Computer Engineering, B.S.

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About

- Bachelor of Science in Computer Engineering
- Bachelor of Science in Computer Engineering, Honors

Computer Engineering is a discipline that bridges the fields of Computer Science and Electrical Engineering. It may be simplistic to state that computer engineers "build computers," but it is not far from the truth. Computer engineers are unique in having the balanced skills to bring the hardware and software work together. Building computers alone does not begin to describe the scope of computer engineering. Computers are now embedded in smart phones, drones, wireless networks, internet devices, autonomous vehicles and are an integral part of AI, cybersecurity and machine learning. The Villanova computer engineering program is a balanced program bringing together such fundamentals as computer architecture, networks, operating systems, digital electronics, embedded systems as well as electives in biomedical engineering, machine learning and cybersecurity.

Mission Statement

The mission of Villanova University's Department of Electrical and Computer Engineering is to empower students to become leaders in their chosen professions and to prepare them for a life of service to others.

Program Educational Objectives

The Program Educational Objectives of the Computer Engineering program are to produce graduates who:

- Use their knowledge, analytical, and design skills to generate and validate sustainable and technically appropriate solutions to practical real-world problems in their chosen profession;
- Communicate and work effectively with others having different roles or responsibilities in their professional work environments;
- Continue to develop their professional knowledge and skills throughout their career;
- Succeed in their careers by practicing their chosen discipline with professionalism, care, and integrity.

The curriculum is structured to provide a thorough foundation in the fundamentals of electrical and computer engineering. Analysis and design are emphasized throughout the curriculum, using a project-based structure to teach students how to work on their own and in teams and to synthesize engineering solutions by utilizing their analytical skills and knowledge. Heavy emphasis is placed on developing oral and written communication skills. The curriculum also provides opportunities for an increased awareness of the broader implications of technology and of the social responsibilities of the profession. The design process is emphasized throughout all four years, and design projects are included in the laboratory courses. The sophomore and junior years include core courses that provide a foundation for the senior year, which includes technical and professional electives and an in-depth design project. The computer engineering curriculum not only provides a solid foundation in the core fundamentals but

offers the flexibility for students to pursue other professional interests. The curriculum includes professional electives, free elective, science/math elective, computer engineering track electives, and humanities electives to serve this purpose. Students have used this flexibility to pursue minors in business, mechatronics, computer science, cognitive science, physics, astronomy, mathematics, foreign languages, history, and theology, to name a few; although, applying these electives towards a minor/concentration is not a requirement. In addition, students have used the flexibility of the curriculum to prepare for post-graduate study in medicine, law, business, education, and engineering.

The computer engineering program offers technical elective courses in the following specialized areas: computer architecture, digital signal processing, computer networks, multimedia systems, microcontrollers, digital integrated electronics and microfabrication, embedded systems, and computer security.

Students in the computer engineering program acquire experience with computers and their engineering applications, beginning with the engineering programming and applications course in the freshman year and continuing throughout the curriculum in the sophomore-level fundamentals courses, junior-level core courses, and senior-level technical electives. In addition to the activities and services offered by the university and the College of Engineering, the Electrical and Computer Engineering (ECE) Department provides the following additional services and activities for its students: an academic advisor, to assist students with the implementations of their academic plans; the ECE Walk-in Tutoring Office, to assist ECE students with their upper-level courses; and college-level and departmental student organizations.

Program: Engineering
Type: Bachelor of Science

Freshman Year

First Semester

Course	Title	Credits
ACS 1000	Ancients	3
THL 1000	Faith, Reason, and Culture	3
CHM 1103	General Chemistry Lab I	1
CHM 1151	General Chemistry I	4
MAT 1500	Calculus I	4
EGR 1200	Egr. Interdisciplinary Proj. I	3
EGR 1001	Career Compass First Yr A	0.5

Second Semester

Course	Title	Credits
ACS 1001	Moderns	3
MAT 1505	Calculus II	4
PHY 2400	Physics I Mechanics	3
ECE 1205	ECE Freshman Projects	3
ECE 1260	EGR Prog and Applic	3
ECE 1261	EGR Prog and Applic	1
EGR 1002	Career Compass First Yr B	0.5

Sophomore Year

First Semester

Course	Title	Credits
ECE 2170	Fundamentals of CPE	3
ECE 2171	Fundamentals of CPE Lab	1
ECE 2160	C++ Algorithms & Data Struct	3
ECE 2161	C++ Algorithms&Data Struct Lab	1
MAT 2705	Diff Equation with Linear Alg	4
CSC 1300	Discrete Structures	3
CSC 2014	Java Bootcamp	1
EGR 2003	Career Compass Second Yr A	0.5

Second Semester

Course	Title	Credits
ECE 2030	Electric Circuits Fundamentals	3
ECE 2031	Elect Circuit Fundamentals Lab	1
ECE 2172	Digital Systems	3
ECE 2173	Digital Systems Lab	1
PHY 2402	Physics II Elec & Magnet	3
	Elective - Ethics	3
	Elective - Math/Science	3
EGR 2004	Career Compass Second Yr B	0.5

Junior Year

First Semester

Course	Title	Credits
CSC 1700	Analysis of Algorithms	3
ECE 2292	Engineering Probability&Stats	3
ECE 3170	Computer Architecture	3
ECE 3171	Computer Architecture Lab	1
ECE 3450	Digital Electronics	3
	Elective - THL (2000 or above)	3
EGR 3005	Career Compass Third Yr A	0.5

Second Semester

Course	Title	Credits
ECE 3180	Computer Networks	3
ECE 3242	Fundamentals of Signal Process	3
ECE 3476	Computer and Network Security	3
ECE 3600	Operating Systems	3
ECE 3971	Design Seminar - CPE	2
EGR 3006	Career Compass Third Yr B	0.5

Senior Year

First Semester

Course	Title	Credits
ECE 4971	Design Project - CPE	3
	Elective - Technical	3
	Elective - Humanities	3
	Elective - Free	3
	Elective - Free	3

Second Semester

Course	Title	Credits
ECE 4973	Design Project Report - CPE	1
	Elective - Technical	3
	Elective - Free	3
	Elective - Free	3
	Elective - Free	3

Category Descriptions

Elective - Ethics

Credits: 3

Electives are subject to change. Electives may be added to this list at the discretion of the College of Engineering.

Choose one of the following:

Course	Title	Credits
CRM 1001	Introduction to Criminology	3
ETH 2050	The Good Life:Eth & Cont Prob	3
PHI 2115	Ethics for Health Care Prof	3
PHI 2121	Environmental Ethics	3
PHI 2130	Business Ethics	3
PHI 2155	Engineering Ethics	3
PHI 2180	Computer Ethics	3
PHI 2550	Technology & Society	3
PHI 4125	Bioethics	3
PJ 5400	Ethics, Justice and the Family	3
NS 4200	Leadership and Ethics	3
SBI 2006	Corporate Responsibility	3
VSB 2007	Corp Respon & Regulation	3

Elective - Math/Science

Credits: 3

Electives are subject to change. Electives may be added to this list at the discretion of the College of Engineering.

Choose one of the following:

- AST 1072, 1074, 2120, 2121, 2122
- BIO 1055 through 8999
- CHM 1152 through 8999
- GEV 1050, 1051, 1750
- MAT 2500, 2600, 3000 through 8999
- MET 1221, 1222
- NS 3100
- PHY 2414, 2416, 4000-8999

Elective - THL (2000 or above)

Credits: 3

Theology (THL) course or course with CTHL (Core Theology) attribute, at the 2000 level or above.

Elective - Technical

Credits: 3

Electives are subject to change. Electives may be added to this list at the discretion of the College of Engineering.

The three Computer Engineering Technical Electives can be taken from the list of approved classes below. A student can take all three electives from the ECE department or two ECE classes and one CSC class. If a student wishes to take a second CSC class as one of their three technical electives they must get permission from the Chair of the Electrical and Computer Engineering Department.

- Seniors can substitute ECE Graduate Level Courses (ECE ≥ 7000) by completing the Permission to Register for Engineering Graduate Course Form. The form can be found on the Current Engineering Undergraduate Students Intranet site.

Course	Title	Credits
ECE 5250	Biomedical Instrumentation	3
ECE 5251	Biomedical Signal Processing	3
ECE 5170	Intro to Post-Quantum Computin	3
ECE 5172	Fund of Digitl Hardware Design	3
ECE 5400	Applied Machine Learning	3
ECE 5450	Microcontrollers & Applic	3
ECE 5451	Adv Microcontroller App Design	3
CSC 4300	Computer Graphics	3
CSC 4380	Info Visualization	3
CSC 4480	Principles of Database Systems	3
CSC 4500	Artificial Intelligence	3
CSC 4510	Machine Learn&Theory&Evolution	3
CSC 4630	Software Dev and Systems	3
CSC 4700	Software Engineering	3
CSC 4730	Human Computer Interaction	3
CSC 4800	Web Application Development	3
CSC 4810	Mobile App Development	3

Elective - Humanities

Credits: 3

Electives are subject to change. Electives may be added to this list at the discretion of the College of Engineering.

One three credit course from:

- Theology (THL) course or course with CTHL (Core Theology) attribute, at the 2000 level or above
- Philosophy (PHI)
- Peace and Justice (PJ)
- ETH 2050 - The Good Life: Ethics & Cont Prob
- EGR 2930 - Catholic Social Teaching for EGRs
- Any Humanities or Social Science course with a PJ (Peace and Justice) attribute.

Elective - Free

Credits: 3

Any Villanova three credit course or Villanova courses that when combined add up to three credits (for example, three 1-credit Honors courses)