

**Course Curriculum**  
*For*  
**M. Tech. Computer Science and Engineering**  
**(Analytics)**



**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 (Analytics)**

### **2.1 Preamble**

**M. Tech. Computer Science and Engineering (Analytics):** The objective of the M. Tech. program in Computer Science and Engineering (Analytics) 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. In order to give due importance to applied as well as theoretical aspects of computing, the curriculum for the M.Tech Computer Science and Engineering (Analytics) program covers most of the foundational aspects of computing sciences, and also 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 Computer Science and Engineering (Analytics) 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.
- Students can attend 2 MOOC/NPTEL/any online courses (as per department list).
- 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)**

<b>PEO-1</b>	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.
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<b>PEO-2</b>	Able to draw upon foundational knowledge, learn, adapt, and successfully bring analytical and computational approaches to changing societal and technological challenges.
<b>PEO-3</b>	Students will develop professional skills that prepare them for immediate employment and life-long learning in advanced areas of computer science and related fields.
<b>PEO-4</b>	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.
<b>PEO-5</b>	Students will demonstrate their ability to adapt to a rapidly changing environment by learning and applying new skills and technologies.
<b>PEO-6</b>	Innovative: Drives scientific and societal advancement through technological innovation and entrepreneurship.
<b>PEO-7</b>	Students will be prepared for excellence and leadership roles along diverse career paths, encouraging professional ethics and active participation needed for a successful career.
<b>PEO-8</b>	Strong analytics skills to analyze the real-world problems.

#### 2.4 Program Outcomes (POs)

<b>PO-1</b>	Analyze a complex problem and apply analytics skills to identify solutions.
<b>PO-2</b>	Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
<b>PO-3</b>	Communicate effectively in a variety of professional contexts.
<b>PO-4</b>	Recognize professional responsibilities and make informed judgments based on legal and ethical principles in computing practice.
<b>PO-5</b>	Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

#### 2.5 Program Specific Objectives (PSOs)

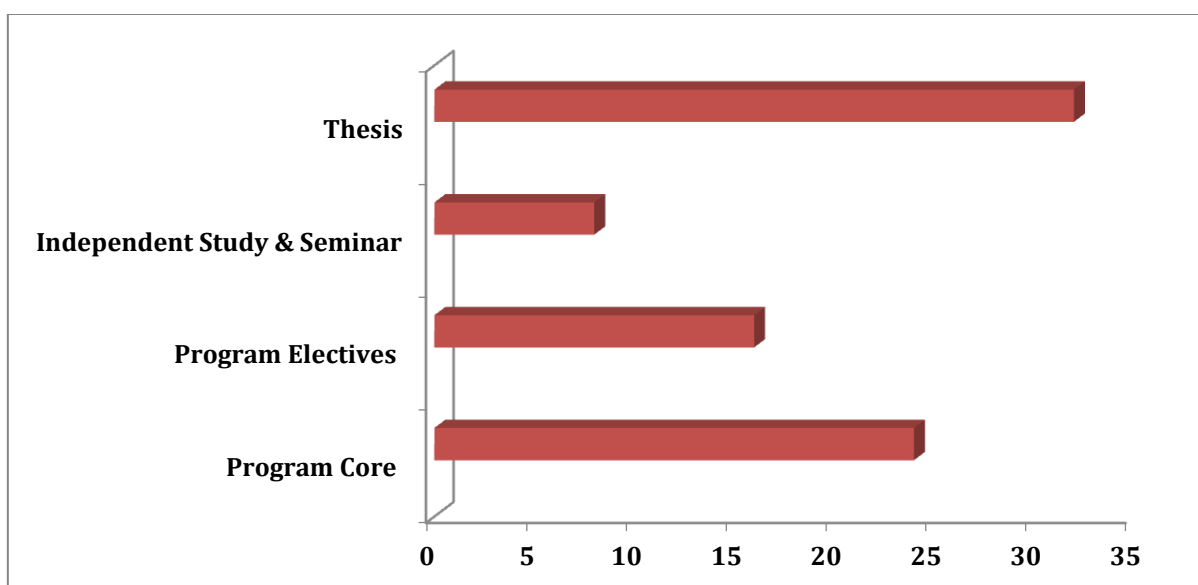
<b>PSO -1</b>	Students will be able to analyze, interpret and provide solutions to the advanced software tools for designing real-life computer science and engineering problems.
<b>PSO -2</b>	Ability to solve complex Knowledge Engineering problems by building systems across various domains, including Systems Engineering, Software Development & Engineering, Networks & Security, Data Mining, and Artificial Intelligence.
<b>PSO -3</b>	Students can pursue higher studies to contribute to research and development and participate in entrepreneurial careers.
<b>PSO -4</b>	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.
<b>PSO -5</b>	Ability to practice as an ethical Analytics 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.

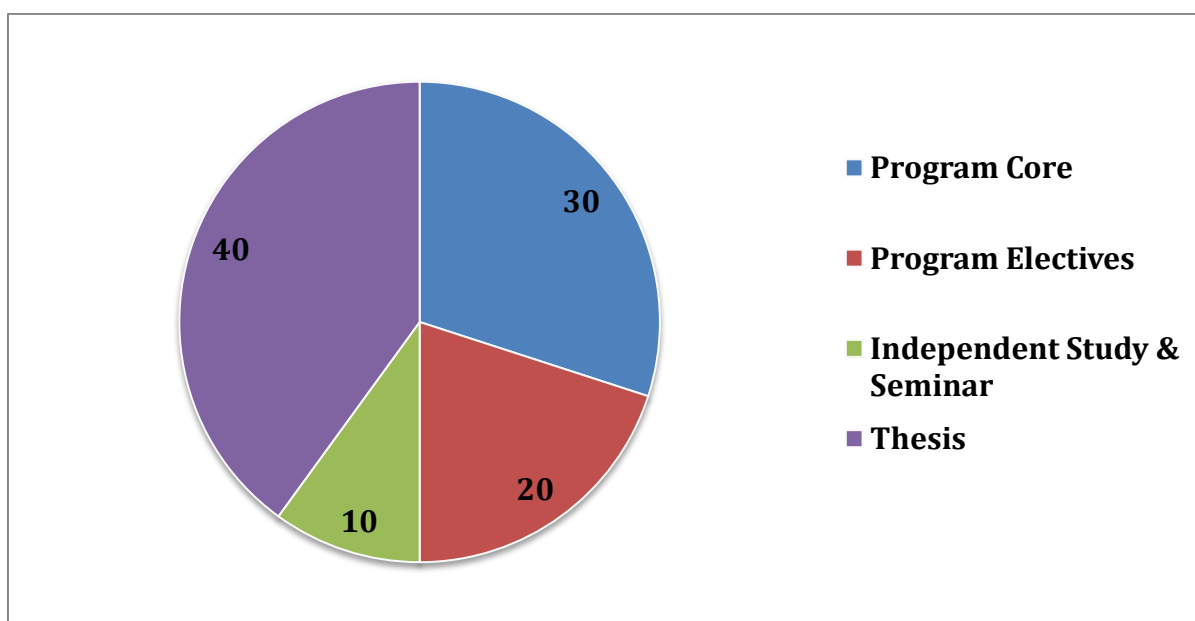
### 3.1 Semester wise Credit Structure

Credits						Total
Sl. No.	Courses	1st Year		2nd Year		
		1 <sup>st</sup> Sem	2 <sup>nd</sup> Sem	3 <sup>rd</sup> Sem	4 <sup>th</sup> Sem	
1	Program Core	12	12	-	-	24
2	Program Electives	8	8	-	-	16
3	Independent Study & Seminar	-	-	4	4	8
4	Thesis	-	-	16	16	32
<b>Total</b>		<b>20</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>80</b>

### 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.	CSA 501	Mandatory Course 1 (Computational Mathematics)	3	1	0	4
2.	CSA XXX	Core 1	3	1/0	0/2	4
3.	CSA XXX	Core 2	3	1/0	0/2	4
4.	CSA XXX	Elective 1	3	1/0	0/2	4
5.	CSA XXX	Elective 2	3	1/0	0/2	4
<b>Total Credits</b>						<b>20</b>

##### SEMESTER – II

S. No.	Course Code	Course Name	L	T	P	Credits
1.	CSA 551	Mandatory Course 2 (Algorithms for Analytics)	3	1/0	0/2	4
2.	CSA XXX	Core 3	3	1/0	0/2	4
3.	CSA XXX	Core 4	3	1/0	0/2	4
4.	CSA XXX	Elective 3	3	1/0	0/2	4
5.	CSA XXX	Elective 4	3	1/0	0/2	4
<b>Total Credits</b>						<b>20</b>

**SEMESTER – III**

S. No.	Course Code	Course Name	L	T	P	Credits
1.	CSA 601	Dissertation I	-	-	-	16
2.	CSA 602	Seminar I	-	-	-	4
<b>Total Credits</b>						<b>20</b>

**SEMESTER – IV**

S. No.	Course Code	Course Name	L	T	P	Credits
1.	CSA 650	Dissertation II	-	-	-	16
2.	CSA 651	Seminar II	-	-	-	4
<b>Total Credits</b>						<b>20</b>

**I. Core Courses**

S. No	Course Code	Course Name	L	T	P	Total
1	CSA 511	Quantitative Techniques	3	1	0	4
2	CSA 512	Optimization Techniques	3	1	0	4
3	CSA 513	Data Mining	3	0	2	4
4	CSA 514	Big Data Analytics	3	0	2	4
5	CSA 515	Simulation and Modeling	3	0	2	4
6	CSA 516	Data Warehousing	3	0	2	4
7	CSA 517	Information Search and Retrieval	3	0	2	4
8	CSA 518	Pattern Recognition and Rule Based Computing	3	0	2	4

**II. Elective Courses**

S. No	Course Code	Course Name	L	T	P	Total
1.	CSA 521	Natural Language Processing	3	0	2	4
2.	CSA 522	Machine Learning	3	0	2	4
3.	CSA 523	Neural Networks	3	0	2	4
4.	CSA 524	Soft Computing	3	0	2	4
5.	CSA 525	Advanced Digital Image Processing	3	0	2	4
6.	CSA 526	Large Network Analysis	3	0	2	4
7.	CSA 527	Knowledge Representation & Reasoning	3	0	2	4
8.	CSA 528	Social Media & Online Marketing	3	0	2	4

9.	CSA 529	Game Theory	3	1	0	4
10.	CSA 530	Cloud Computing	3	0	2	4
11.	CSA 531	Recommender Systems	3	0	2	4
12.	CSA 532	Research Methodology	3	1	0	4
13.	CSA 533	Advanced Databases	3	0	2	4
14.	CSA 534	Special Topics on Distributed Databases	3	0	2	4
15.	CSA 535	Deep Learning and Applications	3	0	2	4
16.	CSA 536	Reinforcement Learning & Applications	3	0	2	4
17.	CSA 537	Database and Online Social Media Security	3	0	2	4
18.	CSA 538	Quantum Computing	3	0	2	4
19.	CSA 539	Human-Machine Interaction	3	0	2	4
20.	CSA 540	Statistical Inference and Simulation Techniques	3	0	2	4
21.	CSA 541	Stream Analytics	3	0	2	4
22.	CSA 542	Blockchain Technology	3	0	2	4
23.	CSA 543	Wireless Sensor Networks	3	0	2	4
24.	CSA 544	Internet of Things	3	0	2	4
25.	CSA 545	Network and Wireless Security	3	0	2	4
26.	CSA 546	Motion Analytics	3	0	2	4
27.	CSA 547	Special Topics in Wireless Sensor Networks	3	0	2	4
28.	CSA 548	High Performance Computing	3	0	2	4
29.	CSA 549	Optical Networks	3	0	2	4
30.	CSA 550	Smart Sensors and Sensor Networking	3	0	2	4