

# COLLEGE OF ENGINEERING

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## HISTORY

The second degree granting unit inaugurated at Villanova University was the College of Engineering, which began instruction in 1905 under the name of the School of Technology. It was the fourth engineering program to be established at a Catholic school of higher education in the United States (after The Catholic University of America, 1896, Manhattan College, 1896, and the University of Notre Dame, 1897). Dr. A.B. Carpenter, a graduate of Lehigh University, was hired in 1904 to organize and direct the School. He was ably assisted by Rev. James J. Dean, a young faculty member in the sciences. It was their responsibility to develop the curricula, hire faculty and plan the facilities needed. Programs in Civil and Electrical Engineering were the first to be initiated, with a total of twelve students enrolled. In 1908, an undergraduate program in Mechanical Engineering was established, and in 1909, the first engineering bachelor's degrees were awarded. An undergraduate program in Chemical Engineering was established in 1919. In the years following the Second World War, the College expanded its degree offerings to the masters level, establishing graduate programs in each of its four engineering departments. A fifth undergraduate degree program in Computer Engineering was added in 1993. A combined Bachelors/Masters Program is available in all programs. In 2003, an Interdisciplinary Doctoral Program was instituted. All of the College's undergraduate degree programs are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). There are three research units in the College: The Center for Advanced Communications (CAC), The Center for Nonlinear Dynamics and Control (CENDAC), and the Villanova Center for the Environment (VCE), a joint effort with the College of Liberal Arts and Sciences.

## MISSION STATEMENT

Villanova University is an independent coeducational institution of higher learning founded by the Augustinian Order of the Roman Catholic Church. The University is a community of persons of diverse professional, academic, and personal interests who, in a spirit of collegiality, cooperate to achieve their common goals and objectives in the transmission, the pursuit, and the discovery of knowledge. The College of Engineering is a tangible expression of the University's mission, tradition, and commitment to society.

As a major engineering college under Catholic auspices, it is committed to the education of engineers within the framework of the University's Judeo-Christian humanistic tradition and the heritage of the Order of St. Augustine.

The College of Engineering, consistent with the mission of Villanova University, is dedicated to the education of engineers who are technically competent, liberally educated, and ethically motivated. The College emphasizes undergraduate instruction and encourages research and scholarly activities in all of its departments. High quality research develops the faculty's intellectual skills and contributes to society's reservoir of knowledge. Graduate engineering programs within the College provide opportunities for advanced study, professional development, and participation in research.

The College mission is to provide an engineering education and to perform research in a manner that benefits society, yields an education based on established enduring values, and attracts quality students and faculty.

## **OBJECTIVES**

The College of Engineering strives to prepare its graduates to understand their roles in a technological society, to make constructive contributions to it, and to provide ethical and moral leadership in their profession and communities. It accomplishes this by various methods, but primarily by integrating into the curriculum the values and morality of the University's Augustinian heritage. In addition to being professionally competent, graduates are expected to have an understanding of their professional and ethical responsibilities, the impact on engineering solutions in a global and societal context, and an appreciation of humanistic concepts in literature, the arts, and philosophy.

The College pursues these objectives by stressing:

- Excellence in teaching
- Faculty development through research and professional activities
- Emphasis on the design process so that the students are exposed to real-world situations
- Graduating students with the following attributes:
  - Ability to apply scientific and mathematical concepts and principles to solve problems in real-world context
  - Ability to plan and conduct experimental investigations, and to analyze and interpret their results
  - Ability to be an effective member of a project team
  - Ability to communicate ideas and information
  - Understanding of the role of the engineering profession and technology, including appreciation of concepts drawn from the humanities and social sciences
  - Development of high professional and ethical standards
  - Motivation and capability to acquire, evaluate, and assimilate knowledge and continue the learning experience

## **DEGREES OFFERED**

The College of Engineering offers full-time (day) academic programs leading to the following degrees: Bachelor of Science in Chemical Engineering, Bachelor of Science in Civil Engineering, Bachelor of Science in Computer Engineering, Bachelor of Science in Electrical Engineering, and Bachelor of Science in Mechanical Engineering.

The undergraduate engineering programs offered by Villanova University are fully accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

## DEGREE REQUIREMENTS

The undergraduate engineering curriculum provides the foundation for careers in engineering as well as the basis for further study in engineering and other professions such as law, medicine, and management. Studies concentrate on mathematics, physics, chemistry, engineering science, and engineering analysis and design within a particular engineering discipline.

The curriculum places special emphasis upon developing oral and written communication skills, and it offers opportunities to develop an appreciation of the social sciences and humanities, and the flexibility to pursue minors. Courses in the humanities are included in each curriculum to make the student engineer more fully aware of social responsibilities and better able to consider non-technical factors in the engineering decision making process. Extensive hands-on laboratory experience leads to required projects for all seniors to ensure professional preparation in the fundamentals of the design process within the real constraints of problem solving. In order to qualify for a bachelor's degree in the College of Engineering, undergraduate engineering students must successfully complete all of the first year core curriculum courses, those major courses required for the particular engineering degree sought, and a series of electives, as indicated in the following sections. They must also achieve cumulative overall and technical grade point averages of at least 2.00 in their course work.

At least half of all the engineering courses and, normally, the final 30 credits of an engineering bachelor's degree program, must be taken at Villanova University. All undergraduate degree requirements should normally be completed within a six-year period. NOTE: It is the responsibility of each student to know and to fulfill all degree requirements. In order to keep the curriculum abreast of the latest engineering developments, Villanova University reserves the right to change the program requirements without prior notice.

## CORE CURRICULUM FOR STUDENTS ENTERING IN FALL 2004 OR LATER

Freshman Year						
First Semester		Credits		Second Semester		Credits
CHM 1151	General Chemistry	4		Elective	Science Elective <sup>2</sup>	3/4
CHM 1103	General Chemistry Laboratory I	1		CHS 1001 <sup>1</sup>	Modern Thought: Enlightenment to Present	3
CHS 1000 <sup>1</sup>	Ancient Medieval and Renaissance Thought	3		EGR 1705	Engineering Computation	3
EGR 1700	Introduction to Engineering	3		MAT 1505	Calculus II	4

MAT 1500	Calculus I	4		PHY 2400	Physics I, Mechanics	3
THL 1050  or THL 1051	Christian Theology, an Introduction or Christianity in History	3				

NOTE <sup>1</sup>: This course may be taken in either semester.

NOTE <sup>2</sup>: Science elective depends upon proposed major. Students should consult adviser for correct course.

## **ENGINEERING CURRICULUM ELECTIVE REQUIREMENTS IN HUMANITIES AND SOCIAL SCIENCE**

In addition to required Freshman Year courses and specified courses for each degree program, candidates for degrees in engineering must successfully complete 12 credits from the following:

- THL 1050 Christian Theology: an Introduction or THL 1051 Christianity in History
- One 3-credit Theology course at the 2000 level or above.
- Two additional 3-credit courses chosen from among the following:
  - o Theology courses at the 2000 level or above
  - o Any Philosophy course
  - o Any Peace and Justice course
  - o ETH 2050 Ethical Traditions and Contemporary Life
  - o EGR 2001 Engineering: The Humanistic Context. (This course is required in some programs. Students should consult adviser.)

## **ELECTIVES**

All students select their remaining humanities and social science electives from among the courses listed in this catalog and offered by the following departments.

Humanities	Social Sciences
Arab & Islamic Studies Art History (except skills courses) Classical Studies Communication (except skills courses) English (Literature) History Honors Program (for eligible students only) Modern Languages (except speaking courses in native language) Philosophy Theatre (except skills courses) Theology (2000 and above)	Economics Geography Peace and Justice Political Science Psychology Sociology Women's Studies

Courses primarily emphasizing skills (such as acting, painting, sculpting, public speaking, etc.) are not acceptable in all programs. Students should consult Department Chair.

## DECLARATION OF MAJOR

All engineering students are enrolled in a common freshman year curriculum with the exception of a science elective taken in the second semester. Prior to the end of their freshman year all engineering students are required to declare their major field of study, i.e., Chemical, Civil, Computer, Electrical, or Mechanical Engineering.

Engineering students who wish to change their major within the College of Engineering must make this request in writing to the Dean of Engineering. Engineering students who wish to change their major to an area outside of engineering must apply for admission to the dean of the college offering that program.

# DEGREE PROGRAMS

## BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING

The chemical engineer typically uses the principles of mathematics, chemistry, physics and engineering sciences to creatively solve technical and commercial problems arising in industries which manufacture products by chemical reactions. These solutions must respond to economic constraints as well as social, ethical and safety implications. The chemical engineer may also apply these principles in related fields where the management of chemical transformations is important, such as preservation of the environment, pharmaceutical manufacturing, bio-engineering or the creation of new medical technology. Finally, the chemical engineer can apply understanding of fundamental principles to fields that interact indirectly with chemical technology, such as industrial management and patent law.

**Program Educational Objectives** - The overall educational objectives of the Bachelor of Science in Chemical Engineering Program are:

- To prepare our graduates to enter the chemical engineering profession immediately after receiving the bachelor's degree, as well as to develop the

personal capabilities that allow them to enter a variety of other professions should they choose to do so.

- ❑ To develop an understanding of the scientific principles underlying technology, upon which the practice of the profession of chemical engineering is based.
- ❑ To develop the technical skills needed to practice the chemical engineering profession, at an entry level immediately upon graduation, and to pursue an advanced degree in chemical engineering at some time after graduation if qualified.
- ❑ To develop those personal and interpersonal skills that facilitate effective practice of the chemical engineering profession and lead to the opportunity for career success.
- ❑ To develop broadly educated, well-rounded graduates, as is consistent with the Augustinian tradition.
- ❑ To prepare graduates whose capabilities will enable them to continue to learn and grow professionally, and who are able to take advantage of professional opportunities as they arise, to enhance their career.

The department has formulated specific educational outcomes that will achieve these overall educational objectives. For a detailed listing of these outcomes, please refer to the department website at [www.engineering.villanova.edu/che](http://www.engineering.villanova.edu/che).

**Curricular Philosophy.** The early years of the chemical engineering curriculum emphasize the basic principles of natural and engineering sciences. Later courses use these principles to develop skill in chemical engineering design - the solving of non-routine, open-ended problems requiring the exercise of judgment, and constrained by economic, safety, reliability or other requirements. Courses gradually develop the students' abilities, with the complexity of design experiences systematically increasing throughout the required courses in chemical engineering science, and culminating in the senior process design course.

Technical electives in the junior and senior years allow the student to tailor the program toward career goals. In the senior year, the student develops the ability to work independently by carrying out a chemical engineering project. All stages of the curriculum apply computers in various modes, ranging from programming personal computers for the solution of simple problems, through the use of computers for process monitoring and control, to the use of sophisticated software packages for process design.

The curriculum includes several technical electives, to be chosen from a list of approved courses under the guidance of a faculty member designated as the student's academic adviser. The student may elect one such technical elective outside the Chemical Engineering Department, as described in the guidance manual. (A copy of the guidance manual which lists acceptable elective courses and describes the advising process is available from the ChE academic advisers or from the department, as well as on the ChE website: [www.engineering.villanova.edu/che](http://www.engineering.villanova.edu/che)).

Program of Studies for students matriculating before Fall 2003

Sophomore Year					
First Semester		Credits	Second Semester		Credits
CHE 2041	Chemical Process Calculations	4	CHE 2032	Chemical Engineering Thermodynamics I	3

CHM 3415	Physical Chemistry for Engineers I	3		CHE 2232	Fluid Flow Operations	3
CHM 3401	Physical Chemistry Lab I	1		CHE 2811	Professional Development I	1
MAT 2705	Differential Equations with Linear Algebra	4		CHE 2432	Modeling and Numerical Methods I	3
PHY 2402	Physics II: Electricity and Magnetism	3		CHM 3416	Physical Chemistry for Engineers II	3
Elective	Humanities THL>2000	3		CHM 3402	Physical Chemistry Lab II	1
				PHY 2403	Physics Lab for Engineering	1
				Elective	Humanities from THL, PHI, PJ, ETH 2050, EGR 2001	3

Junior Year						
First Semester		Credits		Second Semester		Credits
CHE 3031	Heat Transfer Operations	3		CHE 3032	Principles of Mass Transfer	3
CHE 3131	Chemical Engineering Thermodynamics II	3		CHE 3232	Dynamic Simulation and Control Applications	3
CHE 3132	Chemical Engineering Economics	3		CHE 3231	Modeling and Numerical Methods II	3
CHE 3911	Chemical Engineering Lab I	1		CHE 3922	Chemical Engineering Lab II	2
CHE 3821	Professional Development II	2		CHE 3822	Professional Development III	2
CHM 2211	Organic Chemistry I	3		CHM 2212	Organic Chemistry II	3
CHM 2201	Organic Chemistry Lab I	1		CHM 2202	Organic Chemistry Lab II	1
Elective	Humanities from THL, PHI, PJ, ETH 2050, EGR 2001	3				

Senior Year						
First Semester		Credits		Second Semester		Credits
CHE 4131	Process Design	3		Electives	Technical	9
CHE 4031	Chemical Reaction Engineering	3		Elective	Humanities/ Social Science	3
CHE 4921	Chemical Engineering Lab III	2		Elective	Free	3
CHE 4831	Chemical Engineering Project	3				
CHE 4821	Professional Development IV	2				
Electives	Technical	6				

Program of Studies for students matriculating Fall 2003 or later

Sophomore Year						
First Semester		Credits		Second Semester		Credits
CHE 2041	Chemical Process Calculations	4		CHE 2032	Chemical Engineering Thermodynamics I	3
CHM 2211	Organic Chemistry I	3		CHE 2232	Fluid Flow Operations	3
CHM 2201	Organic Chemistry Lab I	1		CHM 2212	Organic Chemistry II	3
MAT 2705	Differential Equations with Linear Algebra	4		CHM 2202	Organic Chemistry Lab II	1
PHY 2402	Physics II: Electricity and Magnetism	3		PHY 2403	Physics Lab for Engineering	1
Elective	Humanities THL>2000	3		Elective	Humanities/ Social Science	3
				Elective	Ethics from any department	3

Junior Year						
First Semester		Credits		Second Semester		Credits

CHE 3031	Heat Transfer Operations	3		CHE 3032	Principles of Mass Transfer	3
CHE 3131	Chemical Engineering Thermodynamics II	3		CHE 3232	Simulation and Control	3
CHE 2432	Modeling and Numerical Methods I	3		CHE 3842	Safety Analysis	2
CHE 3841	Applied Statistics	2		CHE 3922	Chemical Engineering Lab II	2
CHE 3911	Chemical Engineering Lab I	1		CHM 3416	Physical Chemistry for Chemical Engineers	3
	Technical Elective	3		CHM 3402	Physical Chemistry Lab for Chemical Engineers	1
Elective	Humanities from THL, PHI, PJ, ETH 2050, EGR 2001	3			Technical Elective	3

Senior Year						
First Semester		Credits		Second Semester		Credits
CHE 4131	Process Design I	3		CHE 4832	Chemical Engineering Research II	3
CHE 4031	Chemical Reaction Engineering I	3			Technical Electives	9
CHE 4831	Chemical Engineering Research I	3		Elective	Humanities/ Social Science	3
CHE 4821	Tech. Literature Investigations	1				
CHE 4921	Chemical Engineering Laboratory III	2				
	Technical Elective	3				

## **BACHELOR OF SCIENCE IN CIVIL ENGINEERING**

Civil engineers are involved in the planning, design, construction, and operation of facilities essential to modern life such as dams, bridges, highways, buildings, airports, harbors, river and shore protection, drinking water supplies, wastewater treatment, solid

and hazardous waste management and disposal, offshore structures, and space platforms. Because these projects are often of a magnitude that affects large segments of the population, the responsibility of the civil engineer extends beyond mere physical facilities into the social, political, and economic welfare of those they serve.

**Mission Statement:** Our mission is to provide our students with a high quality, contemporary, broad-based civil engineering education within a Judaeo-Christian, humanistic context preparing our students for professional practice, graduate study, and life-long learning.

**Program Educational Objectives** - Graduates of our Department will be prepared to:

- Use their broad based civil engineering backgrounds to perform as entry-level engineers in general civil engineering or in environmental, geotechnical, structural, transportation, or water resources engineering.
- Enter graduate school in the disciplines listed above or closely related disciplines, as well as other areas such as business and law.
- Continue the process of life-long learning as required for long-term personal and professional growth.
- Recognize their professional and ethical responsibilities to society as members of the engineering professional community.
- Use communication, computer, and teamwork skills to help themselves and their employers succeed.
- Relate their personal and professional lives to the Judaeo-Christian, humanistic tradition.

The broad-based curriculum provides flexibility and meets student needs through a selection of electives. More information on the Civil Engineering program can be found at the Department website [www.engineering.villanova.edu/ce](http://www.engineering.villanova.edu/ce).

**Program of Studies**

Sophomore Year						
First Semester		Credits		Second Semester		Credits
CEE 2104	Mechanics: Statics & Dynamics	4		CEE 2103	Mechanics of Solids	3
CEE 2602	Civil Egr. Measurements	3		CEE 2311	Environmental Egr. Science	3
MAT 2500	Calculus III	4		MAT 2705	Differential Equations with Linear Algebra	4
PHY 2402	Physics II: Electricity and Magnetism	3		Elective	Humanities THL>2000	3
GLY 2805	Geology for Engineers	3		Elective	Free	3

Junior Year						
First Semester		Credits		Second Semester		Credits
CEE 3321	Water & Wastewater Treatment	3		CEE 3211	Transportation Engineering	3
CEE 3401	Structural Analysis	3		CEE 3412	Structural Design	3
CEE 3500	Fluid Mechanics	3		CEE 3511	Hydraulic Egr. & Hydrology	3
CEE 3704	CE Numerical & Statistical Analysis	3		CEE 3801	Soil Mechanics	3
CEE 3902	CE Materials	2		CEE 3901	Soil Mechanics Laboratory	1
CEE 3921	Environmental Egr. Laboratory	1		CEE 3911	Fluid Mechanics Laboratory	1
				CEE 3912	Structural Egr. Laboratory	1
				Elective	Humanities from THL, PHI, PJ, ETH 2050	3

Senior Year						
First Semester		Credits		Second Semester		Credits
CEE 4601	CEE Professional Practice	3		CEE 4606	CEE Capstone Design Project	3
CEE 4701	Economy and Risk	3		EGR 2001	Engineering: Humanistic Context	3
Elective	CEE Senior Elective <sup>1</sup>	3		Elective	Social Science from ECO, GEO, PJ, PSC, PSY, SOC, WS	3
Elective	CEE Senior Elective <sup>1</sup>	3		Elective	Humanities Elective	3
Elective	CEE Senior Elective <sup>1</sup>	3		Elective	Free	3
Elective	Technical Elective <sup>2</sup>	3		Elective	Technical Elective <sup>2</sup>	3

<sup>1</sup>CEE Senior Electives include:

- CEE 4224 Transportation Facilities Design
- CEE 4331 Solid & Hazardous Waste
- CEE 4412 Advanced Structural Engineering
- CEE 4521 Water Resources Engineering Design
- CEE 4801 Foundation Design

<sup>2</sup>Technical Electives include

- CEE 4235 Advanced Transportation Engineering
  - CEE 4612 CEE Undergraduate Research,
- and other courses defined as Technical Electives by the College of Engineering

## **BACHELOR OF SCIENCE IN COMPUTER ENGINEERING**

The objectives of the computer engineering program are to prepare graduates for successful professional careers in computer engineering and to nurture in them the skills required for career-long learning whether through informal self-study, continuing education, or formal advanced study in computer engineering or a related discipline.

**Program Educational Objectives** - The educational objectives for the computer engineering program are listed below.

- Graduates will master, to the satisfaction of the faculty, the fundamentals of the discipline.
- Graduates will have substantial experience in engineering design.
- Graduates will develop and nurture skills for life-long learning and continuing professional development.
- Graduates will be able to communicate effectively.
- Graduates will have opportunities to explore the technological and social implications of their professional activities.

A more detailed description of these objectives is available.

The curriculum is structured to provide a thorough foundation in the fundamentals of computer engineering, electrical engineering and computer science. Design, as well as analysis, is emphasized throughout the curriculum, using a project-based structure to teach students how to learn on their own, work in teams, and synthesize new engineering solutions by using their knowledge and analytical skills. Great importance 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 in computer algorithms, digital system design, computer architectures, microprocessor systems, computer interfacing, and the C programming language. This provides a foundation for the senior year which includes electives and an in-depth design project. Students can tailor their senior year towards a variety of objectives by carefully choosing electives in computer engineering, the humanities, and other subjects. The Electrical and Computer Engineering Department provides these specialized areas: computer communications security, multimedia, fuzzy logic, neural networks, microcontrollers, software engineering, computer networks, and real-time digital signal processing.

Senior electives can also be used to complement the computer engineering requirements with studies in fields outside of the department. Possibilities include a computer science minor, a mathematics minor, a business minor, and a minor or concentration in cognitive science. Selection of specializations and study options require

each student to assume an active and responsible role in the planning and decision making as the program unfolds. To aid in this, detailed information is available from the departmental office and can be discussed with the Department Chair or the Computer Engineering program adviser.

### Dual Degree Program Leading to a Bachelor of Science in Computer Engineering and a Bachelor of Science in Electrical Engineering

Superior students may earn both the Bachelor of Science in Computer Engineering and the Bachelor of Science in Electrical Engineering degrees. The two degrees are awarded simultaneously upon completion of all requirements for both degrees. Because of the significant overlap between the two programs, it is possible to earn both degrees in four and a half years. Interested students should consult the ECE special programs adviser as early in their undergraduate studies as possible to obtain additional information.

#### Program of Studies – Class of 2006 & 2007

Sophomore Year						
First Semester		Credits		Second Semester		Credits
CSC 1051	Algorithms and Data Structures I	4		CSC 1052	Algorithms and Data Structures II	4
ECE 2042	Fundamentals of Computer Engineering I	3		ECE 2044	Fundamentals of Computer Engineering II	3
ECE 2043	Fundamentals of Computer Engineering I Lab I	1		ECE 2045	Fundamentals of Computer Engineering II Lab II	1
ECE 2052	Fundamentals of Electrical Engineering I	3		ECE 2054	Fundamentals of Electrical Engineering II	3
ECE 2053	Fundamentals of Electrical Engineering I Lab I	1		ECE 2055	Fundamentals of Electrical Engineering II Lab II	1
ECE 2409	Fundamentals of MATLAB	2		PHY 2402	Physics II: Electricity and Magnetism	3
MAT 2705	Differential Equations with Linear Algebra	4		Elective	Humanities <sup>3</sup>	3

Junior Year						
First Semester		Credits		Second Semester		Credits
CSC 1300	Discrete Structures	3		CSC 4700	Software Engineering	3

CSC 1600	Operating Systems	3		ECE 3240	Discrete-Time Signals and Systems	4
ECE 3424	Expert Systems Programming	3		ECE 3450	Digital Electronics	3
ECE 3445	Computer Architecture	4		ECE 3720	Engineering Probability and Statistics	3
ECE 3900	Professional Development Seminar	2		ECE 3971	Design Seminar - CPE	3

Senior Year						
First Semester		Credits		Second Semester		Credits
ECE 4470	Computer Networks	4		ECE 4973	Design Project Report - CPE	1
ECE 4971	Design Project – CPE	3		Elective	Technical Elective <sup>1</sup>	3
Electives	Technical Electives <sup>1</sup>	6		Elective	Restricted Elective <sup>2</sup>	3
Elective	Humanities THL $\geq$ 2000	3		Elective	Free	3
				Elective	Humanities from THL, PHI, PJ, ETH 2050, EGR 2001	3
				Elective	Humanities/Social Science	3

<sup>1</sup>Technical electives must be chosen from the approved list of computer engineering or computer science courses. At least 2 must be taken from the computer engineering list of approved electives.

<sup>2</sup>Restricted elective must be an approved technical elective or have the approval of the ECE Department Chair.

<sup>3</sup>Choose from EGR 2001, ETH 2050, PHI 1600, PHI 2130, PHI 2150, PHI 2180, PHI 3820, PHI 3825.

### Program of Studies – Class of 2008

Sophomore Year						
First Semester		Credits		Second Semester		Credits
ECE 2042	Fundamentals of Computer Engineering I	3		ECE 2044	Fundamentals of Computer Engineering II	3
ECE 2043	Fundamentals of Computer Engineering I Lab I	1		ECE 2045	Fundamentals of Computer Engineering II Lab II	1

ECE 2620	C++ Programming, Algorithms & Data Structures	4		ECE 2052	Fundamentals of Electrical Engineering I	3
ECE 2409	Fundamentals of MATLAB	2		ECE 2053	Fundamentals of Electrical Engineering I Lab I	1
ECE 2900	Intro to Electrical and Computer Engineering	1		ECE 3445	Computer Architecture	3
MAT 2705	Differential Equations with Linear Algebra	4		ECE 3720	Engineering Probability Statistics	3
Elective	Humanities THL $\geq 2000$	3		Elective	Science or Mathematics	3

Junior Year							
First Semester			Credits	Second Semester			Credits
CSC 1300	Discrete Structures	3		ECE 3240	Discrete-Time Signals and Systems	4	
CSC 1600	Operating Systems	3		ECE 3XXX	(Course under development)	3	
ECE 3450	Digital Electronics	3		ECE 4470	Computer Networks	4	
ECE 3XXX	Software Engineering	1		Elective	Technical Elective*	3	
ECE 3900	Professional Development Seminar	2		ECE 3971	Design Seminar - CPE	2	
Elective	Science or Math	3					

Senior Year							
First Semester			Credits	Second Semester			Credits
ECE 4971	Design Project - CPE	3		ECE 4973	Design Project Report - CPE	1	
Elective	Technical Elective*	3		Elective	Technical Elective**	3	
Electives	Professional Electives***	6		Electives	Professional Electives***	6	
Elective	Ethics Elective	3		Elective	Humanities from THL, PHI, ETH, PJ, EGR 2001	3	

				Elective	Free	3
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\*At least two (2) technical electives must be chosen from the Computer Engineering Technical Electives list.

\*\*Technical elective must be chosen from the Computer Engineering Technical Electives list or the Computer Science Technical Electives.

\*\*\*Professional elective must meet one of the following criteria: (a) be from the approved list for Computer Engineering Technical Electives or Computer Science Technical Electives; (b) be a course used to satisfy a minor or concentration requirement after the Free elective and, where applicable, the Humanities/Social Science elective have been used toward the minor or concentration; (c) be Math 2500; (d) be another course approved by the ECE Department Chair.

Note: See “Engineering Curriculum Elective Requirements” for list of approved courses.

## **BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING**

The objectives of the electrical engineering program are to prepare graduates for successful professional careers in electrical engineering and to nurture in them the skills required for career-long learning, whether through informal self-study, continuing education, or formal advanced study in electrical engineering or a related discipline.

**Program Educational Objectives** - The educational objectives for the electrical engineering program are listed below.

- Graduates will master, to the satisfaction of the faculty, the fundamentals of the discipline.
- Graduates will have substantial experience in engineering design.
- Graduates will develop and nurture skills for life-long learning and continuing professional development.
- Graduates will be able to communicate effectively.
- Graduates will have opportunities to explore the technological and social implications of their professional activities.

A more detailed description of these objectives is available.

The curriculum is structured to provide a thorough foundation in the fundamentals of electrical and computer engineering. Design, as well as analysis, is emphasized throughout the curriculum, using a project-based structure to teach students how to work on their own, work in teams, and synthesize new engineering solutions by using their knowledge and analytical skills. Great importance 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 electives and an in-depth design project. Students can tailor their senior year towards a variety of objectives by carefully choosing electives in electrical engineering, the humanities, and other subjects. The Electrical and Computer Engineering Department provides these specialized areas: control systems, digital signal processing, microwave networks, communication electronics, optoelectronics, analog and digital integrated electronics, microcontrollers, and power systems.

Senior electives can also be used to complement the electrical engineering requirements with studies in fields outside of the department. Possibilities include minors

in business, cognitive science, computer engineering, computer science, mathematics, and physics and concentrations in cognitive science and mechatronics.

Students in the electrical engineering program acquire a working knowledge of computers and their applications by studying algorithms, programming, and the design and interfacing of computers. The year-long, sophomore-level Fundamentals of Computer Engineering sequence and junior-level courses on Digital Electronics and Analog Electronics provide hands-on-experiences with software and hardware interfacing techniques. Senior electives provide applications of computer-aided analysis and design, simulation, and real-time laboratory processing in areas such as control, communication electronics, signal processing, integrated electronics, optoelectronics, microcontrollers, and microwave networks. Selection of specializations and electives require each student to assume an active and responsible role in the planning and decision making as the program unfolds. To aid in this, detailed information is available from the departmental office and can be discussed with the Department Chair and the Electrical Engineering program adviser.

### Dual Degree Program Leading to a Bachelor of Science in Computer Engineering and a Bachelor of Science in Electrical Engineering

Superior students may earn both the Bachelor of Science in Computer Engineering and the Bachelor of Science in Electrical Engineering degrees. The two degrees are awarded simultaneously upon completion of all requirements for both degrees. Because of the significant overlap between the two programs, it is possible to earn both degrees in four and a half years. Interested students should consult the ECE special programs adviser as early in their undergraduate studies as possible to obtain additional information.

#### Program of Studies – Class of 2006 & 2007

Sophomore Year						
First Semester		Credits		Second Semester		Credits
ECE 2042	Fundamentals of Computer Engineering I	3		ECE 2044	Fundamentals of Computer Engineering II	3
ECE 2043	Fundamentals of Computer Engineering I Lab I	1		ECE 2045	Fundamentals of Computer Engineering II Lab II	1
ECE 2052	Fundamentals of Electrical Engineering I	3		ECE 2054	Fundamentals of Electrical Engineering II	3
ECE 2053	Fundamentals of Electrical Engineering I Lab I	1		ECE 2055	Fundamentals of Electrical Engineering II Lab II	1
ECE 2420	Engineering Programming and Applications	3		ECE 2409	Fundamentals of MATLAB	2

MAT 2705	Differential Equations with Linear Algebra	4		MAT 2500	Calculus III	4
PHY 2402	Physics II: Electricity and Magnetism	3		PHY 2403	Physics Lab for Engineering	1

Junior Year						
First Semester		Credits		Second Semester		Credits
ECE 3220	Signal Processing	4		ECE 3550	Analog Electronics	4
ECE 3450	Digital Electronics	3		ECE 3690	Engineering Electromagnetics	4
ECE 3500	Electronic Materials and Devices	4		ECE 3770	Electrical Communications	4
ECE 3720	Engineering Probability and Statistics	3		ECE 3970	Design Seminar - EE	3
ECE 3900	Professional Development Seminar	2		Elective	Humanities THL $\geq$ 2000	3

Senior Year						
First Semester		Credits		Second Semester		Credits
ECE 4290	Engineering System Models and Control	4		ECE 4972	Design Project Report – EE	1
ECE 4970	Design Project - EE	3		Elective	Technical Elective <sup>1</sup>	3
Elective	Technical Electives <sup>1</sup>	6		Elective	Restricted Elective <sup>2</sup>	3
Elective	Humanities <sup>3</sup>	3		Elective	Free	3
				Elective	Humanities from THL, PHI, PJ, ETH 2050, EGR 2001	3
				Elective	Humanities/Social Science	3

<sup>1</sup>Technical electives must be chosen from the approved list of electrical engineering courses.

<sup>2</sup>A Restricted elective must be an approved technical elective or have the approval of ECE Department Chair.

<sup>3</sup>Choose from EGR 2001, ETH 2050, PHI 1600, PHI 2130, PHI 2150, PHI 2180, PHI 3820, PHI 3825.

**Program of Studies – Class of 2008**

Sophomore Year						
First Semester		Credits		Second Semester		Credits
ECE 2052	Fundamentals of Electrical Engineering I	3		ECE 2054	Fundamentals of Electrical Engineering II	3
ECE 2053	Fundamentals of Electrical Engineering I Lab I	1		ECE 2055	Fundamentals of Electrical Engineering II Lab II	1
ECE 2409	Fundamentals of MATLAB	2		ECE 2042	Fundamentals of Computer Engineering I	3
ECE 2900	Intro to Electrical and Computer Engineering	1		ECE 2043	Fundamentals of Computer Engineering I Lab I	1
MAT 2705	Differential Equations with Linear Algebra	4		ECE 3720	Engineering Probability and Statistics	3
PHY 2402	Physics II, Electricity & Magnetism	3		MAT 2500	Calculus III	4
PHY 2403	Physics Lab for Engineering	1		Elective	THL $\geq$ 2000	3

Junior Year						
First Semester		Credits		Second Semester		Credits
ECE 3220	Signal Processing	4		ECE 3450	Digital Electronics	3
ECE 3500	Electronic Materials and Devices	4		ECE 3690	Engineering Electromagnetics	4
ECE 3550	Analog Electronics	4		ECE 3770	Electrical Communications	4
ECE 3900	Professional Development Seminar	2		ECE 3970	Design Seminar - EE	2
Elective	Science, Technical, Mathematics	3		ECE 4290	Engineering System Models and Control	4

Senior Year							
First Semester			Credits	Second Semester			Credits
ECE 4970	Design Project - EE	3		ECE 4972	Design Project Report - EE	1	
Elective	EE Track*	3		Elective	EE Track*	3	
Electives	Professional Electives***	6		Electives	Professional Electives***	6	
Elective	Ethics Elective**	3		Elective	Humanities from THL, PHI, ETH, PJ, EGR 2001	3	
				Elective	Free	3	

\*Track Electives chosen from one of the following tracks: Signal Processing Systems, High Frequency Systems, Embedded Systems, Electronic Systems, Power Systems, or General Electrical Engineering. See Approved Lists of Courses of EE Tracks.

\*\*Ethics-based Elective chosen from EGR 2001, ETH 2050, PHI 1600, PHI 2130, PHI 2150, PHI 2180, PHI 3820, PHI 3825.

\*\*\*Professional Elective, preapproved by EE Academic Advising Committee, for the pursuit of minors, concentrations, and other academic plans

Note: See “Engineering Curriculum Elective Requirements” for list of approved courses.

## BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

Mechanical Engineering is concerned with applying the principles of solid mechanics, fluid mechanics, thermodynamics, heat transfer, material science, dynamics and control to the analysis and design of machines and systems of all types. In applying this technical knowledge, the mechanical engineer must consider economic constraints and the social and ecological implications of solutions imposed. The mechanical engineering curriculum offers the student an opportunity to pursue educational objectives within the framework of this broad theme.

**Mission Statement** The mission of the Department of Mechanical Engineering is to provide a sound, broad-based educational experience that prepares students for the societal and professional aspects of their lives. Students will be educated, competent, and socially responsible mechanical engineers who clearly possess the following characteristics:

- Proficiency in the design of mechanical components and systems,
- Proficiency in analyzing and solving fundamental engineering problems,
- Proficiency in written, oral, and graphical communications,
- Preparedness for employment, graduate studies, and continuing education,
- A broad education that includes an understanding of professional and ethical responsibilities.

This mission statement is consistent with the goals in the strategic plan and the university mission statement.

### Program Educational Objectives

- ❑ Have the skills and abilities needed for successful employment in the mechanical engineering and related professions.
- ❑ Understand the fundamental scientific principles that underpin the mechanical engineering profession,
- ❑ Possess the necessary communication and interpersonal skills to enable them to be successful in mechanical engineering and other professions.
- ❑ Know the importance of life-long learning for enhancing their personal and professional growth, and their careers.
- ❑ Be broadly educated, consistent with the tradition of St. Augustine.

The first two years of the mechanical engineering program are devoted to laying a foundation of mathematics, physical science, and the general engineering sciences. The junior and senior years are devoted primarily to mechanical engineering topics. The required courses span the field of mechanical engineering, and career/ME electives provide the opportunity to pursue specific areas of the discipline in greater depth. The student chooses three courses (9 credit hours) of technical electives plus an additional three credits of a career/free elective. The design process is emphasized throughout the program and culminates with a senior year project that requires a synthesis of basic principles learned in previous courses.

All mechanical engineering students are required to take at least one of the elective courses offered by the department, designated as the ME elective in the program of studies. Ordinarily students will take two or more such courses, designated career/ME electives and one other course, designated the career/free elective, which can be any three credit course. However, the career/ME and the career/free elective slots may be applied to a minor or concentration in Liberal Arts & Sciences or to a minor in Business. The specific courses must be selected in conjunction with the appropriate departmental office and the student's academic adviser. Requirements for a minor are set by the appropriate department. All concentrations and minors must be approved by the Chair of Mechanical Engineering. Any course which meets a mechanical engineering curriculum requirement and also a requirement for a concentration or minor may be counted for both.

Throughout the curriculum the technical courses are balanced by a careful selection of humanities courses to ensure that the effects of technology on society are given due consideration in design.

A faculty adviser is assigned to each student at the beginning of his/her freshman year to provide academic and career guidance for the remainder of the student's years in the program until graduation. The adviser should be consulted regarding such topics as career electives, minors or concentrations, graduate studies, undergraduate research, and completion of degree requirements for graduation.

### Program of Studies

Sophomore Year						
First Semester		Credits		Second Semester		Credits
MAT 2500	Calculus III	4		CEE 2103	Mechanics of Solids	3
ME 2100	Statics	3		COM 1101	Business and Professional Communication	3
ME 2502	Professional Development	1		MAT 2705	Differential Equations with	4

	Seminar				Linear Algebra	
ME 2505	Mechanical Engineering Analysis & Design	4		ME 2113	Manufacturing Engineering	3
PHY 2402	Physics II: Electricity and Magnetism	3		ME 2900	Mechanical Engineering Laboratory I	1
PHY 2403	Physics Lab for Engineering	1		ME 3100	Thermodynamics I	3

Junior Year							
First Semester			Credits	Second Semester			Credits
ME 3150	Introduction to Dynamics	3		ECE 6020	Introduction to Electrical Systems	3	
ME 3300	Materials Science I	3		ME 3403	Solid Mechanics & Design II	3	
ME 3402	Solid Mechanics and Design I	3		ME 3950	Heat Transfer	3	
ME 3600	Fluids and Fluid Systems	3		ME 3802	Vibrations	3	
Elective	Humanities THL>2000	3		ME 3900	Mechanical Engineering Laboratory II	1	
				ME 4800	Design Seminar in ME I	1	
					Humanities from THL, PHI, PJ, ETH 2050	3	

Senior Year							
First Semester			Credits	Second Semester			Credits
ME 4902	Mechanical Engineering Laboratory III	1		ME 4802	Design Seminar in Mechanical Engineering III	1	
ME 4102	System Dynamics	3		Electives	Career/ME Electives	6	
ME 4801	Design Seminar in Mechanical Engineering II	2		Elective	Career/Free <sup>1</sup>	3	
ME 4850	Thermal-Fluid System Design	1		Elective	Professional Development <sup>2</sup>	3	
Elective	Ethics Elective <sup>3</sup>	3		Elective	Social Science/	3	

					Humanities	
Elective	ME Elective	3				

<sup>1</sup>This is a career elective for those students pursuing a concentration as described above; for all other students it serves as a free elective.

<sup>2</sup>Choose from BL 1090, BL 2135, CEE 4601, EGR 2001, ME 5600.

<sup>3</sup>Choose from EGR 2001, ETH 2050, ETH 3500, ETH 3650, HON 1380, PHI 2121, PHI 2180, PHI 2550.

## **SPECIAL PROGRAMS**

### **DUAL DEGREE PROGRAMS, MINORS AND OPTIONS**

The College of Engineering provides the flexibility for its students to pursue various program additions and options. These include a dual degree program leading to a Bachelor of Arts degree, or a Bachelor's degree through the College of Commerce and Finance; a dual degree program leading to a Bachelor of Science in Computer Engineering and a Bachelor of Science in Electrical Engineering; academic minors in Business, Chemistry, Computer Engineering, Computer Science, Mathematics, Mechatronics, and Physics; the Honors Program; and the ROTC Programs. Also the College of Engineering offers a Five-Year Combined Bachelors/Masters Program in all programs.

### **BACHELOR OF ARTS - DUAL DEGREE PROGRAM**

Engineering students wishing to enter a Dual Degree Program must write a letter to the Dean of Engineering requesting admission into the program.

### **MINORS OUTSIDE THE COLLEGE OF ENGINEERING**

Students should contact the Dean's Office in the respective college regarding the specific program.

### **COMPUTER ENGINEERING MINOR**

The department offers a minor in computer engineering to students outside the major. The requirements include five required courses and two electives. The required courses are:

- ECE 1620: Engineering Programming and Applications
- ECE 2042 & 2043: Fundamentals of Computer Engineering I & Lab
- ECE 2044 & 2045: Fundamentals of Computer Engineering II & Lab
- ECE 2052 & 2053: Fundamentals of Electrical Engineering I & Lab
- ECE 3445: Computer Architecture (prerequisites ECE 2042 & 2043)

The two electives must be selected from the following list.

- ECE 5240: Multimedia
- ECE 5430: Microcomputer System Design (prerequisites ECE 2042 & 2043)
- ECE 5444: Introduction to Fuzzy Logic (prerequisite ECE 2409)

ECE 5445: Introduction to Neutral Networks (prerequisite ECE 2409)  
ECE 5450: Microcontrollers and Applications (prerequisites ECE2042 & 2043)  
ECE 5470: Topics in Computer Networks  
ECE 5477: Computer Communications Security  
ECE 5484: Advanced Digital System Design (prerequisite ECE 3450)  
ECE 5540: Digital Integrated Electronics (prerequisite ECE 3450)  
ECE 5790: Digital Signal Processing (prerequisite ECE 3220 or ECE 3240)  
ECE 5792: Real-Time Digital Signal Processing (prerequisite ECE 5790)

Prerequisite courses must be satisfied.

## **MECHATRONICS MINOR**

The purpose of the mechatronics minor is to provide interested undergraduate Mechanical Engineering and Electrical and Computer Engineering students an opportunity to undertake interdisciplinary courses of relevance to state-of-the-art electromechanical system applications. The requirements of the minor according to major are the following. Contact your academic adviser if you wish to pursue this minor.

### **Mechanical Engineering Majors (One course is taken in place of ECE 6020)**

Required ME Courses:

ME 2100: Statics

ME 3150: Introduction to Dynamics

ME 4102: System Dynamics

Required ECE Courses:

ECE 2052 and ECE 2053 (lab): Fundamentals of Electrical Engineering I

ECE 2054 and ECE 2055 (lab): Fundamentals of Electrical Engineering II

ECE 2042 and ECE 2043 (lab): Fundamentals of Computer Engineering I

One of the remaining courses must be chosen from the following ECE electives:

ECE 3550: Analog Electronics

ECE 4290: Engineering System Models and Controls

ECE 5450: Microcontrollers

ECE 5800: Electric Machines

One of the remaining courses must be chosen from the following ME electives:

ME 5411: Mechatronics

ME 5421: Robotics

### **Electrical and Computer Engineering Majors**

Required ME Courses:

ME 2100: Statics

ME 3150: Introduction to Dynamics

ME 4102: System Dynamics

Required ECE Courses:

ECE 2052 and ECE 2053 (lab): Fundamentals of Electrical Engineering I

ECE 2054 and ECE 2055 (lab): Fundamentals of Electrical Engineering II

ECE 2042 and ECE 2043 (lab): Fundamentals of Computer Engineering I

One of the following courses must be chosen from the following ME electives:

ME 5411: Mechatronics

ME 5421: Robotics

ME 5203: Introduction to Automatic Control

One of the remaining courses must be chosen from the following ECE electives:

ECE 5390: Control System Design

ECE 5450: Microcontrollers

ECE 5800: Electric Machines

## **FIVE-YEAR COMBINED BACHELORS/MASTERS PROGRAMS**

In many fields, the Master's degree is rapidly becoming the entry level requirement for engineering graduates seeking employment. The College of Engineering offers the opportunity to those students who wish to obtain a Bachelor's and Master's degree in five years. This program is academically demanding and requires a recommendation from the student's undergraduate program adviser.

The Combined Bachelors/Masters program may permit students, who enter the program in their senior year, to take a maximum of nine graduate credits which could be counted toward both the baccalaureate and masters degrees. The baccalaureate is awarded upon completion of the undergraduate requirements. Students apply to the Combined Bachelors/Masters program early in the second semester of their junior year. Recommendation from the appropriate undergraduate program adviser is required, and the standard department graduate admission process is used. The Combined Bachelors/Masters program requirements will vary; interested students should contact the department in which they would like to pursue graduate study. All departments in the College of Engineering offer the Combined Bachelors/Masters program.

## **ACADEMIC POLICIES & GENERAL INFORMATION**

Unless otherwise noted, the College of Engineering follows the general university academic policies and regulations listed in the University section of this Catalog. It is the responsibility of the student to know and comply with all academic policies and regulations of the University and of the College of Engineering. Such policies may change without prior notice. Policies specific to the College of Engineering follow:

### **ACADEMIC STANDING**

In order to remain in good academic standing, undergraduate engineering students must maintain a cumulative Grade Point Average (GPA) of at least 2.00 and a cumulative Technical Grade Point Average (TGPA) of at least 2.00. Technical courses are defined as all engineering, science, and mathematics courses.

## **ADVANCED PLACEMENT CREDIT**

Information on advanced placement credit is found at [www.engineering.villanova.edu/prospective/apcreditpolicyrevisions.pdf](http://www.engineering.villanova.edu/prospective/apcreditpolicyrevisions.pdf)

## **ADVISING**

During the freshman year a student is encouraged to learn more about the engineering profession in order to make a more informed choice of a major field of study. Assistance necessary to arrive at this decision (which is made at the end of the freshman year) is provided by the College of Engineering in the following ways:

As a freshman, a student is assigned to a faculty adviser, who provides career planning advisement and when appropriate, referrals. In addition, the College of Engineering sponsors programs which inform freshman students about career opportunities available in each major field of engineering.

Academic advisement for freshmen, i.e. class scheduling and course adjustments, is provided by the office of the Dean of Engineering.

Academic advisement for upper class engineering students is provided by the student's faculty adviser.

## **AUDIT**

A student may elect to audit a course to reinforce and strengthen his/her current knowledge or to explore new areas without the pressure of tests and grades. No academic credit is earned for auditing a course. However, the audited course is noted on the student's official record. Permission to audit a course must be obtained from the student's adviser.

## **AWARDS AND HONORS**

Full-time engineering students who achieve a semester Grade Point Average of 3.25 or higher qualify for the Dean's List in the College of Engineering.

The Dean's Award for Academic Achievement is presented to engineering seniors in recognition of outstanding academic performance in their undergraduate studies in the College of Engineering. Seniors with a cumulative Grade Point Average of 3.50 or more, after seven semesters are eligible for this award.

The Dean's Award for Meritorious Service is presented to engineering seniors in recognition of exceptional dedication and service unselfishly given to the College of Engineering over an extended period of time. The quality and consistency of the service to the College are recognized by means of this award.

In order to recognize and encourage excellence in scholarship, chapters of the following national honorary engineering societies are maintained by the college: Tau Beta Pi, for all engineers; Chi Epsilon, for Civil Engineers; Eta Kappa Nu, for Electrical Engineers and Computer Engineers; and Pi Tau Sigma, for Mechanical Engineers.

## **BANKRUPTCY POLICY**

A freshman engineering student may request to declare academic bankruptcy in any required course in the freshman engineering curriculum, and repeat the course with a new start on the grade earned for that course. The grade earned in the first attempt for any

such "bankrupted" course will remain on the transcript, but only the grade from the second attempt at that course will be used in computing the future cumulative and technical grade point average.

The following restrictions apply to this policy:

1. This option applies only to freshman engineering students, defined as those students who have earned fewer than 36 credits toward an engineering degree at Villanova.
2. This option applies only to those courses designated in the University Catalog as requirements for the freshman year of studies in engineering.
3. This option may be exercised only one time per course, but there is no limit on the number of different courses in the freshman curriculum for which this option may be employed.
4. Once this option is exercised and the grade previously earned for any specified course is declared "bankrupt," this decision may not be revoked and therefore the original grade may not be reinstated.
5. The student must agree that the course for which the policy is exercised must be retaken at Villanova, and must be completed by the end of the next semester of the normal academic year (i.e., a fall course must be completed in the following spring semester, and a spring course must be completed in either the following summer or the following fall semester).

## **COMPUTING**

**College and University Computing.** The entire campus is linked via a high-speed network and is connected to the internet. The College has multiple computer labs reserved for use exclusively by engineering students. Access to the workstations in these labs is provided 24 hours a day, 7 days a week, with proper authorization of the student's Wildcard. The College also provides several remote access solutions, such as Terminal Services for remote application execution, and Virtual Private Networks, for campus equivalent network connectivity. Beginning with the freshman class of 2003-04, students are issued wireless laptop computers as part of their curricula. New computers are issued every two years. Support of the program is provided by UNIT, the University's IT group, with a walk-in, on-line, and telephone help desk system.

**Departmental Computing.** There are more than 100 microcomputer workstations located in engineering classrooms, laboratories, and the four engineering departments.

The Chemical Engineering Department makes available a number of personal computers for student use in carrying out classroom assignments. It has also dedicated several personal computers to data acquisition and control in laboratory experiments. Chemical Engineering students utilize a dedicated departmental intranet of personal computers to run packaged software for simulation of process systems, including AspenTech's ASPEN-PLUS. The departmental computer laboratory also provides a wide range of special-purpose software prepared by the department faculty in the sciences of material and energy balances, thermodynamics, process control, fluid flow and heat/mass transfer.

The Civil and Environmental Engineering Department utilizes a variety of industry specific software in its classes. Examples include AUTOCAD, MATLAB, STAAD, PCA BEAM, PCA COL, HEC-RAS, HEC-HMS, HCS, SIM Traffic and others. These packages are available through the college laptop program and computer labs. Student

exposure to computer based applications includes spreadsheet and economic analysis, structural design and analysis of buildings and bridges, slope stability, stream water quality modeling and waste load allocations, sensitivity and matrix analysis of civil engineering systems, watershed hydrology and river hydraulics, and transportation system planning and simulation of traffic systems. The department maintains computers in its laboratories to support senior level projects undergraduate research.

The Electrical and Computer Engineering Department utilizes Sun file servers with Sun workstations, which are available in the Advanced Computer Systems Laboratory. In addition the department has PC's, CAE workstations and Microcontroller Development Systems. The department software includes UNIX, SMP, ILS, HP ECE Design Center software, VHDL CAD Tools, MATLAB, SIMULINK, Electronics Workbench, and PSpice. This software is used for digital signal processing, real-time control and robotics, microwave measurement, and the design of analog and digital circuits and systems.

The Mechanical Engineering Department has personal computers that are equipped with data acquisition systems and software for graphing, designing, and calculating. Software includes MATLAB, FLUENT, Mathcad, ANSYS, AUTOCAD, PCDEFORMTM, DADS, Working Model 3DTM and other applications programs used for finite element analysis, heat transfer and fluid flow, and multi-body dynamic analysis.

## **INTERNATIONAL STUDIES**

The College of Engineering, recognizing the continued changes globally in both the learning and practicing of the skills of engineering, encourages all majors to consider studying in an overseas university some time during their four years at Villanova. By enhancing language and communication skills, in addition to taking courses in engineering where appropriate, Villanova Engineers will strengthen their own liberal arts program so integral to a Villanova Engineering degree.

For more information contact your Department Chair or the International Studies Office, Middleton Hall, 2nd floor (phone 610-519-6412).

## **LABORATORY FACILITIES**

Dedication of the Center for Engineering Education and Research (CEER) took place in June 1998. The multi-million dollar facility provides leading edge technological support for teaching and research in the College of Engineering.

The 88,400-square-foot structure houses 30 instructional and research laboratories, a computer-aided engineering center, an interdisciplinary student projects laboratory, student group study rooms, a multi-media lecture hall seating 140, and conference rooms.

The Chemical Engineering Department maintains modern laboratory facilities to support the Bachelor of Science in Chemical Engineering curriculum. Experiments in the three Chemical Engineering Laboratory courses range from the demonstration of fundamental principles in bench-scale or pilot plant equipment, to hands-on experience with fully integrated, industrial scale process equipment. In addition, the department maintains extensive general-purpose laboratory capabilities for those students who carry out an experimental investigation as part of their senior Senior Research project.

The Civil and Environmental Engineering Department is committed to "hands-on" education in its experimental, computational, and design laboratories. Facilities are currently dedicated to instruction and research capabilities in materials (soils, concrete, and steel), the environment, geology, structures, measurements, fluid mechanics and hydraulics. The department's newest facility, the Structural Engineering Teaching and

Research Lab, opened in May 2005. The building provides 5,000 ft<sup>2</sup> of useable floor space to test full-scale structural members up to 90 feet in length. The building includes two smaller laboratories for testing construction materials under various environmental conditions. The facility supports undergraduate instruction as well as both undergraduate and graduate research.

The Electrical and Computer Engineering Department laboratory facilities are available to serve as important components of study in specialized areas as well as for core studies. Laboratories are currently in place for instruction and research in Control Systems, Digital Systems and Microprocessors, Electronics, Signal Processing, Intelligent Systems, Solid State Devices, Microwaves, Microcontrollers, Advanced Electronics, Advanced Computer Systems, Antenna Anechoic Chamber, Antenna Research, Communications, and Student Projects.

The Mechanical Engineering Department laboratories provide an environment for students to reinforce their understanding of the fundamental principles of mechanical engineering and apply that knowledge in experimental analysis and problem-solving. Laboratories currently available include Manufacturing Processes, Thermodynamics, Engine Testing, Materials Testing and Material Science, Vibration, Stress, Heat Transfer, Fluid Mechanics, and Wind Tunnel.

## **REGISTRATION OPTIONS**

Qualified undergraduate engineering students are permitted and encouraged to enroll in more challenging courses than those specified in their standard curriculum, provided that they obtain approval from their Department Chair and other appropriate individuals where necessary, as indicated below.

Required and elective courses in the humanities and social sciences may be taken through the Honors Program for those students who qualify. Application should be made directly to the Director of the Honors Program.

Undergraduate students wishing to enroll in an engineering graduate course must have written approval from their Department Chair and the chair of the department offering the course. Permission will normally be granted only to seniors who have a cumulative Grade Point Average of 3.0 or higher. Permission to enroll in graduate courses offered by other Colleges within the University must be obtained from the Dean of that College as well as the chair of the department offering the course and the student's Department Chair.

## **SATISFACTORY/UNSATISFACTORY GRADE POLICY**

Upperclass engineering students may elect to take, on a Satisfactory/Unsatisfactory basis, one course per semester which meets all of the following criteria: 1) it is not specifically designated by course number in the curriculum of the student's major; 2) it is not being given by the department in which the student is majoring; 3) it is not designated as a Technical Elective in the curriculum of the student's major; and 4) permission to take the course has been specifically granted by the chair of the department in which the student is majoring.

To take a course on a Satisfactory/Unsatisfactory basis, the student must first register for the course by the normal procedure. After registration has been completed, the student must complete a Satisfactory/Unsatisfactory form (supplied by the Registrar's Office); this form must be signed by the student's Department Chair.

Other pertinent information can be found under the “Grading System” policies in the University section of this Catalog.

## **SCHOLASTIC LOADS AND OVERLOADS**

The individual engineering majors are comprised of appropriately sequenced course groupings referred to as “regular semester course loads.” Students enrolled in the College of Engineering may take up to four credits, or one course overload, in any given semester provided that (1) a freshman has permission from the office of the Dean of Engineering. Normally, only second semester freshmen with a GPA of at least 3.5 are permitted to overload, or (2) an upperclassman has approval from his adviser and chair. Normally a GPA of at least 3.0 is required in this case.

## **TECHNICAL ELECTIVES**

Students who are required to select technical electives as part of their departmental program are required to select these electives from among the courses listed in this Catalog and offered by the following departments: Astronomy, Biology, Chemistry, Chemical Engineering, Civil and Environmental Engineering, Computing Sciences, Electrical and Computer Engineering, Mathematical Sciences, Mechanical Engineering, and Physics. The selection must be done with the advice and approval of the student's adviser and chair.

## **TRANSFER OF CREDIT**

With recommendation of their Department Chair, and approval of the Dean, engineering students are permitted to earn course credit at other schools. In order to initiate a request to do this, the student must obtain and complete a Course Elsewhere Form, available in the Office of the Dean of Engineering. A complete description of the substitute course content in the form of a copy of the other institution's official course catalog or a copy of the other institution's web description must be attached to this form. The student should allow 7-10 days for final action to be taken on the request. After that time, the student making the request should contact the Dean's Office to determine the outcome.

Students who have completed approved courses elsewhere must request that institution to forward a transcript to their Department Chair. NOTE: only courses in which a grade of “C” (or the equivalent) or better is received will be transferred for credit. Grades of courses taken elsewhere are not included in the calculation of the Grade Point Average (GPA) or Technical Grade Point Average (TGPA) at Villanova University.

College-level work done prior to high school graduation may be awarded transfer credits upon receipt of evidence that the course was/is taken beyond the minimum requirements for high school graduation, according to the curriculum requirements of the school. In addition, all other University requirements must be fulfilled.

## **WITHDRAWAL FROM COURSES**

Engineering student requests for authorized withdrawal from a course without penalty (WX) will be granted automatically until approximately three and a half weeks after mid-term break (see academic calendar @ [www3.villanova.edu/calendar/index.html](http://www3.villanova.edu/calendar/index.html))

for exact date). After that date the student must present a valid reason for the request, such as insufficient information to determine standing in the course, (i.e., grades on tests and assignments), or serious personal or medical problems. The Associate Dean of Academic Affairs will decide whether or not to grant these requests based on the information supplied by the student and recommendations from the faculty member teaching the course and, in the case of upperclass students, the chair of the department in which the student is majoring.

## **STUDENT ORGANIZATIONS**

In order to encourage close contact between our engineering students and practicing professional engineers, and to assist students in establishing their engineering identity, the College of Engineering maintains student chapters of many engineering professional societies. These groups, with the cooperation and support of the faculty and practicing professional engineers, organize and sponsor meetings, guest speakers, and field trips of interest to engineering students.

Refer to the website: [www.engineering.villanova.edu/students](http://www.engineering.villanova.edu/students) for information on student organizations.

The broader professional and social interests of all engineering students are served by the Villanova University Engineering Student Council. Membership in this organization is open to all undergraduate engineering students.

## DEPARTMENTS

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### CHEMICAL ENGINEERING

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<b>Chair:</b>	Dr. C. Michael Kelly
<b>Professors:</b>	Joye, C.M. Kelly, Punzi
<b>Associate Professors:</b>	Muske, Ritter, Skaf, Weinstein
<b>Assistant Professors:</b>	W. Kelly
<b>Office:</b>	217 White Hall, tel. 610-519-4950
<b>Website:</b>	<a href="http://www.engineering.villanova.edu/che">www.engineering.villanova.edu/che</a>
<b>Courses:</b>	<a href="http://catalog.villanova.edu/courses/che.html">catalog.villanova.edu/courses/che.html</a>

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### CIVIL AND ENVIRONMENTAL ENGINEERING

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<b>Chair:</b>	Dr. Ronald A. Chadderton
<b>Professors:</b>	Chadderton
<b>Associate Professors:</b>	Dinehart, Suri, Traver, Yost
<b>Assistant Professors:</b>	Duran, Glynn, Gross, Liu, Wadzuk, Welker
<b>Office:</b>	139 Tolentine Hall, tel. 610-519-4960
<b>Website:</b>	<a href="http://www.engineering.villanova.edu/ce">www.engineering.villanova.edu/ce</a>
<b>Courses:</b>	<a href="http://catalog.villanova.edu/courses/cee.html">catalog.villanova.edu/courses/cee.html</a>

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### ELECTRICAL AND COMPUTER ENGINEERING

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<b>Chair:</b>	Dr. Pritpal Singh
<b>Professors:</b>	Amin, Buckley, Hoorfar, Zygmunt
<b>Associate Professors:</b>	Bukowski, Caverly, DiMeo, Dwyer, Kresch, Mobasserri, Perry, Peyton-Jones, Singh
<b>Assistant Professors:</b>	Jupina, Konyk, Kulkarni, McKeough, Mercede
<b>Instructor:</b>	Char
<b>Office:</b>	411 Tolentine Hall, tel. 610-519-4970
<b>Website:</b>	<a href="http://www.engineering.villanova.edu/ece">www.engineering.villanova.edu/ece</a>
<b>Courses:</b>	<a href="http://catalog.villanova.edu/courses/ece.html">catalog.villanova.edu/courses/ece.html</a>

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### MECHANICAL ENGINEERING

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**Chair:** Dr. Gerard Jones  
**Professors:** Ashrafiuon, Jones, Nataraj, Whitman  
**Associate Professors:** Chun, Jen, Kroos, Radhakrishnan, Santhanam  
**Assistant Professors:** Fleischer, Hoffman, Koffke, O'Brien, Rauli  
**Instructor:** Fulmer  
**Industrial Professor:** Casey  
**Office:** 131 Tolentine Hall, tel. 610-519-4980  
**Website:** [www.engineering.villanova.edu/me](http://www.engineering.villanova.edu/me)  
**Courses:** [catalog.villanova.edu/courses/me.html](http://catalog.villanova.edu/courses/me.html)