GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Deemed to be University)

VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A^{++} Grade

GITAM School of Computer Science and Engineering

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 July 2025)

Academic Regulations

Applicable for the Undergraduate Programmes in the School of Computer Science and 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

MISSION

UCSEN04: B.Tech. Computer Science and Engineering
(Data Science)
(w.e.f. academic year 2024-25 admitted batch)

Programme Educational Objectives (PEOs)

PEO 1	
PEO 2	
PEO 3	
PEO 4	
PEO 5	

PEO Articulation

	PEO1	PEO2	PEO3	PEO4	PEO5
M1					
M2					
M3					
M4					
M5					

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 the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	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.
PO4	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.
PO5	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.
PO6	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.
PO7	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.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering 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 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.
PO11	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.
PO12	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.
PSO1	Identify, formulate and solve engineering problems to provide efficient solutions.
PSO2	Design and develop computer-based applications of varying complexities in emerging areas of Computer Science and Engineering.
PSO3	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

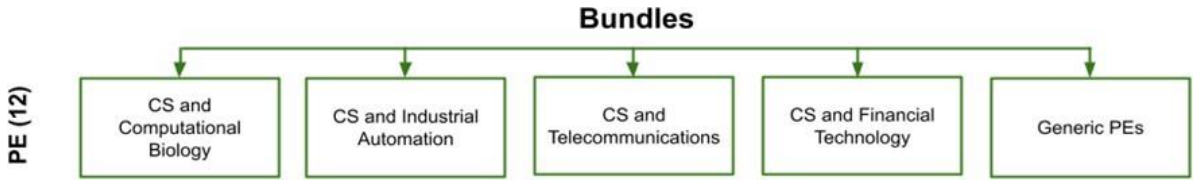
(Flexible Credit System)

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 Computer Science and Engineering, 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 'Computer Science and Engineering' and 'School of Core Engineering' 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
	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) : 55 credits								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
MATH1341	100	Calculus and Differential Equations	3	1	0	0	0	4
MATH1272	100	Linear Algebra	3	1	0	0	0	4
MATH2561	200	Probability and Statistics for Engineering	3	1	0	0	0	4
MATH2572	200	Discrete Mathematical structures	3	1	0	0	0	4
PHYS1291	100	Fundamentals of Engineering Physics	3	0	2	0	0	4
CHEM1111	100	Engineering Chemistry	2	1	2	0	0	4
24CSEN1031	100	Programming for Problem Solving - 1	0	0	6	0	0	3
24CSEN1041	100	Programming for Problem Solving - 2	0	0	6	0	0	3
24EECE2231	200	Foundations of Electrical and Electronics Engineering	3	0	2	0	0	4
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
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
		Total Credits						**55**

* *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	Data Structures	3	0	2	0	0	4
24CSEN2011	200	Operating Systems	3	0	2	0	0	4
24CSEN1002	100	Digital Logic Circuits	2	0	0	0	0	2
24CSEN2021	200	Computer Organization and Architecture	3	1	0	0	0	4
24CSEN3001	300	Design and Analysis of Algorithms	3	0	2	0	0	4
24CSEN2031	200	Database Management Systems	3	0	2	0	0	4
24CSEN2041	200	Computer Networks	3	0	2	0	0	4
24CSEN1011	100	Object Oriented Programming	3	0	2	0	0	4
24CSEN2171	200	Foundations of Data Science	3	0	2	0	0	4
24CSEN2161	200	Machine Learning	3	0	2	0	0	4
24CSEN2181	200	Applied Data Analytics	3	0	2	0	0	4
24CSEN2191	200	Data Visualization	3	0	2	0	0	4
24CSEN3111	300	Speech Processing	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	Cell and Molecular Biology	3	1	0	0	0	4
24BTEN3481	300	Digital Medicine	3	1	0	0	0	4
24BTEN3491	300	Algorithmic Foundations of Computational Biology	3	1	0	0	0	4
24BTEN3501	400	Molecular Modeling and Drug Design	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	Introduction to Cyberphysical Systems	3	0	2	0	0	4
24MECH3311	300	Industry 4.0	3	1	0	0	0	4
24EECE3611	300	Control Engineering	3	0	2	0	0	4
24MECH3301	300	Smart Manufacturing	3	1	0	0	0	4

Bundle 03 : CS and Telecommunications								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
24CSEN2081	200	Cryptography and Concepts of Security	3	0	2	0	0	4
24CSEN3131	300	Advanced Computer Networks	3	0	2	0	0	4
24CSEN3141	300	Introduction to Wireless Networks	3	0	2	0	0	4
		Software Defined Networks and Network Function Virtualization						4
Bundle 04 : CS and Financial Technology								
ACFN2011	200	Financial Institute and Markets	4	0	0	0	0	4
24CSEN2201	200	Cyber Security	3	1	0	0	0	4
24CSEN3121	300	Introduction to Blockchain and Crypto assets	3	0	2	0	0	4
ACFN3081	300	Digital Banking	4	0	0	0	0	4
Bundle 05 : General Programme Electives								
24CSEN2151	200	Artificial Intelligence	3	0	2	0	0	4
24CSEN3091	300	Natural Language Processing	3	0	2	0	0	4
24CSEN3101	300	Neural Networks and Deep Learning	3	0	2	0	0	4
24CSEN4051	400	Advances in Machine Learning	3	0	2	0	0	4
24CSEN2051	200	Introduction to Machine Learning and Data Science	3	0	2	0	0	4
24CSEN2061	200	Theory of Computation	3	1	0	0	0	4
24CSEN1021	100	Software Engineering	2	0	4	0	0	4
24CSEN2071	200	Discrete Optimization	3	1	0	0	0	4
24CSEN2091	200	Logic for Computer Science	3	1	0	0	0	4
24CSEN3011	300	Randomized Algorithms	3	1	0	0	0	4
24CSEN4001	400	Game Theory	3	1	0	0	0	4
24CSEN2101	200	Microcontrollers and their Applications	3	0	2	0	0	4
24CSEN4011	400	Advanced Computer Architecture	3	1	0	0	0	4
24CSEN3021	300	Distributed Systems	3	0	2	0	0	4
24CSEN3031	300	Cloud Computing	3	0	2	0	0	4
24CSEN4021	400	GPU Architectures and Programming	3	0	2	0	0	4
24CSEN3041	300	Digital Image Processing	3	0	2	0	0	4
24CSEN2111	200	Computer Graphics and Multimedia	3	0	2	0	0	4
24CSEN2121	200	Human Computer Interaction	3	0	2	0	0	4
24CSEN4031	400	Computer Vision	3	0	2	0	0	4

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

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.

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