

(For students admitted in 2020-21 under the 4-year degree)

## BEng in Computer Engineering

In addition to the requirements of their major programs, students are required to complete the University requirements for graduation. For details please refer to the respective section on this website.

Some courses can be used to fulfill both Major and University Common Core Requirements. Students may reuse a maximum of 9 credits of these courses to count towards both Requirements.

Students may use no more than 6 credits earned from courses offered in pure online delivery mode to satisfy the graduation requirements of a degree program. This 6-credit limit does not apply to credits obtained through the credit transfer procedures of the University.

For students graduating with an additional major, they must take all the requirements specified for that major, within which they must complete at least 20 single-counted credits. These 20 credits cannot be used to fulfill any other requirements for graduation except for the 120-credit degree requirement.

### Major Requirements

#### Engineering Fundamental Course(s)

			Credit(s) attained
COMP		Note: COMP 1021 <u>OR</u> COMP 1022P	3
COMP	1021	Introduction to Computer Science	3
COMP	1022P	Introduction to Computing with Java	3
ENGG	1010	Academic Orientation	0
LANG	2030	Technical Communication I	3
MATH		Note: [(MATH 1012 <u>OR</u> MATH 1013 <u>OR</u> MATH 1023) <u>AND</u> (MATH 1014 <u>OR</u> MATH 1024)] <u>OR</u> [MATH 1020]	4-7
MATH	1012	Calculus IA	4
MATH	1013	Calculus IB	3
MATH	1014	Calculus II	3
MATH	1020	Accelerated Calculus	4
MATH	1023	Honors Calculus I	3
MATH	1024	Honors Calculus II	3
MATH	2011	Introduction to Multivariable Calculus	3
MATH	2111	Matrix Algebra and Applications	3
PHYS		Note: PHYS 1112 <u>OR</u> PHYS 1312	3
PHYS	1112	General Physics I with Calculus	3
PHYS	1312	Honors General Physics I	3
PHYS		Note: PHYS 1114 <u>OR</u> PHYS 1314	3
PHYS	1114	General Physics II	3
PHYS	1314	Honors General Physics II	3

SENG		Engineering Introduction course (If the students take an introduction course included in their major, this course can be counted towards their major requirement.)	3-4
COMP	1021	Introduction to Computer Science	3
ELEC	1100	Introduction to Electro-Robot Design	4
ELEC	1200	A System View of Communications: from Signals to Packets	4
BIEN	1010	Introduction to Biomedical Engineering	3
CENG	1000	Introduction to Chemical and Biological Engineering	3
CIVL	1100	Discovering Civil and Environmental Engineering	3
ENGG	1100	First Year Cornerstone Engineering Design Project Course	3
IEDA	2010	Industrial Engineering and Decision Analytics	3
IEDA	2200	Engineering Management	3
ISDN	1002	Redefining Problems for the Real Needs	3
ISDN	1006	Human-centered Innovation	3
MECH	1901	Automotive Engineering	3
MECH	1902	Energy Systems in a Sustainable World	3
MECH	1905	Buildings for Contemporary Living	3
MECH	1906	Mechanical Engineering for Modern Life	3
MECH	1907	Introduction to Aerospace Engineering	3

## Required Course(s)

			<b>Credit(s) attained</b>
CPEG		Note: [CPEG 1971 <u>AND</u> (CPEG 4901 <u>OR</u> CPEG 4902 <u>OR</u> CPEG 4911 <u>OR</u> CPEG 4912)] <u>OR</u> [CPEG 4910] (Students taking the Research Option must take either CPEG 4902 or CPEG 4912)	6
CPEG	1971	Industrial Experience	0
CPEG	4901	Computer Engineering Final Year Project in COMP	6
CPEG	4902	Computer Engineering Final Year Thesis in COMP	6
CPEG	4910	Co-op Program	6
CPEG	4911	Computer Engineering Final Year Project in ELEC	6
CPEG	4912	Computer Engineering Final Year Thesis in ELEC	6
CPEG	2930	Academic and Professional Development I	0
CPEG	3930	Academic and Professional Development II	0
COMP		Note: (COMP 2011 <u>AND</u> COMP 2012) <u>OR</u> COMP 2012H	5-8
COMP	2011	Programming with C++	4
COMP	2012	Object-Oriented Programming and Data Structures	4
COMP	2012H	Honors Object-Oriented Programming and Data Structures	5
COMP/ELEC		Note: COMP 2611 <u>OR</u> ELEC 2350	4
COMP	2611	Computer Organization	4
ELEC	2350	Introduction to Computer Organization and Design	4

COMP/ELEC		Note: COMP 2711 <u>OR</u> COMP 2711H <u>OR</u> ELEC 2600	4
COMP	2711	Discrete Mathematical Tools for Computer Science	4
COMP	2711H	Honors Discrete Mathematical Tools for Computer Science	4
ELEC	2600	Probability and Random Processes in Engineering	4
COMP	3511	Operating Systems	3
ELEC	1100	Introduction to Electro-Robot Design	4
ELEC		Note: ELEC 1200 <u>OR</u> ELEC 2100 <u>OR</u> ELEC 2400 (2 out of 3 courses)	8
ELEC	1200	A System View of Communications: from Signals to Packets	4
ELEC	2100	Signals and Systems	4
ELEC	2400	Electronic Circuits	4
ELEC	3300	Introduction to Embedded Systems	4
ENGG	2010	Engineering Seminar Series	0
LANG		Note: LANG 4030 <u>OR</u> LANG 4031	3
LANG	4030	Technical Communication II for CSE & CPEG	3
LANG	4031	Technical Communication II for ECE & CPEG	3

## Elective(s)

			<b>Minimum credit(s) required</b>
COMP/ELEC		CPEG Restricted Elective (1 course from the specified elective list)	3
COMP	4521	Mobile Application Development	3
COMP	4611	Design and Analysis of Computer Architectures	3
ELEC	4310	Embedded System Design	4
ELEC	4320	FPGA-based Design: From Theory to Practice	3
ELEC	4330	Mobile Embedded Systems: Hardware Platform, Software Development, and Applications	3
COMP/ELEC/ ENGG		Area Courses (At least 2 courses should be taken from one single area and at least 2 courses outside that area. Courses taken as Major Required Courses may not be counted towards the elective requirement.)	15
<b>Artificial Intelligence / Theory Area</b>			
COMP	3211	Fundamentals of Artificial Intelligence	3
COMP	3711	Design and Analysis of Algorithms	3
COMP	3711H	Honors Design and Analysis of Algorithms	4
COMP	3721	Theory of Computation	3
COMP	4211	Machine Learning	3
COMP	4221	Introduction to Natural Language Processing	3
COMP	4331	Data Mining	3
COMP	4332	Big Data Mining and Management	3
COMP	4421	Image Processing	3

COMP	4471	Deep Learning in Computer Vision	3
COMP	5211	Advanced Artificial Intelligence	3
COMP	5212	Machine Learning	3
COMP	5213	Introduction to Bayesian Networks	3
COMP	5221	Natural Language Processing	3
COMP	5223	Perception and Information Processing for Robotics	3
COMP	5331	Knowledge Discovery in Databases	3
COMP	5421	Computer Vision	3
COMP	5711	Introduction to Advanced Algorithmic Techniques	3
COMP	5712	Introduction to Combinatorial Optimization	3
COMP	5713	Computational Geometry	3
ELEC	3180	Data-Driven Portfolio Optimization	3
ELEC	3210	Machine Learning and Information Processing for Robotics	3
ELEC	4230	Deep Learning for Natural Language Processing	3
ELEC	4240	Deep Learning in Computer Vision	3
<b>Communications Area</b>			
ELEC	3100	Signal Processing and Communications	4
ELEC	3600	Electromagnetics: From Wireless to Photonic Applications	4
ELEC	4110	Digital Communications and Wireless Systems	3
ELEC	4150	Information Theory and Error-Correcting Codes	3
ELEC	4610	Engineering Optics	4
ELEC	4620	Photonics and Optical Communications	4
<b>Embedded System / Robotics Area</b>			
COMP	4511	System and Kernel Programming in Linux	3
COMP	4521	Mobile Application Development	3
COMP	4611	Design and Analysis of Computer Architectures	3
ELEC	3200	System Modeling, Analysis and Control	4
ELEC	3210	Machine Learning and Information Processing for Robotics	3
ELEC	4220	Introduction to Robotics: From Mobile Robots to Manipulators	4
ELEC	4250	Robotic Manipulation and Mobility	3
ELEC	4310	Embedded System Design	4
ELEC	4320	FPGA-based Design: From Theory to Practice	3
ELEC	4330	Mobile Embedded Systems: Hardware Platform, Software Development, and Applications	3
ENGG	4950	Engineering Special Project	1-4
<b>Graphic / Multimedia Area</b>			
COMP	4411	Computer Graphics	3
COMP	4421	Image Processing	3
COMP	4431	Multimedia Computing	3
COMP	4441	Computer Music	3
COMP	4451	Game Programming	3
COMP	4461	Human-Computer Interaction	3
COMP	4462	Data Visualization	3

COMP	4471	Deep Learning in Computer Vision	3
COMP	5411	Advanced Computer Graphics	3
COMP	5421	Computer Vision	3
ELEC	3170	Digital Media and Multimedia Applications	4
<b>Semiconductor / VLSI Area</b>			
ELEC	3310	Digital Fundamentals and System Design	4
ELEC	3400	Introduction to Integrated Circuits and Systems	4
ELEC	3450	Introduction to Smart Electric Power Systems	3
ELEC	3500	Microelectronic Devices and Technology	4
ELEC	4410	CMOS VLSI Design	3
ELEC	4420	Analogue Integrated Circuits Design and Analysis	4
ELEC	4430	Integrated Power Electronics	3
ELEC	4510	Semiconductor Materials and Devices	3
ELEC	4520	Integrated Circuit Fabrication Technology	3
ELEC	4530	Fundamentals of Photovoltaic and Renewable Energy	3
<b>Signal Processing Area</b>			
ELEC	3100	Signal Processing and Communications	4
ELEC	4130	Digital Image Processing	3
ELEC	4810	Introduction to Biosensors and Bioinstrumentation	4
ELEC	4820	Medical Imaging	3
ELEC	4830	Statistical Signal Analysis and Applications in Neural Engineering	3
<b>Software / Database Area</b>			
COMP	3021	Java Programming	3
COMP	3031	Principles of Programming Languages	3
COMP	3111	Software Engineering	4
COMP	3111H	Honors Software Engineering	4
COMP	3311	Database Management Systems	3
COMP	4021	Internet Computing	3
COMP	4111	Software Engineering Practices	3
COMP	4311	Principles of Database Design	3
COMP	4321	Search Engines for Web and Enterprise Data	3
COMP	4331	Data Mining	3
COMP	4332	Big Data Mining and Management	3
COMP	4521	Mobile Application Development	3
COMP	4651	Cloud Computing and Big Data Systems	3
COMP	5111	Fundamentals of Software Analysis	3
COMP	5112	Parallel Programming	3
COMP	5311	Database Architecture and Implementation	3
COMP	5331	Knowledge Discovery in Databases	3
<b>Systems / Networking Area</b>			
COMP	3632	Principles of Cybersecurity	3
COMP	4511	System and Kernel Programming in Linux	3

COMP	4521	Mobile Application Development	3
COMP	4611	Design and Analysis of Computer Architectures	3
COMP	4621	Computer Communication Networks I	3
COMP	4631	Computer and Communication Security	3
COMP	4632	Practicing Cybersecurity: Attacks and Counter-measures	3
COMP	4641	Social Information Network Analysis and Engineering	3
COMP	4651	Cloud Computing and Big Data Systems	3
COMP	5621	Computer Networks	3
COMP	5622	Advanced Computer Communications and Networking	3
COMP	5631	Cryptography and Security	3
ELEC	3120	Computer Communication Networks	3
ELEC	4310	Embedded System Design	4

*Students may opt to graduate with or without an option. Students who take an option MUST complete all requirements specified in addition to the major requirements.*

## Option(s)

### Research Option

Students in the Research Option should also take either CPEG 4902 or CPEG 4912 as specified in the major requirements.

<i>Elective Course(s)</i>	<b>Minimum credit(s) required</b>
COMP/ELEC/ UROP	2-3
Research Electives [Students should take either (ELEC 5900 <u>AND</u> UROP 1100) or a 3-credit COMP 5000-level course to fulfill this requirement.]	
COMP	Any COMP course at 5000-level
ELEC 5900	1
UROP 1100	1
COMP/ELEC	CPEG Electives (1 PG-level course as approved by advisor) 3