

Course Curriculum
For
B. 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.

B. Tech. (Computer Science and Engineering)

2.1 Preamble

B. Tech. (Computer Science and Engineering): The objective of the B.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. In order to give due importance to applied as well as theoretical aspects of computing, the curriculum for the B.Tech (CSE) 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 BTech program is 160.
- The Curriculum is based on the guidelines of National Education Policy (NEP) – 2020.
- The curriculum has embedded the Multi Exit/ Multi Entry in the BTech program.
- There is provision of Major degree and Minor Degree for students.
- The curriculum is designed to meet the prevailing and ongoing industrial requirements.
- The curriculum includes Project based Education with Projects every year.
- 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 UG 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 **7 electives** are proposed in the complete UG program among them **at least 5 electives** are required from a bouquet to get the specialization (with the respective bouquet) with B.Tech in Computer Science and Engineering.
- Students can attend 2 MOOC/NPTEL/any online courses (as per department list) among the proposed **7 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.
- If any student from the other branch will do **4 courses (16 credits) and one project (2 credits)** from a bouquet and **one project** (from the CSE UG scheme), then the student will be awarded the **minor degree in Computer Science and Engineering with the respective bouquet specialization**. The project should be approved by the CSE dept. Hence, in a minor degree a student should complete **18 credits other than the desired credits** of his/her major degree.

2.3 Cardinal Mentions

- ✓ The students can exit after completing 1st Year, 2nd Year and 3rd Year from the programme and will be awarded Certificate, Diploma and Advanced Diploma in Computer Science and Engineering respectively. A minimum Credit requirement for Certificate is 40 Credits, Diploma is 80 Credits and Advanced Diploma is 120 Credits respectively.
- ✓ The other branches students can opt for Minor Degree in Computer Science and Engineering across any specialization offered by the department from 5th Semester onwards by obtaining 18 credits from Computer Science and Engineering (16 credits in course work and 02 credits in projects) from the respective specializations.

2.4 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.
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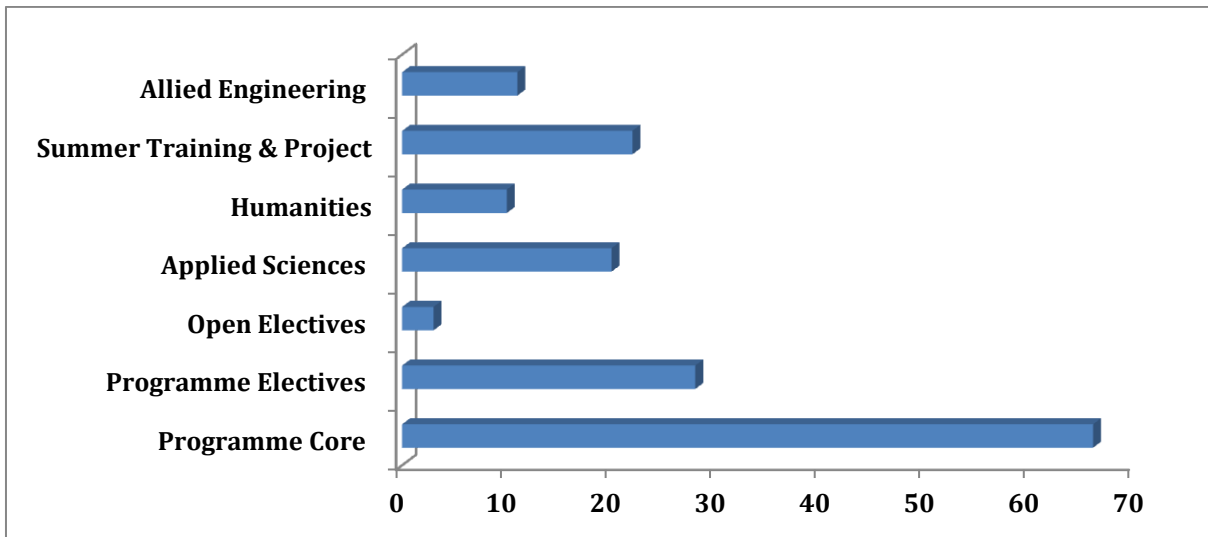
2.5 Program Specific Objectives (PSOs)

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.

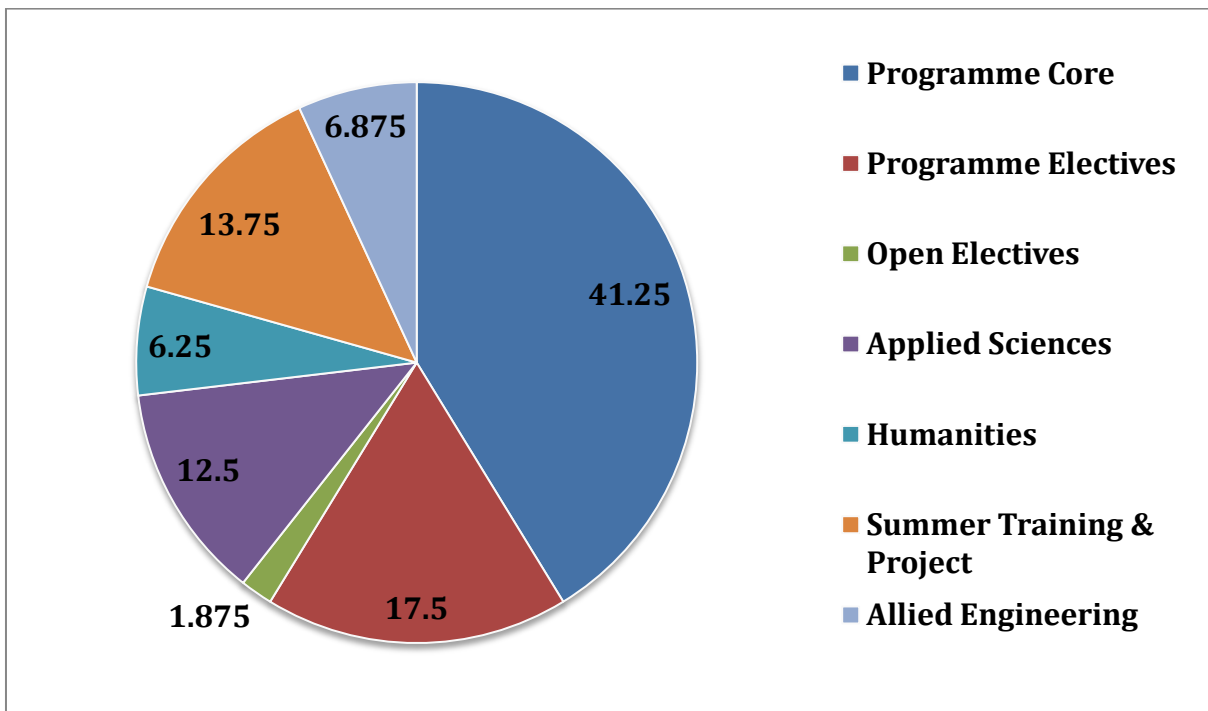
3.1 Semester wise Credit Structure

Sl. No	Courses	Credits								Total
		1 st Year		2 nd Year		3 rd Year		4 th Year		
		1 st Sem	2 nd Sem	3 rd Sem	4 th Sem	5 th Sem	6 th Sem	7 th Sem	8 th Sem	
1	Programme Core	8	11	12	12	12	15	16	4	66
2	Programme Electives	0	0	0	0	4	8	16	0	28
3	Open Electives	0	0	0	0	0	3	0	0	3
4	Applied Sciences	8	4	4	0	4	0	0	0	20
5	Humanities	4	0	0	3	0	0	3	0	10
6	Summer Training & Project	0	2	0	1	0	2	1	16	22
7	Allied Engineering	0	3	4	4	0	0	0	0	11
Total		20	20	20	20	20	20	20	20	160

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.	CSB 101	Problem Solving & Computer Programming	3	0	2	4
2.	CSB 102	Introduction to Computer Systems	3	0	2	4
3.	MAL 101	Advanced Calculus	3	1	0	4

4.	HMB 101	Theory and Practices of Human Ethics	2	0	2	3
5.	MEB 162	Engineering Visualization	3	0	2	4
6.	HMP 102	Communication Skills	0	0	2	1
7.	EAP 101	Extra Academic Activity	-	-	-	-
Total Credits						20

SEMESTER – II

S. No.	Course Code	Course Name	L	T	P	Credits
1.	CSB 151	Data Structures	3	0	2	4
2.	CSL 152	Discrete Structures	3	1	0	4
3.	CSL 153	System Programming	3	0	0	3
4.	MAL 152	Applied Linear Algebra	3	1	0	4
5.	CSP 154	Introduction to Hardware	0	0	2	2
6.	EVP 102	Nature and Care	0	0	1	1
7.	CSP 100	Project I	0	0	4	2
Total Credits						20

SEMESTER – III

S. No.	Course Code	Course Name	L	T	P	Credits
1.	CSB 202	Design and Analysis of Algorithms	3	0	2	4
2.	ECB 206	Digital Electronics and Logic Design	3	0	2	4
3.	CSB 203	Operating System	3	0	2	4
4.	CSB 204	Database Management Systems	3	0	2	4
5.	MAL 202	Probability and Statistics	3	1	0	4
Total Credits						20

SEMESTER – IV

S. No.	Course Code	Course Name	L	T	P	Credits
1.	CSB 251	Computer Architecture and Organization	3	0	2	4

2.	CSB 252	Artificial Intelligence	3	0	2	4
3.	HMB 251	Professional Communication	2	0	2	3
4.	CSB 254	Software Engineering	3	0	2	4
5.	ECB 254	Communication Systems	3	0	2	4
6.	CSP 200	Project II	0	0	2	1
Total Credits						20

SEMESTER – V

S. No.	Course Code	Course Name	L	T	P	Credits
1.	CSB 301	Computer Networks	3	0	2	4
2.	CSB 304	Quantum Computing	3	0	2	4
3.	CSL 302	Theory of Computation	3	1	0	4
4.	CSB 303	Data Mining	3	0	2	4
5.	CSX XXX	Elective 1 [Select in Set 1 from the respective specialization]	3	0	2	4
Total Credits						20

SEMESTER – VI

S. No.	Course Code	Course Name	L	T	P	Credits
1.	CSB 352	Theory of App Development	2	0	2	3
2.	CSB 351	Compiler Design	3	0	2	4
3.	XXX XXX	Open Elective	3	0	0	3
4.	CSX XXX	Elective 2[Select in Set 2 from the respective specialization]	3	0	2	4
5.	CSX XXX	Elective 3[Select in Set 2 from the respective specialization]	3	0	2	4
6.	CSP 300	Project III				2
7.	CSP 301	Internship (during summer break)	Credit will be given in next Semester			
Total Credits						20

SEMESTER – VII

S. No.	Course Code	Course Name	L	T	P	Credits
1.	CSX XXX	Elective 4 [Select in Set 3 from the respective specialization]	3	0/1	2/0	4
2.	CSX XXX	Elective 5 [Select in Set 3 from the respective specialization]	3	0/1	2/0	4
3.	CSX XXX	Elective 6 [Select in Set 3 from the respective specialization]	3	0/1	2/0	4
4.	CSX XXX	Elective 7 [Select in Set 3 from the respective specialization]	3	0/1	2/0	4
5.	HML 401	Management Principles and Practices	3	0	0	3
6.	CSP 401	Internship (completed in last summer break)	-	-	-	1
Total Credits						20

SEMESTER – VIII

S. No.	Course Code	Course Name	L	T	P	Credits
1.	CSP 400	B. Tech Project (Internship inside NIT Delhi / Outside NIT Delhi)	-	-	-	16
2.	CSL XXX	Independent Study	4	0	0	4
Total Credits						20

4.2 Program Elective Courses

Elective Courses

Bouquet 1 of Elective Courses [Specialization in Artificial Intelligence and Machine Learning]

S. No.	Course Code	Course Name	L	T	P	Credits
Set 1						
1	CSB 311	Machine Learning	3	0	2	4
2	CSB 312	Pattern Recognition	3	0	2	4
3	CSB 313	Digital Image Processing	3	0	2	4
4	CSB 314	Computer Vision	3	0	2	4
5	CSL 315	Optimization Techniques	3	1	0	4
6	CSB 405	Fuzzy Logic and Applications	3	0	2	4
7	CSB 406	Cloud Computing	3	0	2	4
Set 2						
8	CSB 316	Information Storage & Retrieval	3	0	2	4

9	CSB 317	Soft Computing	3	0	2	4
10	CSB 406	Deep Learning and Applications	3	0	2	4
11	CSB 407	Natural Language Processing	3	0	2	4
12	CSB 408	Reinforcement Learning and Applications	3	0	2	4
13	CSB 409	Social Network Analysis	3	0	2	4
14	CSB 410	Quantum Machine Learning	3	0	2	4
15	CSB 411	Multi Agents	3	0	2	4
16	CSB 412	Motion Analytics	3	0	2	4
17	CSB 314	Computer Vision	3	0	2	4
18	CSL 315	Optimization Techniques	3	1	0	4
19	CSB 405	Fuzzy Logic and Applications	3	0	2	4
Set 3						
20	CSB 413	Introduction to Cognitive Computing	3	0	2	4
21	CSL 414	Game Theory	3	1	0	4
22	CSB 415	Machine Learning Operations	3	0	2	4
23	CSB 405	Fuzzy Logic and Applications	3	0	2	4
24	CSB 406	Cloud Computing	3	0	2	4
25	CSB 406	Deep Learning and Applications	3	0	2	4
26	CSB 407	Natural Language Processing	3	0	2	4
27	CSB 408	Reinforcement Learning and Applications	3	0	2	4
28	CSB 409	Social Network Analysis	3	0	2	4
29	CSB 410	Quantum Machine Learning	3	0	2	4
30	CSB 411	Multi Agents	3	0	2	4
31	CSB 412	Motion Analytics	3	0	2	4
32	CSB 405	Fuzzy Logic and Applications	3	0	2	4

Bouquet 2 [Specialization in Data Science]

S. No	Course Code	Course Name	L	T	P	Credits
Set 1						
1	CSL 321	Mathematical Foundation of Data Science	3	1	0	4
2	CSB 311	Machine Learning	3	0	2	4
3	CSB 322	Introduction to Statistical Learning	3	0	2	4
4	CSL 315	Optimization Techniques	3	1	0	4
Set 2						
5	CSB 322	Introduction to Statistical Learning	3	0	2	4
6	CSL 315	Optimization Techniques	3	1	0	4
7	CSB 323	Data Handling & Visualization	3	0	2	4
8	CSL 324	High-Dimensional Probability for Mathematicians and Data Scientists	3	1	0	4
9	CSB 325	Time Series Analysis	3	0	2	4

10	CSB 326	Distributed System	3	0	2	4
11	CSB 409	Social Network Analysis	3	0	2	4
12	CSB 421	Internet of Things	3	0	2	4
13	CSB 406	Cloud Computing	3	0	2	4
14	CSB 422	Big Data Analytics	3	0	2	4
15	CSB 423	Computer Vision	3	0	2	4
16	CSB 424	Deep Learning and Applications	3	0	2	4
Set 3						
17	CSB 425	Information Security and Privacy	3	0	2	4
18	CSB 426	Business Intelligence and Analytics	3	0	2	4
19	CSB 427	Advanced Databases	3	0	2	4
20	CSL 414	Game Theory	3	1	0	4
21	CSB 409	Social Network Analysis	3	0	2	4
22	CSB 421	Internet of Things	3	0	2	4
23	CSB 406	Cloud Computing	3	0	2	4
24	CSB 422	Big Data Analytics	3	0	2	4
25	CSB 423	Computer Vision	3	0	2	4
26	CSB 424	Deep Learning and Applications	3	0	2	4

Bouquet 3 [Specialization in Information Security]

S. No	Course Code	Course Name	L	T	P	Credits
Set 1						
1	CSB 331	Network and Data Security	3	0	2	4
2	CSB 332	Mobile and Wireless Security	3	0	2	4
3	CSB 333	Cryptography and Computer Security	3	0	2	4
4	CSB 334	Threat Intelligence	3	0	2	4
5	CSB 335	Information Security	3	0	2	4
6	CSB 436	Block chain Technology	3	0	2	4
7	CSB 437	Cyber Physical System Security	3	0	2	4
Set 2						
8	CSB 438	Security Engineering	3	0	2	4
9	CSB 439	Database and Online Social Media Security	3	0	2	4
10	CSB 333	Cryptography and Computer Security	3	0	2	4
11	CSB 334	Threat Intelligence	3	0	2	4
12	CSB 335	Information Security	3	0	2	4
Set 3						
13	CSB 436	Block chain Technology	3	0	2	4
14	CSB 437	Cyber Physical System Security	3	0	2	4
15	CSB 438	Security Engineering	3	0	2	4
16	CSB 439	Database and Online Social Media Security	3	0	2	4
17	CSB 440	Introduction to Cyber Security	3	0	2	4

18	CSB 441	Machine Learning Applications for Cyber Security	3	0	2	4
19	CSB 442	Malware analysis and digital Forensic	3	0	2	4
20	CSB 443	Cyber Security and Laws	3	0	2	4
21	CSB 444	Software Security	3	0	2	4

Bouquet 4 of Elective Courses [Specialization in Computer Systems]

S. No	Course Code	Course Name	L	T	P	Credits
Set 1						
1	CSB 341	Advanced Computer Networks	3	0	2	4
2	CSB 342	Project Management for Software Development	3	0	2	4
3	CSB 343	Computer Graphics	3	0	2	4
4	CSB 344	Object Oriented Programming	3	0	2	4
Set 2						
5	CSB 345	Distributed Systems	3	0	2	4
6	CSB 346	Parallel Algorithms	3	0	2	4
7	CSB 347	Concurrent and Parallel Programming	3	0	2	4
8	CSL 348	Randomized Algorithms	3	1	0	4
9	CSB 406	Cloud Computing	3	0	2	4
10	CSL 315	Optimization Techniques	3	1	0	4
Set 3						
11	CSB 406	Cloud Computing	3	0	2	4
12	CSL 315	Optimization Techniques	3	1	0	4
13	CSB 451	Advanced Computer Architecture	3	0	2	4
14	CSB 452	Advanced Operating Systems	3	0	2	4
15	CSB 453	Advanced Database Management Systems	3	0	2	4
16	CSL 454	Computational Complexity	3	1	0	4
17	CSB 455	Simulation and Modeling	3	0	2	4
18	CSB 456	Real Time 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	Total
Set 1						
1	CSB 351	Wireless Sensor Networks	3	0	2	4
2	CSB 406	Cloud Computing	3	0	2	4
3	CSB 352	Optical Networks	3	0	2	4
Set 2						
4	CSL 353	Queuing Theory	3	1	0	4
5	CSB 345	Distributed Systems	3	0	2	4

6	CSB 354	Mobile Computing	3	0	2	4
7	CSB 355	Wireless Mobile Communications	3	0	2	4
8	CSB 356	Network and Wireless Security	3	0	2	4
9	CSB 357	High Performance Computing	3	0	2	4
10	CSB 358	Information Theory and Coding	3	0	2	4
11	CSL 315	Optimization Techniques	3	1	0	4
12	CSB 471	Network Administration	3	0	2	4
Set 3						
13	CSB 471	Network Administration	3	0	2	4
14	CSB 341	Advanced Computer Networks	3	0	2	4
15	CSB 472	Next Generation Networks	3	0	2	4
16	CSL 414	Game Theory	3	1	0	4
17	CSB 473	Wireless Sensor Networks with Internet of Things	3	0	2	4
18	CSB 474	Quantum Computing	3	0	2	4
19	CSB 475	Smart Sensors and Sensor Networking	3	0	2	4
20	CSB 476	Special Topics in Wireless Sensor Networks	3	0	2	4
21	CSB 477	High Speed Network (Special Topic) (4G, 5G, 6G)	3	0	2	4

Total Credits: 160