

COMPUTER SCIENCE, MASCS

Penn Engineering expands its graduate portfolio with the Master of Applied Science in Computer Science (MAS-CS), offered in both online and on-campus formats. Building on the success and legacy of the Master of Computer and Information Technology (MCIT) program, MAS-CS reflects Penn Engineering's ongoing commitment to providing rigorous, accessible, and forward-looking education for a global community of learners.

The MAS-CS is designed for students from non-computer science backgrounds who seek to gain a strong foundation in computing and prepare for impactful careers in technology and interdisciplinary fields. The curriculum combines core study in programming, systems, algorithms, databases, and artificial intelligence with opportunities to take courses in emerging domains such as Data Science, Cybersecurity, Software Systems, Artificial Intelligence, and Innovation & Technology Leadership.

Through its applied and flexible design, the MAS-CS equips students with the technical fluency, analytical skills, and creative problem-solving mindset needed to thrive in today's technology-driven world—whether on campus in Philadelphia or online anywhere in the world.

The degree and major requirements displayed are intended as a guide for students entering in the Fall of 2026 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.

Curriculum

A total of 10 course units are required for the MAS-CS degree.¹

Code	Title	Course Units
Required Courses ¹		
CIT 5910	Introduction to Software Development ²	1
CIT 5920	Mathematical Foundations of Computer Science ²	1
CIT 5930	Introduction to Computer Systems ²	1
CIT 5940	Data Structures and Software Design	1
CIT 5950	Computer Systems Programming	1
CIT 5960	Algorithms and Computation	1
Electives		
Select 4 Electives ⁴		4
Total Course Units		10

¹ It is expected that full-time MAS-CS students will take the six required courses during the first two semesters of enrollment and four electives during their second year.

² Offered in the Fall semester only. These courses are prerequisites for CIT 5940 Data Structures and Software Design, CIT 5950 Computer Systems Programming and CIT 5960 Algorithms and Computation, respectively, which are offered in Spring semester only.

³ Courses can be waived or replaced only with the permission of the instructor. As of Fall 2016, students must pass a proficiency exam in

order to waive a course. All CIT courses must be completed (or waivers obtained) during the first semester that the course is offered during the student's time in the program. Students may not waive or replace more than two required CIT courses. Courses that are waived need to be replaced with a suitable alternative.

⁴ Electives

- MAS-CS students must also complete four graduate-level (5000 or higher) electives.
- At least three must be a CIS course; one may be an approved non-CIS course.
- The following courses are **recommended** for all MAS-CS students:
 - CIS 5500 Database and Information Systems
 - CIS 5550 Internet and Web Systems
 - CIS 5730 Software Engineering
 - CIS 5570 Programming for the Web
- Additional suitable electives include:
 - CIS 5020 Analysis of Algorithms
 - CIS 5050 Software Systems
 - CIS 5190 Applied Machine Learning
 - CIS 5510 Computer and Network Security
 - CIS 5520 Advanced Programming
 - CIS 5530 Networked Systems
 - CIS 5590 Programming and Problem Solving
- Click here (<https://www.cis.upenn.edu/courseinformation/>) for all CIS graduate course options.
- One course from the list of pre-approved non CIS graduate courses, found here (<https://www.cis.upenn.edu/graduate/advising/handbook/approved-non-cis-electives/>), may be used as an elective. Graduate courses offered in other departments may count as an elective with the prior approval of the MAS-CS program director; in general, such courses must have a strong technical component in order to be approved.

Continuing in the Master of Science in Computer & Information Science (CIS/MSE) Program

MAS-CS students may apply to continue in the Master of Science in Engineering in Computer & Information (CIS/MSE) program. Students pursuing this dual degree route need to satisfy a minimum GPA requirement, have earned a high grade in at least one CIS elective, and have completed the majority of the MAS-CS requirements at the time of applying. In addition to the ten courses required for the MAS-CS program, students continuing in the CIS/MSE program need to take six additional CIS graduate courses for a total of sixteen credits; satisfactory completion results in the awarding of the MAS-CS and CIS/ MSE degrees. Click here (<https://www.cis.upenn.edu/mse-in-cis-requirements/>) to access the CIS/MSE degree requirements. Click here (<https://grad.seas.upenn.edu/student-handbook/academic-options/>) to access the MAS-CS-CIS/MSE dual degree application.

Curriculum

The MAS-CS degree consists of 10 course units (CUs) and is designed to give students a solid foundation in computer science, while offering flexibility to explore a range of concentrations.

Core MAS-CS Curriculum

Code	Title	Course Units
Required Courses		6
CIT 5910	Introduction to Software Development	
CIT 5920	Mathematical Foundations of Computer Science	
CIT 5930	Introduction to Computer Systems	
CIT 5940	Data Structures and Software Design	
CIT 5950	Computer Systems Programming	
CIT 5960	Algorithms and Computation	
Technical Electives		3
Students must complete 3 Elective CUs from the list below.		
CIS 5150	Fundamentals of Linear Algebra and Optimization	
CIS 5210	Artificial Intelligence	
CIS 5300	Natural Language Processing	
CIS 5450	Big Data Analytics	
CIS 5470	Software Analysis	
CIS 5490	Wireless Communications for Mobile Networks and Internet of Things	
CIS 5500	Database and Information Systems	
CIS 5510	Computer and Network Security	
CIS 5530	Networked Systems	
CIS 5550	Internet and Web Systems	
CIS 5690	GPU Computing for Machine Learning Systems	
CIS 5810	Computer Vision & Computational Photography	
EAS 5160	Mathematical Foundations for Machine Learning I: Probability	
EAS 5170	Mathematical Foundations for Machine Learning II: Linear Algebra	
EAS 5830	Blockchains	
or CIT 5820	Blockchains and Cryptography	
EAS 5850	Imaging Informatics	
EAS 5860	Medical Image Analysis	
ESE 5410	Machine Learning for Data Science	
ESE 5420	Statistics for Data Science	
ESE 5460	Principles of Deep Learning	
HCIN 6022	Digital Health ¹	
Open Electives		1
Students may complete 1 Elective CU from the list below, or they may complete an additional 1 CU from the above Technical Elective list.		
DATS 5750	Cloud Technologies Practicum	
EAS 5240	Technology Ethics and the Legal Landscape	
EAS 5740	How to Use Data	
Total Course Units		10

¹ HCIN 6022 should only be taken as an elective if students plan to apply for the Graduate Certificate in Health Care and Technology from the Perelman School of Medicine. All SEAS students entering the Graduate

Certificate in Health Care and Technology must take this course as part of their degree studies. SEAS students taking this course for credit in an engineering degree must complete a final project focused on an area of computer science.

Concentrations

Engineering Entrepreneurship

Code	Title	Course Units
MAS-CS Core		6
Entrepreneurship Electives		3
Students must complete 3 Elective CUs from the list below.		
EAS 5070	Intellectual Property and Business Law for Engineers	
EAS 5240	Technology Ethics and the Legal Landscape	
EAS 5440	Technology Innovation and Entrepreneurship (In Development)	
EAS 5470	Engineering Product Management from Theory to Practice	
EAS 5720	Design Thinking (In Development)	
ESE 5400		
Open Elective		1
Total Course Units		10

Artificial Intelligence

Code	Title	Course Units
MAS-CS Core		6
AI Electives		3
Students must complete 3 Elective CUs from the list below.		
CIS 5210	Artificial Intelligence	
CIS 5300	Natural Language Processing	
CIS 5690	GPU Computing for Machine Learning Systems	
EAS 5240	Technology Ethics and the Legal Landscape	
ESE 5410	Machine Learning for Data Science	
ESE 5420	Statistics for Data Science	
ESE 5460	Principles of Deep Learning	
CIS 5980	Artificial Intelligence Capstone (In Development)	
Open Elective		1
Total Course Units		10

Data Science

Code	Title	Course Units
MAS-CS Core		6
DS Electives		3
Students must complete 3 Elective CUs from the list below.		
CIS 5450	Big Data Analytics	
CIS 5500	Database and Information Systems	
ESE 5410	Machine Learning for Data Science	
ESE 5420	Statistics for Data Science	

DATS 5980	Data Science Capstone	
Open Elective		1
Total Course Units		10

Software Systems

Code	Title	Course Units
MAS-CS Core		6
Systems Electives		3
Students must complete 3 Elective CUs from the list below.		
CIS 5470	Software Analysis	
CIS 5490	Wireless Communications for Mobile Networks and Internet of Things	
CIS 5510	Computer and Network Security	
CIS 5530	Networked Systems	
CIS 5550	Internet and Web Systems	
CIS 5690	GPU Computing for Machine Learning Systems	
DATS 5750	Cloud Technologies Practicum	
EAS 5830	Blockchains	
Open Elective		1

Cybersecurity

Code	Title	Course Units
MAS-CS Core		6
Cyber Electives		3
Students must complete 3 Elective CUs from the list below.		
CIS 5510	Computer and Network Security	
CIS 5560	Cryptography	
CIS XXXX	HCI & Security (To Be Developed)	
Open Elective		1
Total Course Units		10

On Campus Program

First Year		Course Units
Fall		
CIT 5910	Introduction to Software Development	1
CIT 5920	Mathematic Foundations of Computer Science	1
CIT 5930	Introduction to Computer Systems	1
	Course Units	3.00
Spring		
CIT 5940	Data Structures and Software Design	1

CIT 5950	Computer Systems Programmin	1
CIT 5960	Algorithms and Computation	1
	Course Units	3.00

Second Year		Course Units
Fall		
CIS Elective 5000 level or higher		2
Non-CIS Elective (Approved List)		1
	Course Units	3.00
Spring		
CIS Elective 5000 level or higher		1
	Course Units	1.00
	Total Course Units	10.00

Online Program

Example Plan of Study for Part Time Online (3 Years)

First Year		Course Units
Fall		
CIT 5910	Introduction to Software Development	1
	Course Units	1.00
Spring		
CIT 5920	Mathematical Foundations of Computer Science	1
	Course Units	1.00
Summer		
CIT 5930	Introduction to Computer Systems	1
	Course Units	1.00
Second Year		
Fall		
CIT 5940	Data Structures and Software Design	1
CIT 5950	Computer Systems Programmin	1
	Course Units	2.00
Spring		
CIT 5960	Algorithms and Computatior	1
	Course Units	1.00

Summer		
EAS 5240	Technology Ethics and the Legal Landscape	1
CIS 5210	Artificial Intelligence	1
Course Units		2.00
Third Year		
Fall		
ESE 5460	Principles of Deep Learning	1
Course Units		1.00
Spring		
ESE 5420	Statistics for Data Science	1
Course Units		1.00
Total Course Units		10.00