COMPUTER ENGINEERING, BSE

Computer Engineering is the discipline that designs and engineers computer systems from digital circuits, through compilers and runtime systems, to networking and world-wide distributed systems. As an engineering discipline, the computer engineer must appreciate the physical aspects of computations (energy, delay, area, reliability, costs) and be able to expertly navigate the multidimensional tradeoff space associated with implementing computations. Since today's high performance programmable computing devices mean enormous computational tasks can be performed entirely in software, the computer engineer must manage computational capabilities and functionalities which migrate between hardware and software driven by advancing technology and these engineering tradeoffs. Recent advances in manufacturing make it economical to construct systems containing billions of components and millions of lines of code, and these systems are increasingly invaluable in life-critical and real-time systems; computer engineering is the discipline that seeks to understand how to design and manage systems of this complexity while providing adequate guarantees of safety and trustworthiness for such systems.

For more information: https://www.seas.upenn.edu/prospective-students/undergrad/majors/computer-engineering/

Computer Engineering (CMPE) Major Requirements

40 course units are required. Read more about the Undergraduate Student Handbook (http://www.seas.upenn.edu/undergraduate/handbook).

Code	Title	Course Units
Engineering		
CIS 120	Programming Languages and Techniques I	1
CIS 121	Programming Languages and Techniques II	1
ESE 150	Digital Audio Basics	1
ESE 215	Electrical Circuits and Systems	1.5
CIS 240	Introduction to Computer Systems	1
ESE 350	Embedded Systems/Microcontroller Laboratory	1.5
CIS 350	Software Design/Engineering	1
ESE 370	Circuit-Level Modeling, Design, and Optimization for Digital Systems	1
CIS 371	Computer Organization and Design	1
CIS 380	Computer Operating Systems	1
CIS 441	Embedded Software for Life-Critical Applications	1
Networking		
ESE 407	Introduction to Networks and Protocols	1
or CIS 553	Networked Systems	
Concurrency Lab		
Select one of the following:		1
CIS 455	Internet and Web Systems	
CIS 565	GPU Programming and Architecture	
ESE 532	System-on-a-Chip Architecture	
Senior Design		
CIS 400	Senior Project	1
or ESE 450	Senior Design Project I - EE and SSE	
CIS 401	Senior Project	1
or ESE 451	Senior Design Project II - EE and SSE	
Math and Natural Science		
MATH 104	Calculus, Part I	1
MATH 114	Calculus, Part II	1
MATH 240	Calculus, Part III	1
Select one of the following:		1
ESE 301	Engineering Probability	
CIS 261	Discrete Probability, Stochastic Processes, and Statistical Inference	
ENM 321	Engineering Statistics	
CIS 160	Mathematical Foundations of Computer Science	1
Select one of the following:		1
PHYS 140	Principles of Physics I (without laboratory)	
PHYS 150	Principles of Physics I: Mechanics and Wave Motion	
PHYS 170	Honors Physics I: Mechanics and Wave Motion	
MEAM 110	Introduction to Mechanics	
Select one of the following:		1
ESE 112	Engineering Electromagnetics	
PHYS 151	Principles of Physics II: Electromagnetism and Radiation	
PHYS 171	Honors Physics II: Electromagnetism and Radiation	
Select one of the following:		1
CHEM 101	General Chemistry I	
BIOL 101	Introduction to Biology A	
BIOL 121	Introduction to Biology - The Molecular Biology of Life	
MATH or Natural Science Elective		1
Natural Science Lab [1]		
Select one of the following:		1
PHYS 050	Physics Laboratory I	
PHYS 150	Principles of Physics I: Mechanics and Wave Motion	
PHYS 170	Honors Physics I: Mechanics and Wave Motion	
MEAM 147	Introduction to Mechanics Lab	
BIOL 101/121	Introduction to Biology A	
CHEM 053	General Chemistry Laboratory I	
Technical Electives		
Math, Science, or Engineering Electives [2]		3
Technical Elective: Select one of the following:		1
ESE 400	Engineering Economics	
EAS 545	Engineering Entrepreneurship I	
EAS 595	Foundations of Leadership	
MGMT 237	Management of Technology	
Math, Science, or Engineering Elective		

Social Sciences and Humanities [3]		
Select 2 Social Science courses		2
Select 2 Humanities courses		2
Select 1 Social Science or Humanities course		1
Select 1 Social Science, Humaities, or Technology in Business & Society courses		1
Ethics Requirement: Select one of the following :		1
EAS 203	Engineering Ethics	
CIS 125	Technology and Policy	
Free Elective		
Select 3 course units of free electives		3
Total Course Units		40

1 One approved Natural Science Lab (.5 cu) is required. Satisfied with PHYS 150 Principles of Physics I: Mechanics and Wave Motion, PHYS 170 Honors Physics I: Mechanics and Wave Motion,MEAM 147 Introduction to Mechanics Lab, BIOL 101 Introduction to Biology A, BIOL 121 Introduction to Biology - The Molecular Biology of Lifeor CHEM 053 General Chemistry Laboratory I

2 A limit of two freshman-level Engineering courses may be used as a Technical Elective.

3 The Social Science & Humanities Depth, Writing & Ethics Requirements can be satisfied with the 7 total course units.

The degree and major requirements displayed are intended as a guide for students entering in the Fall of 2018 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.
