

Course Curriculum
For
M. Tech. Computer Science and Engineering



**Department of Computer Science and
Engineering**
National Institute of Technology Delhi

**w.e.f. the Academic Year
2022-2023**

Department of Computer Science and Engineering

National Institute of Technology Delhi

1.1 About the Department

The Computer Science and Engineering Department was started in 2010 along with the foundation of NIT Delhi. Initially, only the Bachelor of Technology Programme was offered with the intake 30 which presently has been increased to 60. Now, apart from B. Tech., the department also offers Master of Technology (Analytics) and Ph.D. programmes which cover a number of important areas of Computer Science and Engineering, e.g., Algorithms, Computer Networks, Data Warehousing and Data Mining, Software Engineering, Machine Learning, Image Processing, Web Technologies, Data Analytics, Complex Networks, Wireless Sensor Networks etc. We provide our students with a broad undergraduate and graduate curriculum based on the application and theoretical foundations of computer science. Our faculty and students participate in interdisciplinary research. The combination of these elements makes the department an especially exciting environment in which to study and work; an environment that serves us well in our goal of providing excellence in education, research, and discovery. The department envisions producing quality graduates, capable of leading the world in the technical realm. The department is equipped with the latest configuration and high computing system with hi-speed Internet facility, both wired as well as wi-fi. The Computer Science programs at this institute are dedicated to educate students and to advance research in computer and information technology. The department has all the facilities to carry out the related teaching and research work.

1.2 Vision

- To promote innovation centric education and perform cutting edge research in Computer Science and Engineering.
- To build an International reputation through continuous research, innovation and industry-led programs of study, where faculties are committed to leading-edge research and innovation and student training.

1.3 Mission

- Facilitate the development of academia-industry collaborations and societal outreach programmers.
- Establish nationally and internationally recognized research activities and expose students to extensive research experience.
- Pass on moral and ethical values and interpersonal competencies to students.

M. Tech. Computer Science and Engineering

2.1 Preamble

M. Tech. Computer Science and Engineering: The objective of the M. Tech program in Computer Science and Engineering (CSE) is to prepare students to undertake careers involving innovation and problem solving using computational techniques and technologies, or to undertake advanced studies for research careers. To give due importance to applied as well as theoretical aspects of computing, the curriculum for the MTech (CSE) program covers most of the foundational aspects of computing sciences and develops in students the engineering skills for problem solving using computing sciences. The program offered at NIT Delhi is designed to equip students with a unique blend of skill sets that include:

- Life skills orientation
- Predominantly practice-oriented approach with access to well-equipped and specialized laboratories, and supervised internship, projects, dissertation, and Ph.D. Thesis.
- Hands-on technical training
- Business perspective, along with emphasis on innovation and entrepreneurship
- Strong theoretical foundation for computer science and engineering
- Hard and soft skills
- Strong research environment
- Participate in the R&D and industrial projects.

2.2 Salient Features

- Minimum Credits requirements for completion of M. Tech program is 80.
- The Curriculum is based on the guidelines of National Education Policy (NEP) – 2020.
- The curriculum is designed to meet the prevailing and ongoing industrial requirements.
- The curriculum is flexible and offers Choice Based Credit System (CBCS).
- The curriculum inherits the Value based Education and offers Interdisciplinary/ Multidisciplinary Courses.
- The Curriculum offers Digital Pedagogy & Flipped Learning with adequate motivation for Entrepreneurship/ Startups.
- The curriculum aims at the Holistic Development of the students.
- In the proposed PG scheme the CSE department is proposing in 05 different following specializations:
 1. *Artificial Intelligence and Machine Learning (Bouquet 1)*
 2. *Data Science (Bouquet 2)*
 3. *Information Security (Bouquet 3)*
 4. *Computer Systems (Bouquet 4)*
 5. *Networks and Distributed Systems (Bouquet 5)*
- Total **5 electives** are proposed in the complete PG program among them **at least 4 electives** are required from a bouquet to get the specialization (with the respective bouquet) with M. Tech in Computer Science and Engineering.

- Students can attend 2 MOOC/NPTEL/any online courses (as per department list) among the proposed **5 electives** and the evaluation will be done by the Department as per Academic Calendar and prevailing norms.
- Students can do any number of courses from the other IITs/NITs/or any other CFTI institutes. There will be the provision of credit transfer as per NIT Delhi norms.
- A list of online courses is proposed by the department after mapping with the existing courses and respective mentors.

2.3 Program Educational Objectives (PEOs)

PEO-1	Students will establish themselves as influential professionals by solving real problems through computer science knowledge and with attention to teamwork, effective communication, critical thinking, and problem-solving skills.
PEO-2	Able to draw upon foundational knowledge, learn, adapt, and successfully bring analytical and computational approaches to changing societal and technological challenges.
PEO-3	Students will develop professional skills that prepare them for immediate employment and life-long learning in advanced areas of computer science and related fields.
PEO-4	Inspiring and Collaborative: A leader and a responsible citizen whose strengths come from an ability to draw on and contribute to diverse teams, expertise, and experiences.
PEO-5	Students will demonstrate their ability to adapt to a rapidly changing environment by learning and applying new skills and technologies.
PEO-6	Innovative: Drives scientific and societal advancement through technological innovation and entrepreneurship.
PEO-7	Students will be prepared for excellence and leadership roles along diverse career paths, encouraging professional ethics and active participation needed for a successful career.
PEO-8	Strong computer science and engineering foundation for implementing research and product development in core computer systems.

2.4 Program Outcomes (POs)

PO-1	Analyze a complex problem and apply computing principles and other relevant disciplines to identify solutions.
PO-2	Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
PO-3	Communicate effectively in a variety of professional contexts.
PO-4	Recognize professional responsibilities and make informed judgments based on legal and ethical principles in computing practice.

PO-5	Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
PO-6	Apply computer science theory and software development fundamentals to produce computing-based solutions.

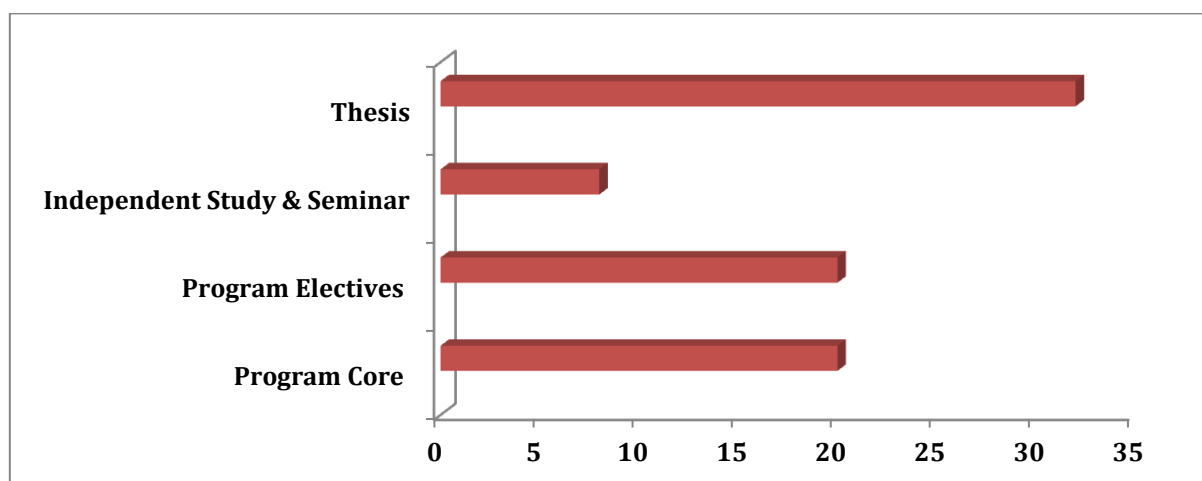
2.5 Program Specific Objectives (PSOs)

PSO -1	Students will be able to analyze, interpret and provide solutions to the advanced software tools for designing real-life computer science and engineering problems.
PSO -2	Ability to solve complex Knowledge Engineering problems by building systems across various domains, including Systems Engineering, Software Development & Engineering, Networks & Security, Data Mining, and Artificial Intelligence.
PSO -3	Students can pursue higher studies to contribute to research and development and participate in entrepreneurial careers.
PSO -4	Ability to apply technical and research-based skills learned through professional society events, certification programs, projects, and lab exercises to provide sustainable solutions to Computer Science and Engineering problems related to society and the environment.
PSO -5	Ability to practice as an ethical Software Engineer or Researcher in the evolving disciplines of Computer Science and Engineering and its allied application domains by employing soft and project management skills learned through internships, project work, and collaborative projects with industry.

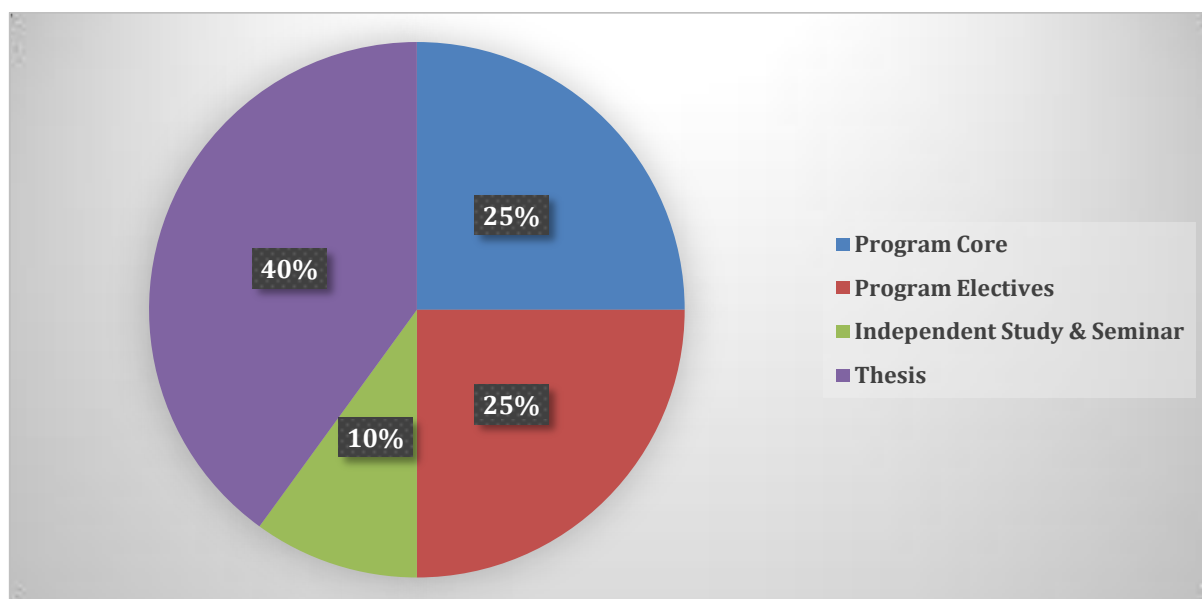
3.1 Semester wise Credit Structure

		Credits				Total
Sl. No.	Courses	1st Year		2nd Year		
		1 st Sem	2 nd Sem	3 rd Sem	4 th Sem	
1	Program Core	12	8	-	-	20
2	Program Electives	8	12	-	-	20
3	Independent Study & Seminar	-	-	4	4	8
4	Thesis	-	-	16	16	32
Total		20	20	20	20	80

3.2 Credits Distribution



3.3 Credits Distribution (%)



4.1 Course Scheme

SEMESTER – I

S. No.	Course Code	Course Name	L	T	P	Credits
1.	CSE 501	Computational Mathematics (Mandatory Course 1)	3	1	0	4
2.	CSE 502	Advanced Databases (Core I)	3	0	2	4
3.	CSE 503	Networking and Communication (Core II)	3	0	2	4

4.	CSE XXX	Elective 1	3	1/ 0	0/ 2	4
5.	CSE XXX	Elective 2	3	1/ 0	0/ 2	4
Total Credits						20

SEMESTER II

S. No.	Course Code	Course Name	L	T	P	Credits
1.	CSE 504	Advanced Data Structure and Algorithms (Mandatory Course 2)	3	0	2	4
2.	CSE 505	Advanced Artificial Intelligence (Core III)	3	0	2	4
3.	CSE XXX	Elective 3	3	1/ 0	0/ 2	4
4.	CSE XXX	Elective 4	3	1/ 0	0/ 2	4
5.	CSE XXX	Elective 5	3	1/ 0	0/ 2	4
Total Credits						20

SEMESTER III

S. No.	Course Code	Course Name	L	T	P	Credits
1	CSE 651	Dissertation I	-	-	-	16
2	CSE 652	Seminar I	-	-	-	4
Total Credits						20

SEMESTER IV

S. No.	Course Code	Course Name	L	T	P	Credits
1	CSE 653	Dissertation II	-	-	-	16
2	CSE 654	Seminar II	-	-	-	4
Total Credits						20

Elective Courses

Bouquet 1 of Elective Courses [Specialization in AI and ML]

S. No.	Course Code	Course Name	L	T	P	Credits
1.	CSE 511	Data Analysis and Visualization	3	0	2	4
2.	CSE 512	Machine Learning	3	0	2	4
3.	CSE 513	Computer Vision and Pattern Recognition	3	0	2	4
4.	CSE 514	Brain Computer Interface	3	0	2	4
5.	CSE 515	Deep Learning and Applications	3	0	2	4
6.	CSE 516	Natural Language Processing	3	0	2	4
7.	CSE 517	Reinforcement Learning and Applications	3	0	2	4
8.	CSE 518	Data Mining	3	0	2	4
9.	CSE 519	Information Retrieval	3	0	2	4
10.	CSE 520	Probabilistic Graph Models	3	0	0	3
11.	CSE 521	Robotics	3	0	2	4
12.	CSE 522	Quantum Computing	3	0	2	4
13.	CSE 523	Deep Multi-Task and meta learning	3	0	2	4
14.	CSE 524	Speech Processing	3	0	2	4
15.	CSE 525	Advanced Digital Image Processing	3	0	2	4
16.	CSE 526	Optimization Techniques	3	1	0	4
17.	CSE 527	Introduction to Cognitive Computing	3	0	2	4
18.	CSE 528	Multi Agents	3	0	2	4
19.	CSE 529	Fuzzy Logic and Applications	3	0	2	4
20.	CSE 530	Motion Analytics	3	0	2	4
21.	CSE 531	Game Theory	3	1	0	4
22.	CSE 532	Social Network Analysis	3	0	2	4

Bouquet 2 [Specialization in Data Science]

S. No	Course Code	Course Name	L	T	P	Credits
1.	CSE 536	Data Handling and Visualization	3	0	2	4
2.	CSE 537	Mathematical Foundation of Data Science	3	1	0	4
3.	CSE 538	High-Dimensional Probability	3	1	0	4
4.	CSE 539	Information Security and Privacy	3	0	2	4
5.	CSE 540	Introduction to Statistical Learning	3	0	2	4
6.	CSE 541	Big Data Analytics	3	0	2	4
7.	CSE 542	Time Series Analysis	3	0	2	4
8.	CSE 543	Business Intelligence and Analysis	3	0	2	4
9.	CSE 544	Internet of Things	3	0	2	4
10.	CSE 545	Cloud Computing	3	0	2	4
11.	CSE 546	Distributed Systems	3	0	2	4
12.	CSE 512	Machine Learning	3	0	2	4
13.	CSE 513	Computer Vision and Pattern Recognition	3	0	2	4
14.	CSE 515	Deep Learning and Applications	3	0	2	4
15.	CSE 518	Data Mining	3	0	2	4
16.	CSE 526	Optimization Techniques	3	1	0	4
17.	CSE 531	Game Theory	3	1	0	4

18.	CSE 532	Social Network Analysis	3	0	2	4
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Bouquet 3 of Elective Courses [Specialization in Information Security]

S. No	Course Code	Course Name	L	T	P	Credits
1.	CSE 561	Introduction to Cyber Security	3	0	2	4
2.	CSE 562	Network and Data Security	3	0	2	4
3.	CSE 563	Software Security	3	0	2	4
4.	CSE 564	Cryptography and Computer Security	3	0	2	4
5.	CSE 565	Machine Learning Applications for Cyber Security	3	0	2	4
6.	CSE 566	Threat Intelligence	3	0	2	4
7.	CSE 567	Malware analysis and digital Forensic	3	0	2	4
8.	CSE 568	Blockchain Technology	3	0	2	4
9.	CSE 569	Mobile and Wireless Security	3	0	2	4
10.	CSE 570	Cyber Physical System Security	3	0	2	4
11.	CSE 571	Information Security	3	0	2	4
12.	CSE 572	Cyber Security and Laws	3	0	2	4
13.	CSE 573	Security Engineering	3	0	2	4
14.	CSE 574	Database and online Social Media Security	3	0	2	4
15.	CSE 575	Randomized Algorithms	3	1	0	4

Bouquet 4 of Elective Courses [Specialization in Computer Systems]

S. No	Course Code	Course Name	L	T	P	Credits
1.	CSE 586	Advanced Computer Networks	3	0	2	4
2.	CSE 587	Data Systems	3	0	2	4
3.	CSE 588	Compiler Design	3	0	2	4
4.	CSE 589	Advanced Computer Architecture	3	0	2	4
5.	CSE 590	Software Design Patterns	3	0	2	4
6.	CSE 591	Map Reduce and Big Data	3	0	2	4
7.	CSE 592	Program Analysis	3	0	2	4
8.	CSE 593	Advanced Operating Systems	3	0	2	4
9.	CSE 594	Software Engineering	3	0	2	4
10.	CSE 595	Database implementation	3	0	2	4
11.	CSE 596	Project Management for Software Development	3	0	2	4
12.	CSE 597	Parallel Algorithms	3	0	2	4
13.	CSE 598	Simulation and Modelling	3	0	2	4
14.	CSE 599	Computational Complexity	3	1	0	4
15.	CSE 546	Distributed Systems	3	0	2	4

Bouquet 5 of Elective Courses [Specialization in Networks and Distributed Systems]

S. No.	Course Code	Course Name	L	T	P	Credits
1.	CSE 611	Queuing Theory	3	1	0	4
2.	CSE 612	Wireless Sensor Networks	3	0	2	4
3.	CSE 613	Next Generation Networks	3	0	2	4
4.	CSE 614	Mobile Computing	3	0	2	4
5.	CSE 615	Network Administration	3	0	2	4

6.	CSE 616	Wireless Mobile Communications	3	0	2	4
7.	CSE 617	Wireless Sensor Networks with Internet of Things	3	0	2	4
8.	CSE 618	Network and Wireless Security	3	0	2	4
9.	CSE 619	High Performance Computing	3	0	2	4
10.	CSE 620	Optical Networks	3	0	2	4
11.	CSE 621	Smart Sensors and Sensor Networking	3	0	2	4
12.	CSE 622	Special Topics in Wireless Sensor Networks	3	0	2	4
13.	CSE 623	Information Theory and Coding	3	0	2	4
14.	CSE 624	High Speed Network (Special Topic) (4G,5G,6G)	3	0	2	4
15.	CSE 522	Quantum Computing	3	0	2	4
16.	CSE 531	Game Theory	3	1	0	4
17.	CSE 541	Big Data Analytics	3	0	2	4
18.	CSE 545	Cloud Computing	3	0	2	4
19.	CSE 546	Distributed Systems	3	0	2	4
20.	CSE 586	Advanced Computer Networks	3	0	2	4

Total Credits: 80