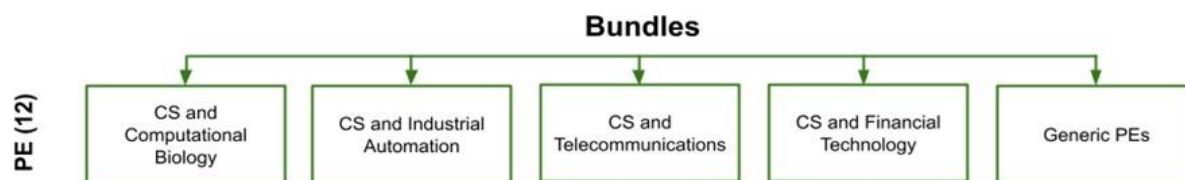
# **Curriculum Structure**

*(Flexible Credit System)*



### A. Salient Features

1. **University Core courses** are common to all the undergraduate students in GITAM (deemed to be university).
2. **Faculty Core courses** provide the basic science and engineering background necessary for B.Tech. students in School of Technology, GITAM (deemed to be university).
3. **Programme Core courses** are specific to the programme chosen by the student. Students in B.Tech. CSE(Data Science) Programme need to earn 50 credits from the specified Programme Core courses.
4. Students should choose a set of programme electives. These may be from a set of generic electives or from a/multiple bundle(s) of thematic programme electives bundles that focus on:
  - interdisciplinary applications of CSE such as Computational Biology or
  - a particular industry domain such as the - healthcare, financial or telecommunications sectors



5. **Open electives** are courses offered by other departments/schools that the students can choose from. Students can earn 9 credits from courses offered by other departments in the School of Technology and 15 credits from courses offered by other schools of the university.

### 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	12
2.	Faculty Core (FC)	55	34
3.	Programme Core (PC)	50	31
4.	Programme Electives (PE)	12	08
5.	Open Electives (OE)	24	15
	<b>Total</b>	<b>160</b>	<b>100</b>

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

Faculty Core (FC) : 55 credits									
Course code	Level	Course title	L	T	P	S	J	C	
MATH1341	100	<a href="#">Calculus and Differential Equations</a>	3	1	0	0	0	4	
MATH1272	100	<a href="#">Linear Algebra</a>	3	1	0	0	0	4	
MATH2561	200	<a href="#">Probability and Statistics for Engineering</a>	3	1	0	0	0	4	
MATH2571	200	<a href="#">Discrete Mathematical structures</a>	3	1	0	0	0	4	
PHYS1291	100	<a href="#">Fundamentals of Engineering Physics</a>	3	0	2	0	0	4	
CHEM1111	100	<a href="#">Engineering Chemistry</a>	2	1	2	0	0	4	
24CSEN1031	100	<a href="#">Programming for Problem Solving - 1</a>	0	0	6	0	0	3	
24CSEN1041	100	<a href="#">Programming for Problem Solving - 2</a>	0	0	6	0	0	3	
24EECE2231	200	<a href="#">Foundations of Electrical and Electronics Engineering</a>	3	0	2	0	0	4	
MECH1011	100	<a href="#">Engineering Visualization and Product Realization</a>	0	0	4	0	0	2	
MECH1041	100	<a href="#">Technology Exploration and Product Engineering</a>	0	0	4	0	0	2	
24PROJ4555	400	Capstone Project - Introduction	0	0	0	0	4	2	
24INTN3555	300	Internship-1	0	0	0	0	4	2	
24PROJ4666/ 24INTN4666/ 24RESH4666	400	Capstone Project - Final / Internship-2 / Research	0	0	0	0	20	10	
HSMCH102	100	Universal Human Values 2: Understanding Harmony	2	1	0	0	0	3	
<b>Total Credits</b>									<b>55</b>

\* Massive Open Online Course (MOOC)

\*\*\*Indicates a Pass/Fail course. These are non-graded courses and are assessed as 'Satisfactory' or 'Unsatisfactory'. No letter grade will be assigned for these courses. These courses may be either of "theory" type or "practical." The minimum pass mark for the award of satisfactory (S) grade is 40. A score less than 40 will lead to an unsatisfactory (U) grade. These courses shall not be a part of SGPA/CGPA calculations. Students are required to get an S grade for graduation.

A suggested semester plan of study is available in [Annexure I](#).

Programme Core (PC) : 50 credits								
Course code	Level	Course Title	L	T	P	S	J	C
24CSEN2001	200	<a href="#">Data Structures</a>	3	0	2	0	0	4
24CSEN2011	200	<a href="#">Operating Systems</a>	3	0	2	0	0	4
24CSEN1001	100	<a href="#">Digital Logic Circuits</a>	2	0	0	0	0	2
24CSEN2021	200	<a href="#">Computer Organization and Architecture</a>	3	1	0	0	0	4
24CSEN3001	300	<a href="#">Design and Analysis of Algorithms</a>	3	0	2	0	0	4
24CSEN2031	200	<a href="#">Database Management Systems</a>	3	0	2	0	0	4
24CSEN2041	200	<a href="#">Computer Networks</a>	3	0	2	0	0	4
24CSEN1011	100	<a href="#">Object Oriented Programming</a>	3	0	2	0	0	4
24CSEN2171	200	<a href="#">Foundations of Data Science</a>	3	0	2	0	0	4
24CSEN2161	200	<a href="#">Machine Learning</a>	3	0	2	0	0	4
24CSEN2181	200	<a href="#">Applied Data Analytics</a>	3	0	2	0	0	4
24CSEN2191	200	<a href="#">Data Visualization</a>	3	0	2	0	0	4
24CSEN3111	300	<a href="#">Speech Processing</a>	3	0	2	0	0	4

### Programme Electives

- Students can choose any three courses from one/multiple bundle(s)/ generic PEs

Programme Elective (PE) : 12 credits								
Bundle 01 : CS and Computational Biology								
Course code	Level	Course Title	L	T	P	S	J	C
24BTEN2161	200	<a href="#">Cell and Molecular Biology</a>	3	1	0	0	0	4
24BTEN3481	300	<a href="#">Digital Medicine</a>	3	1	0	0	0	4
24BTEN3491	300	<a href="#">Algorithmic Foundations of Computational Biology</a>	3	1	0	0	0	4
24BTEN3501	400	<a href="#">Molecular Modeling and Drug Design</a>	3	1	0	0	0	4
Bundle 02 : CS and Industrial Automation								
Course code	Level	Course Title	L	T	P	S	J	C
24CSEN4041	400	<a href="#">Introduction to Cyberphysical Systems</a>	3	0	2	0	0	4
24MECH3311	300	<a href="#">Industry 4.0</a>	3	1	0	0	0	4
24EECE3611	300	<a href="#">Control Engineering</a>	3	0	2	0	0	4
24MECH3301	300	<a href="#">Smart Manufacturing</a>	3	1	0	0	0	4

<b>Bundle 03 : CS and Telecommunications</b>								
Course code	Level	Course Title	L	T	P	S	J	C
24CSEN2081	200	<a href="#">Cryptography and Concepts of Security</a>	3	0	2	0	0	4
24CSEN3131	300	<a href="#">Advanced Computer Networks</a>	3	0	2	0	0	4
24CSEN3141	300	<a href="#">Introduction to Wireless Networks</a>	3	0	2	0	0	4
		Software Defined Networks and Network Function Virtualization						4
<b>Bundle 04 : CS and Financial Technology</b>								
		Financial Institute and Markets						4
24CSEN2201	200	<a href="#">Cyber Security</a>	3	1	0	0	0	4
24CSEN3121	300	<a href="#">Introduction to Blockchain and Crypto assets</a>	3	0	2	0	0	4
		Digital Banking						4
<b>Bundle 05 : General Programme Electives</b>								
24CSEN2151	200	<a href="#">Artificial Intelligence</a>	3	0	2	0	0	4
24CSEN3091	300	<a href="#">Natural Language Processing</a>	3	0	2	0	0	4
24CSEN3101	300	<a href="#">Neural Networks and Deep Learning</a>	3	0	2	0	0	4
24CSEN4051	400	<a href="#">Advances in Machine Learning</a>	3	0	2	0	0	4
24CSEN2051	200	<a href="#">Introduction to Machine Learning and Data Science</a>	3	0	2	0	0	4
24CSEN2061	200	<a href="#">Theory of Computation</a>	3	1	0	0	0	4
24CSEN1021	100	<a href="#">Software Engineering</a>	2	0	4	0	0	4
24CSEN2071	200	<a href="#">Discrete Optimization</a>	3	1	0	0	0	4
24CSEN2091	200	<a href="#">Logic for Computer Science</a>	3	1	0	0	0	4
24CSEN3011	300	<a href="#">Randomized Algorithms</a>	3	1	0	0	0	4
24CSEN4001	400	<a href="#">Game Theory</a>	3	1	0	0	0	4
24CSEN2101	200	<a href="#">Microcontrollers and their Applications</a>	3	0	2	0	0	4
24CSEN4011	400	<a href="#">Advanced Computer Architecture</a>	3	1	0	0	0	4
24CSEN3021	300	<a href="#">Distributed Systems</a>	3	0	2	0	0	4
24CSEN3031	300	<a href="#">Cloud Computing</a>	3	0	2	0	0	4
24CSEN4021	400	<a href="#">GPU Architectures and Programming</a>	3	0	2	0	0	4
24CSEN3041	300	<a href="#">Digital Image Processing</a>	3	0	2	0	0	4
24CSEN2111	200	<a href="#">Computer Graphics and Multimedia</a>	3	0	2	0	0	4
24CSEN2121	200	<a href="#">Human Computer Interaction</a>	3	0	2	0	0	4
24CSEN4031	400	<a href="#">Computer Vision</a>	3	0	2	0	0	4

24CSEN3051	300	<a href="#">Adhoc and Sensor Networks</a>	3	0	2	0	0	4
24CSEN3061	300	<a href="#">IoT Architecture and Protocols</a>	3	0	2	0	0	4
24CSEN3071	300	<a href="#">Cloud, Fog and Edge Computing</a>	3	0	2	0	0	4
24CSEN2131	200	<a href="#">Web Application Frameworks</a>	3	0	2	0	0	4
24CSEN2141	200	<a href="#">Middleware Frameworks</a>	3	0	2	0	0	4
24CSEN3081	300	<a href="#">Principles of DevOps and MLOps</a>	2	0	4	0	0	4
24CSEN2211	200	<a href="#">Information Security and Risk Management</a>	3	1	0	0	0	4
24CSEN2221	200	<a href="#">Cyber Forensics</a>	3	1	0	0	0	4
24CSEN3151	300	<a href="#">Advanced Data Structures</a>	3	0	2	0	0	4
24CSEN3161	300	<a href="#">Compiler Design</a>	3	0	2	0	0	4
24CSEN3171	300	<a href="#">Design Patterns</a>	3	0	2	0	0	4
24CSEN4061	400	<a href="#">Graph Data Analytics</a>	3	1	0	0	0	4
24CSEN3181	300	<a href="#">Principles of Programming Languages</a>	3	1	0	0	0	4
24CSEN3191	300	<a href="#">Approximation Algorithms</a>	3	1	0	0	0	4
24CSEN3201	300	<a href="#">Real Time Systems</a>	3	1	0	0	0	4
24CSEN4071	400	<a href="#">Quantum Computing</a>	3	0	2	0	0	4
24CSEN2231	200	<a href="#">Foundations of Metaverse</a>	3	1	0	0	0	4
24CSEN2241	200	<a href="#">Digital Humans Concepts</a>	3	0	2	0	0	4
24CSEN2251	200	<a href="#">Introduction to Augmented Reality and Virtual Reality</a>	3	0	2	0	0	4
24CSEN4081	400	<a href="#">Generative AI</a>	3	1	0	0	0	4
24CSEN3211	300	<a href="#">Mobile Application Development</a>	3	0	2	0	0	4
24CSEN3221	300	<a href="#">Next Generation Networks</a>	3	0	2	0	0	4
24CSEN3231	300	<a href="#">Environmental Data Science</a>	3	0	2	0	0	4
24CSEN4091	400	<a href="#">Machine Learning for Cyber-Physical Systems</a>	3	1	0	0	0	4
24CSEN3241	300	<a href="#">Digital Systems Design</a>	3	0	2	0	0	4
24CSEN3251	300	<a href="#">Data Warehousing and Mining</a>	3	0	2	0	0	4
24EECE3601	300	<a href="#">Model Based Systems Engineering</a>	3	0	2	0	0	4
		Game Programming						4
		Security and Privacy of CPS						4
		Cloud Security						4
		Applications of IoT for Sustainability						4
		Sustainable Computation						4
		Image and Video Analysis						4

## 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

## Additional Learning

Students can opt for additional learning to broaden their study in another discipline or deepen their knowledge in their chosen field. Further learning by earning additional credits may lead to a Minor or Honors programme. Detailed rules and regulations for minors and honors programme can be found in University Academic Regulations <https://www.gitam.edu/academics/academic-regulations>.



---

**GITAM School of Technology**  
**GITAM (Deemed to be Universtiy)**  
**Visakhapatnam | Hyderabad | Bengaluru**