SHIV NADAR
UNIVERSITY
CHENNAI

SSN School of Engineering

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Bachelor of Technology
Computer Science and Engineering (Internet of Things)

CURRICULUM

REGULATION 2025

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Graduates will excel in professional roles within the expanding field of Internet of Things, contributing to the design, development, and deployment of innovative IoT solutions.

PEO 2: Graduates will possess the expertise to engineer comprehensive IoT systems, integrating diverse devices, networks, and data management techniques to address real-world challenges.

PEO 3: Graduates will be capable of leveraging data acquired from IoT devices, applying analytics and machine learning to derive actionable insights, and optimizing IoT applications for enhanced performance and decision-making.

PEO 4: Graduates will design and implement IoT solutions with a strong emphasis on security, privacy, and ethical considerations, ensuring responsible and sustainable technological advancements.

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PROGRAM OUTCOMES (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

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PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: IoT Systems Development: Graduates will be able to design, develop, and deploy complete IoT systems, including device selection, sensor integration, network configuration, and application development, considering factors like scalability, security, and reliability.

PSO 2: Data Acquisition and Analysis for IoT: Graduates will be able to implement data acquisition, storage, and processing solutions for IoT applications, and apply data analytics and machine learning techniques to extract meaningful insights for informed decision-making.

PSO 3: IoT Security and Privacy: Graduates will be able to analyze security and privacy requirements in IoT deployments and implement appropriate security measures, including authentication, authorization, encryption, and vulnerability mitigation, to protect IoT systems and data.

COURSE SUMMARY

The listed courses in the curriculum are broadly classified as per the recommendations from the UGC.

Sl. No	Broad Category of Course	Minimum Credit Requirement
1	Major Core (MC)	80
2	Minor Stream (MS)	32
3	Multidisciplinary (MD)	09
4	Ability Enhancement Course (AEC)	08
5	Skill Enhancement Course (SEC)	09
6	Value Added Courses (VAC)	06-08
7	Summer Internship (SI)	02-04
8	Project Dissertation (PD)	12
Total		**160**

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The semester wise credit breakup of the Curriculum based on the above credit breakup proposed by the UGC is as follows:

Semester\Category	MC	MS	MD	AEC	SEC	VAC	SI	PD	TOTAL
1	11	-	9	3	-	1	-	-	**24**
2	16	-	-	3	2	1	-	-	**22**
3	11	8	-	-	2	2	-	-	**23**
4	10	5	-	-	4	-	-	-	**19**
5	11	6	-	3	1	-	-	-	**21**
6	11	6	-	-	-	-	1	4	**22**
7	10	5	-	-	-	-	-	6	**21**
8	-	2	-	-	-	4	-	2	**8**
Total	**80**	**32**	**9**	**9**	**9**	**8**	**1**	**12**	**160**

SEMESTER I

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Communicative English	AEC	3	2	1	0	3
2	Mathematics I	MD	4	3	1	0	4
3	Problem Solving and Programming in C + LAB	MC	5	2	1	2	4
4	Digital Design + Lab	MC	4	2	0	2	3
5	Basic Electrical and Electronics Engineering + Lab	MC	5	3	0	2	4
6	Engineering Physics	MD	3	3	0	0	3
7	Engineering Physics Lab	MD	4	0	0	4	2
8	Extra Academic Activity 1	VAC	2	0	0	0	1
Total			**26**	**15**	**3**	**6**	**22**

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SEMESTER II

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	English for Engineers	AEC	3	2	1	0	3
2	Mathematics II	MC	3	3	0	0	3
3	Data Structures + Lab	MC	5	2	1	2	4
4	Computer Organization and Architecture	MC	3	3	0	0	3
5	Object Oriented Programming + Lab	MC	4	2	0	2	3
6	Discrete Mathematics	MC	3	3	0	0	3
7	Microprocessor and Microcontroller Lab	SEC	3	0	1	2	2
8	Extra Academic Activity 2[#]	VAC	2	0	0	0	1
		Total	**30**	**15**	**3**	**10**	**24**

[#]**Note**: At the induction programme, students will have the option to choose from three youth programmes: the **National Service Scheme (NSS)**, the **Youth Red Cross Society (YRCS)**, and the **National Sports Organisation (NSO)**. The grades earned by students will be included in the mark statement; however, these grades will not contribute to the calculation of the CGPA.

SEMESTER III

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Design and Analysis of Algorithms + Lab	MC	5	3	0	2	4
2	Fundamentals of Internet of Things + Lab	MC	5	2	1	2	4
3	Theory of Computation	MS	3	3	0	0	3
4	Operating Systems + Lab	MC	4	2	0	2	3
5	Linear Algebra for Computer Technologists	MS	3	2	1	0	3
6	JAVA Programming	MS	2	2	0	0	2
7	Environmental Science and Engineering	VAC	2	2	0	0	2
8	JAVA Programming LAB	SEC	3	0	1	2	2
Total			**27**	**16**	**3**	**8**	**23**

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SEMESTER IV

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Computer Networks + LAB	MS	4	2	0	2	3
2	Database Management Systems + LAB	MC	4	2	0	2	3
3	IoT Architecture & Programming + Lab	MC	5	2	1	2	4
4	Machine Learning Algorithms + Lab	MC	4	2	0	2	3
5	Full Stack Web Technologies	MS	2	2	0	0	2
6	Full Stack Web Technologies LAB	SEC	3	0	1	2	2
7	Mini Project	SEC	3	0	1	2	2
Total			**25**	**10**	**3**	**12**	**19**

SEMESTER V

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Distributed Systems + Lab	MC	5	2	1	2	4
2	Wireless Communication Techniques + Lab	MC	5	2	1	2	4
3	Signal Processing for IoT + Lab	MC	4	2	0	2	3
4	MINOR STREAM COURSE 1	MS	3	3	0	0	3
5	MINOR STREAM COURSE 2	MS	3	3	0	0	3
6	Ability Enhancement Course Basket[#]	AEC	3	3	0	0	3
7	Tools for Big Data Analytics	SEC	2	0	0	2	1
Total			**25**	**15**	**2**	**8**	**21**

[#]The following is a tentative list of courses that may be offered under the ***Ability Enhancement Course Basket***:

1. Linguistics
2. Mass Communication
3. Academic Writing

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SEMESTER VI

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Foundation of Robotics + Lab	MC	5	2	1	2	4
2	Cloud IoT Analytics + Lab	MC	5	2	1	2	4
3	Software Engineering	MC	3	3	0	0	3
4	MINOR STREAM COURSE 3	MS	3	3	0	0	3
5	MINOR STREAM BASKET 1	MS	3	3	0	0	3
6	Capstone Project Phase 1	PD	8	0	0	8	4
7	Industrial Training/Internship	SI	2	0	0	2	1
Total			**29**	**13**	**2**	**14**	**22**

SEMESTER VII

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Edge Intelligence + Lab	MC	5	2	1	2	4
2	IoT Security Essentials	MC	3	3	0	0	3
3	Compiler Design	MC	3	3	0	0	3
4	MINOR STREAM BASKET 2	MS	3	3	0	0	3
5	MINOR STREAM BASKET 3	MS	2	2	0	0	2
6	Capstone Project Phase 2	PD	12	0	0	12	6
Total			**28**	**13**	**1**	**14**	**21**

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SEMESTER VIII

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Professional Ethics and Human Values	VAC	2	2	0	0	2
2	Value Added Course Basket#	VAC	2	2	0	0	2
3	MINOR STREAM BASKET 4	MS	2	2	0	0	2
4	Capstone Project Phase 3	PD	4	0	0	4	2
Total			**10**	**6**	**0**	**4**	**8**

#The following is a tentative list of courses that may be offered under the ***Value-Added Course Basket***:

1. Entrepreneurship Essentials
2. Green Computing
3. Water Resource Management

MINOR STREAMS

The Department of Computer Science and Engineering offers its students the following list of Minor Streams.

1. Foundations of AI and Data Science
2. Foundations of Internet of Things
3. Foundations of Cybersecurity
4. Machine Intelligence (Advanced AI and DS)
5. Cyber Physical Systems (Advanced IoT)
6. Advanced Cybersecurity

Each Minor Stream has seven courses worth 19 credits. The student must enroll in any one of the above six Minor Streams. Minor Streams tagged with Foundations must not be enrolled by students whose Major Core courses overlap with the listed courses in the Minor Stream.

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MINOR STREAM 1 - Foundations of AI and Data Science

Sl. No.	Course Title	Semester	Contact Hours	L	T	P	C
1	Data Analysis through Statistical Inference*^	5	4	2	0	2	3
2	Deep Learning*	5	6	2	1	0	3
3	Data Mining and Data Warehousing + LAB#*	6	5	2	0	2	3
4	MINOR STREAM BASKET 1	6	3	3	0	0	3
5	MINOR STREAM BASKET 2	7	3	3	0	0	3
6	MINOR STREAM BASKET 3	7	3	3	0	0	2
7	MINOR STREAM BASKET 4	8	4	2	0	0	2

*Mandatory Course for the Minor Stream 1
^Mandatory Course for the Minor Stream 3

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The following is the tentative list of courses that may be offered under the ***Minor Stream Baskets***:

Minor Stream Basket 1 (3 Credit courses)	***Minor Stream Basket 2 (3 Credit courses)***	***Minor Stream Basket 3 (2 Credit courses)***	***Minor Stream Basket 4 (2 Credit courses)***
Natural Language Processing#	Data Preprocessing#	Machine Learning Operations (MLOps)	Speech Analytics
Reinforcement Learning#	Predictive Analytics#	Multi-Agent Systems	Video Analytics
GPU Programming for AI	Graph Machine Learning#	Edge Computing	Financial Data Analytics
Recommendation Systems	AI Ethics, Safety, and Explainability#		
Optimization Techniques for Machine Learning	Soft Computing		

#These courses are part of the Major Core courses for B.Tech. Artificial Intelligence and Data Science.

<u>Note: Students from B.Tech. AI and DS must not opt for this Minor Stream.</u>

MINOR STREAM 2 - Foundations of Internet of Things

Sl. No.	Course Title	Semester	Contact Hours	L	T	P	C
1	Fundamentals of Embedded Systems*	5	3	2	1	0	3
2	Fundamentals of Internet of Things*	5	3	2	1	0	3
3	IoT Architecture & Programming*	6	3	2	1	0	3
4	MINOR STREAM BASKET 1	6	3	3	0	0	3
5	MINOR STREAM BASKET 2	7	3	3	0	0	3
6	MINOR STREAM BASKET 3	7	2	2	0	0	2
7	MINOR STREAM BASKET 4	8	2	2	0	0	2

*Mandatory courses for the Minor Stream 2

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The following is the tentative list of courses that may be offered under the ***Minor Stream Baskets***:

Minor Stream Basket 1 (3 Credit courses)	***Minor Stream Basket 2 (3 Credit courses)***	***Minor Stream Basket 3 (2 Credit courses)***	***Minor Stream Basket 4 (2 Credit courses)***
Foundations of Robotics#	Wireless Communication Techniques#	Wheeled Mobile Robots	Industry IoT 4.0
Cloud Analytics for IoT#	Signal Processing for IoT#	Smart Power Grids	Micro and Smart systems
Programming Edge Accelerators	Edge Intelligence#	Wireless Ad Hoc and Sensor Network	Affective Computing
Embedded Interface Design (HCI)	IoT Security Essentials#		
Embedded Vision	Wearable Technology		

#These courses are part of the Major Core courses for B.Tech. Computer Science and Engineering (Internet of Things)

<u>Note: Students from B.Tech. CSE (IoT) must not opt for this Minor Stream.</u>

MINOR STREAM 3 – Foundations of Cybersecurity

Sl. No.	Course Title	Semester	Contact Hours	L	T	P	C
1	Foundations of Cybersecurity[#*]	5	4	2	0	2	3
2	Digital Forensics[#*]	5	3	3	0	0	3
3	Vulnerability Assessment and Penetration Testing[#*]	6	3	3	0	0	3
4	MINOR STREAM BASKET 1	6	3	3	0	0	3
5	MINOR STREAM BASKET 2	7	3	3	0	0	3
6	MINOR STREAM BASKET 3	7	3	2	0	0	2
7	MINOR STREAM BASKET 4	8	2	2	0	0	2

*Mandatory courses for the Minor Stream 3

The following is the tentative list of courses that may be offered under the ***Minor Stream Baskets***:

Minor Stream Basket 1 (3 Credit courses)	***Minor Stream Basket 2 (3 Credit courses)***	***Minor Stream Basket 3 (2 Credit courses)***	***Minor Stream Basket 4 (2 Credit courses)***
Malware Analysis and Reverse Engineering[#]	Modern Cryptography[#]	Infrastructure Security	Financial Data Analytics
Embedded Systems and Security[#]	Network and Information Security [#]	Incidence Response	Open Source Intelligence
Programming Edge Accelerators	Cloud Computing and Security[#]	Wireless Ad Hoc and Sensor Network	Affective Computing
Cyber Laws and Ethics	Blockchain Technology[#]	DevSecOps	
Fault Tolerant Systems	Federated Learning		

[#]These courses are part of the Major Core courses for B.Tech. Computer Science and Engineering (Cybersecurity)

<u>Note: Students from B.Tech. CSE (Cybersecurity) must not opt for this Minor Stream.</u>

MINOR STREAM 4 - Machine Intelligence
(Advanced AI and Data Science)

Sl. No.	Course Title	Semester	Contact Hours	L	T	P	C
1	Data Analysis through Statistical Inference*	5	4	2	0	2	3
2	Optimization Techniques for Machine Learning*	5	3	3	0	0	3
3	Deep generative models*	6	3	3	0	0	3
4	MINOR STREAM BASKET 1	6	3	3	0	0	3
5	MINOR STREAM BASKET 2	7	3	3	0	0	3
6	MINOR STREAM BASKET 3	7	2	2	0	0	2
7	MINOR STREAM BASKET 4	8	2	2	0	0	2

*Mandatory Course for the Minor Stream 4

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The following is the tentative list of courses that may be offered under the ***Minor Stream Baskets***:

Minor Stream Basket 1 (3 Credit courses)	***Minor Stream Basket 2 (3 Credit courses)***	***Minor Stream Basket 3 (2 Credit courses)***	***Minor Stream Basket 4 (2 Credit courses)***
Tensor Computations of AI	Social Network Analysis	Machine Learning Operations (MLOps)	Speech Analytics
GPU Programming for AI	Human Computer Interactions and AI	Multi-Agent Systems	Video Analytics
Evolutionary Computing	Soft Computing	Edge Computing	Financial Data Analytics
Advanced Control Theory	Foundation of Robotics		
Affective Computing	Federated Learning		

MINOR STREAM 5 - Cyber Physical Systems (Advanced IoT)

Sl. No.	Course Title	Semester	Contact Hours	L	T	P	C
1	Modern Control Theory*	5	3	3	0	0	3
2	Embedded RTOS*	5	4	2	0	2	3
3	Programmable Logic Embedded System Design*	6	4	2	0	2	3
4	MINOR STREAM BASKET 1	6	3	3	0	0	3
5	MINOR STREAM BASKET 2	7	3	3	0	0	3
6	MINOR STREAM BASKET 3	7	2	2	0	0	2
7	MINOR STREAM BASKET 4	8	2	2	0	0	2

*Mandatory courses for the Minor Stream 5

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The following is the tentative list of courses that may be offered under the ***Minor Stream Baskets***:

Minor Stream Basket 1 (3 Credit courses)	***Minor Stream Basket 2 (3 Credit courses)***	***Minor Stream Basket 3 (2 Credit courses)***	***Minor Stream Basket 4 (2 Credit courses)***
IoT Embedded Firmware	Wearable Technology	Wheeled Mobile Robots	Industry IoT 4.0
Programming Edge Accelerators	Drone Technology	Smart Power Grids	Micro and Smart systems
Embedded Interface Design (HCI)	Automotive IoT	Wireless Ad Hoc and Sensor Network	Affective Computing
Embedded Vision	Federated Learning		

MINOR STREAM 6 - Advanced Cybersecurity

Sl. No.	Course Title	Semester	Contact Hours	L	T	P	C
1	Privacy Engineering*	5	4	2	0	2	3
2	Cyber Physical Systems*	5	3	3	0	0	3
3	Fault Tolerant Systems*	6	3	3	0	0	3
4	MINOR STREAM BASKET 1	6	3	3	0	0	3
5	MINOR STREAM BASKET 2	7	3	3	0	0	3
6	MINOR STREAM BASKET 3	7	3	2	0	0	2
7	MINOR STREAM BASKET 4	8	2	2	0	0	2

*Mandatory courses for the Minor Stream 6

The following is the tentative list of courses that may be offered under the ***Minor Stream Baskets***:

Minor Stream Basket 1 (3 Credit courses)	***Minor Stream Basket 2 (3 Credit courses)***	***Minor Stream Basket 3 (2 Credit courses)***	***Minor Stream Basket 4 (2 Credit courses)***
Social Media Analysis and Security	Quantum Cryptography	Infrastructure Security	Financial Data Analytics
High Performance Computing and Security	Federated Learning	Incidence Response	Open Source Intelligence
Cyber Laws and Ethics	Wireless security	SecOps	Affective Computing
Fault Tolerant Systems	Risk Management		

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MICROSPECIALIZATION

The University proposes to offer Micro-Specializations to Undergraduate students. Its salient features are as follows:

1. Each Micro-Specialization has a defined structure in terms of three sequential components:
    - **Component I** - One Foundation course that constitutes a mandatory requirement and also a prerequisite for subsequent components.
    - **Component II** - Two courses from a specified vertical.
    - **Component III** - Project/Design/Term Paper
2. A Student would be required to complete all three components (10-12 credits) from the specified stream to earn a Micro-Specialization.

Eligibility for Micro-Specialization registration

To register for a Micro-Specialization, the student must have completed all curricular requirements up to the previous semester and have a CGPA ≥ 8.5. The student must maintain a CGPA ≥ 8.5 without any backlog in the subsequent semesters to keep the Micro-Specialization registration active. The Micro-Specialization must not overlap with the Major Core courses or Minor Stream courses credited as part of the degree program.

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Provisional List of Micro-Specialization Verticals

The following is the list of Micro-Specialization verticals offered to our undergraduate students:

1. Artificial Intelligence and Data Science
2. Internet of Things
3. Cyber security
4. Medical Technology
5. Advanced Robotic Systems
6. Quantum Technology
7. Micro and Smart Systems Technology