

College of Engineering

# 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, 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 bachelors 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. All of the College's undergraduate degree programs are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). In the 1990s, research units were established in the areas of advanced communications and environmental engineering.

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, and by emphasizing the engineering design process. In addition to being professionally competent, graduates are expected to have an understanding of their professional and ethical responsibilities, the impact of engineering solutions in a global and societal context, and an appreciation of humanistic concepts in literature, the arts and philosophy.

## Objectives

The College of Engineering is committed to providing a modern, relevant, high quality education that prepares its graduates to understand their role in today's and tomorrow's technological society, to make constructive engineering contributions, and provide ethical leadership to the engineering profession. The College pursues these objectives by stressing:

- ✘ The integration of the morality and values of the University's Augustinian heritage into the engineering curriculum.
- ✘ Faculty development by participation in high quality research which contributes to the body of knowledge used by the engineering profession.
- ✘ Emphasis on the engineering design process in order to motivate, stimulate, and educate students.
- ✘ A spirit of mutual respect, pride, confidence and cooperation among the engineering faculty, students, and graduates in their pursuit of knowledge and wisdom.

The undergraduate program seeks to develop the following specific attributes in all graduates:

- ✘ A fundamental understanding of mathematics, physical sciences and the scientific method.
- ✘ An ability to apply scientific and mathematical concepts and principles to solve problems in real-world situations.
- ✘ An ability to plan and conduct an experimental investigation, and to analyze and interpret its results.
- ✘ An ability to identify and define a problem related to a system, component, or process, develop and evaluate alternative solutions, and effect one or more designs to solve the problem.
- ✘ An ability to be an effective member of a project team.
- ✘ High professional and ethical standards.
- ✘ An effectiveness in communicating ideas and information.
- ✘ An understanding of the role of the engineering profession and technology, and their impact on society.
- ✘ A broad educational background, including an appreciation of concepts drawn from the humanities and social sciences.
- ✘ A motivation and capability to acquire, evaluate, and assimilate knowledge and continue the learning experience.
- ✘ An ability to use computers and other tools, skills and techniques of modern engineering practice.
- ✘ An appreciation of the interrelationships of people within society and the role of an engineer as an individual within society.

## **Degrees Offered**

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

#### Freshman Year

<i>Fall Semester</i>		<i>Cr.</i>	<i>Spring Semester</i>		<i>Cr.</i>
CHM 1151	General Chemistry	4	CHM 1152	General Chemistry II	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 1610	Engineering Design Graphics	3
EGR 1611	Engineering Analysis	3	MAT 1505	Calculus II	4
MAT 1500	Calculus I	4	PHY 2400	Physics I, Mechanics	3
THL 1050	Christianity: Traditions and Transitions	3			

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

## Declaration of a Major

All engineering students are enrolled in a common freshman year curriculum. Prior to the end of their freshman year all undergraduate 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 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, 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.

**Educational Objectives** - The overall educational objectives of the Bachelor of 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/chem](http://www.engineering.villanova.edu/chem).

## 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 advisor. At least one of these electives must emphasize advanced chemical engineering fundamentals or design. 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 advisors or from the department as well as on the ChE website: [www.engineering.villanova.edu/chem](http://www.engineering.villanova.edu/chem)).

### Program of Studies

#### Sophomore Year

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
CHE 2041	Chemical Process Calculations	4	CHE 2032	Chemical Engineering Thermodynamics I	3
CHM 3411	Physical Chemistry 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 3412	Physical Chemistry II	3
Elective	Humanities/Social Science Requirement	3	CHM 3402	Physical Chemistry Lab II	1
			PHY 2403	Physics Lab for Engineering	1
			Elective	Humanities/Social Science Requirement	3

#### Junior Year

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
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/Social Science Requirement	3			

### Senior Year

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
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			

## Bachelor of 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 affect 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.** Our mission is to provide our students with a high quality, contemporary, broad-based civil engineering education within a Judeo-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:

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- ≠ perform as entry-level civil engineers in general civil engineering or in three of the following five disciplines: transportation engineering, geotechnical engineering, structural engineering, environmental engineering, and water resources engineering,
- ≠ enter graduate school in the disciplines listed above or other closely related disciplines, as well as other unrelated disciplines, such as, business, management, law, and others,
- ≠ continue the process of life-long learning for long-term personal and professional growth,
- ≠ recognize their professional and ethical responsibilities to society as members of the engineering professional community,
- ≠ use the communication, computer, measurement, and teamwork skills learned to help their employers succeed,
- ≠ relate their personal and professional lives to the Judeo-Christian, humanistic tradition.

The broad-based curriculum provides flexibility and meets student needs through a selection of electives in the junior and senior years. Under special circumstances, and with the approval of the student's advisor and chairperson, a course taken outside the department may be substituted for the Civil Engineering (CEE) elective. More information on the Civil Engineering program can be found at the department website: [www.engineering.villanova.edu/cee](http://www.engineering.villanova.edu/cee)

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### Sophomore Year

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
CEE 2101	Engineering Mechanics I - Statics	3	CEE 2102	Engineering Mechanics II - Dynamics	3
CEE 2602	Civil Engineering Measurements	3	CEE 2103	Mechanics of Solids	3
MAT 2500	Calculus III	4	GLY 2805	Geology for Engineers	3
PHY 2402	Physics II, Electricity and Magnetism	3	MAT 2705	Differential Equations with Linear Algebra	4
Elective	Humanities	3	ME 2950	Materials Testing	1
			ME 3100	Thermodynamics I	3

### Junior Year

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
CEE 3111	Fluid Mechanics	3	CEE 3101	Soil Mechanics	3
CEE 3211	Transportation Engineering	3	CEE 3501	Environmental Engineering I	3
CEE 3401	Structural Mechanics	3	CEE 3511	Hydraulic Engineering and Hydrology	3

CEE 3704	CE Numerical and Statistical Analysis	3	CEE 3901	Soil Mechanics Laboratory	1
CEE 3911	Fluid Mechanics Laboratory	1	Elective	CEE Design Elective <sup>1</sup>	4
Elective	Humanities/Social Science Requirement	3	Elective	Humanities/Social Science Requirement	3

### Senior Year

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
CEE 4605	Civil Engineering Design Project I	3	CEE 4606	Civil Engineering Design Project II	3
CEE 4701	Economy and Risk	3	Elective	CEE Elective <sup>3</sup>	3
Elective	CEE Design Elective <sup>2</sup>	4	Elective	Free	3
Elective	CEE Design Elective <sup>2</sup>	4	Elective	Humanities/Social Science Requirement	3
ECE 6020	Introduction to Electrical Systems	3	Elective	Social Science	3

<sup>1</sup>CEE students select one from the following design course sequences:

CEE 3224 Transportation Facilities Design - 3cr

CEE 3924 Transportation Facilities Design Laboratory - 1cr

or

CEE 3422 Structural Design - 4cr

<sup>2</sup>CEE students select two from the following design course sequences:

CEE 4522 Environmental Engineering II - 3cr

CEE 4922 Environmental Engineering Laboratory - 1cr

or

CEE 4523 Water Resources Engineering Design - 4cr

or

CEE 4821 Geological Engineering - 4cr

<sup>3</sup>CEE students select one from the following:

CEE 4225 Advanced Transportation Engineering - 3cr

CEE 4423 Computer-Aided Structural Engineering - 3cr

CEE 4723 Modeling of Civil Systems - 3cr

One of the Civil Engineering Design Course Sequences not selected previously - 4cr

## Bachelor of 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.

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, are 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

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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, and a business minor. 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 chairperson or the Computer Engineering program advisor.

**Dual Degree Program Leading to a Bachelor of Computer Engineering and a Bachelor of Electrical Engineering.** Superior students may earn both the Bachelor of Computer Engineering and the Bachelor of Electrical Engineering. The two degrees are awarded simultaneously upon completion of all requirements for both degrees. Because of the significant overlaps 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 advisor as early in their undergraduate studies as possible to obtain additional information.

**Five Year Bachelor's/Master's Program.** A full-time student has the option of applying for admission to the 5 year Bachelor's/Master's Program. Admission to this program is contingent upon the student's achievement of an acceptable GPA at the end of the junior year. If admitted to the program, the student's technical electives in the senior year of the undergraduate program are fulfilled by taking appropriate graduate level courses. These courses will also count towards the degree requirements for the Master of Science in Computer Engineering. Graduate degree requirements are then completed during the fifth year of the program. Students are assigned a special program advisor to assist in appropriate course selection.

During the senior and fifth years, the student must meet all graduate engineering requirements. Upon completion of all requirements for both degrees, the student is simultaneously awarded the Bachelor of Computer Engineering and the Master of Science in Computer Engineering. A student who has completed all undergraduate requirements for the bachelor degree, but who withdraws from the 5 year Bachelor's/Master's program without completing the master degree requirements, will be awarded the degree Bachelor of Computer Engineering.

## Program of Studies - Class of 2003 and Later

### Sophomore Year

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
CSC 2070	Algorithms and Data Structures: Accelerated	4	CSC 1300	Discrete Structures I	3
ECE 2040	Fundamentals of Computer Engineering I	4	ECE 2041	Fundamentals of Computer Engineering II	4
ECE 2050	Fundamentals of Electrical Engineering I	4	ECE 2051	Fundamentals of Electrical Engineering II	4
ECE 2409	Fundamentals of MATLAB	2	PHY 2402	Physics II: Electricity and Magnetism	3
MAT 2705	Differential Equations with Linear Algebra	4	Elective	Humanities/Social Science	3

### Junior Year

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
CSC 1600	Operating Systems	3	CSC 4700	Software Engineering	3
CSC 1700	Design and Analysis of Algorithms	3	ECE 3240	Discrete Time Signals and Systems	4
ECE 3420	Expert Systems Programming	3	ECE 3450	Digital Electronics	3
ECE 3445	Computer Architecture	4	ECE 3720	Engineering Probability and Statistics	3
Elective	Humanities/Social Science	3	ECE 3971	Design Seminar - CPE	3

### Senior Year

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
ECE 4470	Computer Networks	4	Electives	Technical Electives <sup>1</sup>	6
ECE 4971	Design Project - CPE	3	Electives	Free	6
Elective	Technical Electives <sup>1</sup>	6	Elective	Humanities/Social Science	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.

## Bachelor of 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

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required for career-long learning whether through informal self-study, continuing education, or formal advanced study in electrical engineering or a related discipline.

The curriculum is structured to provide a thorough foundation in the fundamentals of computer and electrical engineering. Design, as well as analysis, are 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, communication electronics, optoelectronics, analog and digital 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 a computer engineering minor, a computer science minor, a mathematics minor, a physics minor, and a business minor.

All students acquire a working knowledge of computers and their applications by studying algorithms, programming, and the design and interfacing of computers. The microcomputer laboratory program provides hands on experience 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 systems, control, communications, signal processing, and microwave circuits. 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 chairperson or the student's faculty advisor.

**Dual Degree Program Leading to a Bachelor of Computer Engineering and a Bachelor of Electrical Engineering.** Superior students may earn both the Bachelor of Computer Engineering and the Bachelor of Electrical Engineering. The two degrees are awarded simultaneously upon completion of all requirements for both degrees. Because of the significant overlaps 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 advisor as early in their undergraduate studies as possible to obtain additional information.

**5 Year Bachelor's/Master's Program.** A full-time student has the option of applying for admission to the 5 year Bachelor's/Master's Program. Admission to this program is contingent upon the student's achievement of an acceptable GPA at the end of the junior year. If admitted to the program, the student's technical electives in the senior year of the undergraduate program are fulfilled by taking appropriate graduate level courses. These courses will also count towards the degree requirements for the Master of Science in Electrical Engineering. Graduate degree requirements are then completed during the fifth year of the program. Students are assigned a special program advisor to assist in appropriate course selection.

During the senior and fifth years, the student must meet all graduate engineering requirements. Upon completion of all requirements for both degrees, the student is simultaneously awarded the Bachelor of Electrical Engineering and the Master of Science in Electrical Engineering. A student who has completed all undergraduate requirements for the bachelor degree, but who withdraws from the 5 year Bachelor's/Master's program without completing the master degree requirements, will be awarded the degree Bachelor of Electrical Engineering.

## Program of Studies - Class of 2003 and Later

### Sophomore Year

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
ECE 2040	Fundamentals of Computer Engineering I	4	ECE 2041	Fundamentals of Computer Engineering II	4
ECE 2050	Fundamentals of Electrical Engineering I	4	ECE 2051	Fundamentals of Electrical Engineering II	4
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

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
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
Elective	Humanities/Social Science	3	Elective	Humanities/Social Science	3

### Senior Year

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
ECE 4290	Engineering System Models and Control	4	Electives	Technical Electives <sup>1</sup>	6
ECE 4970	Design Project - EE	3	Electives	Free	6
Elective	Technical Electives <sup>1</sup>	6	Elective	Humanities/Social Science	3

Elective	Humanities/Social Science	3			
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<sup>1</sup>Technical electives must be chosen from the approved list of electrical engineering courses.

## Bachelor of 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 and prepared to be competent, socially responsible mechanical engineers who clearly possess the following characteristics:

1. Proficiency in the design of mechanical components and systems,
2. Proficiency in analyzing and solving fundamental engineering problems,
3. Proficiency in written, oral, and graphical communication,
4. Preparedness for employment/graduate studies, and continuing education,
5. A broad education that includes an understanding of professional and ethical responsibilities.

**Program Educational Objectives.** The educational objectives of the Bachelor of Mechanical Engineering Program are as follows. Our graduates will:

- ? be prepared for entry into the mechanical engineering profession upon completion of their degree,
- ? have developed the skills and abilities to enter professions other than mechanical engineering if they desire,
- ? understand the fundamental scientific principles that underpin the mechanical engineering profession, and have attained the technical skills necessary to effectively practice mechanical engineering
- ? possess the necessary communication and interpersonal skills to enable them to be successful in mechanical engineering and other professions
- ? be aware of 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 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 advisor. 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 advisor is assigned to each student at the beginning of his/her sophomore year to provide academic and career guidance for the remainder of the student's years in the program until graduation. The advisor should be consulted regarding such topics as career electives, minors or concentrations, and completion of degree requirements for graduation.

**3+2 Bachelor's/Master's Program.** Any full-time student with an acceptable GPA, normally greater than or equal to 3.00, at the start of the senior year, has the option of pursuing a 3+2 Bachelor's/Master's Program. In order to be considered for this program, the student, prior to the beginning of the senior year, must write a letter to the chairman requesting admission to the program, and must complete an application form for graduate studies in the College of Engineering. Students who are admitted to the program take their three career/ME electives from 7000 level ME courses during their senior year. These three courses also will be counted toward the requirements for a Master of Mechanical Engineering degree. During both the senior year and the fifth year, the admitted student must meet all graduate engineering requirements. Upon completion of all undergraduate degree requirements, the student receives his/her Bachelor of Mechanical Engineering degree, and in the fifth year when all required graduate work has been completed, the student receives a Master of Mechanical Engineering degree. All graduate courses must be taken at Villanova in order to be included in this program.

## Program of Studies

### Sophomore Year

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
CEE 2101	Engineering Mechanics I Statics	3	CEE 2102	Engineering Mechanics II - Dynamics	3
MAT 2500	Calculus III	4	CEE 2103	Mechanics of Solids	3
ME 2500	Mechanical Engineering Analysis & Design I	3	MAT 2705	Differential Equations with Linear Algebra	4
PHY 2402	Physics II: Electricity and Magnetism	3	ME 2900	Mechanical Engineering Laboratory I	1
PHY 2403	Physics Lab for Engineering	1	ME 2501	Mechanical Engineering Analysis & Design II	3
CA 1100	Fundamentals of Public Speaking	3	ME 2113	Manufacturing Engineering	3
ME 2502	Professional Development Seminar	1			

## Junior Year

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
ME 3300	Materials Science I	3	CEE 3111	Fluid Mechanics	3
ME 3500	Mechanical Engineering Analysis & Design III	3	ECE 6020	Introduction to Electrical Systems	3
ME 3900	Mechanical Engineering Laboratory II	1	ME 3200	Machine Design	4
ME 3401	Stress Analysis I	3	ME 5202	Vibrations	3
ME 3100	Thermodynamics I	3	ME 3101	Thermodynamics II	3
Elective	Humanities/Social Science Requirement	3	ME 3901	Mechanical Engineering Laboratory III	1

## Senior Year

<i>First Semester</i>		<i>Cr.</i>	<i>Second Semester</i>		<i>Cr.</i>
ME 4800	Design Seminar in Mechanical Engineering I	1	ME 4801	Design Seminar in Mechanical Engineering II	3
ME 4900	Mechanical Engineering Laboratory IV	1	Elective	Humanities/Social Science Requirement	3
ME 4101	Heat Transfer I	3	Elective	Professional Development <sup>2</sup>	3
ME 4102	System Dynamics	3	Electives	Career/ME Electives	6
EGR 2001	Engineering: The Humanistic Context	3	Elective	Career/ME or Free <sup>3</sup>	3
Elective	Social Science <sup>1</sup>	3			
Elective	ME Elective	3			

<sup>1</sup>See Humanities and Social Science Electives

<sup>2</sup>Select one of the following: ME 6621, PHI 1600, PHI 2150, PHI 3820, or PHI 3825.

<sup>3</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.

## Humanities and Social Science Requirements

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

- ✍ THL 1050 (Christianity: Traditions and Transitions).
- ✍ One 3-credit THL course at the 2000 level or above.
- ✍ Two additional 3-credit courses chosen from among the following:
  - ? THL courses at the 2000 level or above
  - ? Any Philosophy courses

## College of Engineering

- ? EGR 2001 Engineering: The Humanistic Context (Excluding Mechanical Engineering where this is a required course)
- ? Any Peace and Justice courses
- ? ETH 2050 College Ethics

## 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.

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

Courses primarily emphasizing skills (such as acting, painting, sculpting, public speaking, etc.) are not acceptable in all programs. Please consult your department chair.

## Special Programs and Options

### 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; a dual degree program leading to a Bachelor of Computer Engineering and a Bachelor of Electrical Engineering; a five year program leading to a Bachelor of Computer Engineering and a Master of Science in Computer Engineering; a five year program leading to a Bachelor of Electrical Engineering and a Master of Science in Electrical Engineering; and a five year program leading to a Bachelor of Mechanical Engineering and a Master of Mechanical Engineering; academic minors in Business, Chemistry, Computer Engineering, Computer Science, Mathematics, and Physics; the Honors Program; and ROTC Programs. See details below or in the appropriate departmental listings.

**Bachelor of Arts - Dual Degree Program.** Under this program it is possible for undergraduate engineering students to earn a Bachelor of Arts Degree in addition to a Bachelor's Degree in Engineering. Depending on the student's engineering major, the student must successfully complete 14 to 17 additional courses beyond those required for the

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

**Business Minor.** Students should contact the Dean's Office in the College of Commerce and Finance regarding this program.

**Computer Engineering Minor.** Students may earn a minor in computer engineering by successfully completing seven courses.: ECE 2040, ECE 2041, ECE 2050, ECE 2420, ECE 3445, and two courses from the following list: ECE 3420, ECE 4470, ECE 5240, ECE 5430, ECE 5444, ECE 5445, ECE 5450, ECE 5477, ECE 5484.

Pre-requisite courses must be satisfied.

## Academic Policies and 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/ap](http://www.engineering.villanova.edu/prospective/ap).

### 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 an engineering advisor, who provides career planning advisement and when appropriate, referrals. In addition, the College of Engineering sponsors Fall and Spring Seminars which inform freshmen 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 Assistant Dean of Engineering.
- ✍ Advising for upper class engineering students is provided by each of the engineering departments for the students who are majoring in the program(s) offered by the department.

### 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

## College of Engineering

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 advisor.

### **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 campus is networked with an ETHERNET backbone which is also linked to the World Wide Web (WWW) and Internet networks. In addition to the several public computing sites located around the campus, the Computer-Aided Engineering (CAE) Centers provide workstations specifically dedicated to meeting the computing needs of engineering students. Access to these workstations is provided 24 hours a day, 7 days a week. The workstations provide network access as well as microcomputer capabilities, using Windows, and UNIX operating systems.

**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 process systems and distillation column design, including AspenTech's ASPEN-PLUS. The departmental computer laboratory also provides a wide range of special-purpose software prepared by the ChE 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's computer facilities include personal computers and associated printers and plotters. A variety of software packages including MATLAB, ANSYS, STAAD-III, HEC-RAS, HEC-HMS, HCS, KERN, and AUTOCAD are used in the curriculum. 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, generation of hydrographs, culvert hydraulics, modeling of river systems, and transportation system planning and simulation of traffic operations.

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 System. 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, ALGOR, PCDEFORM™, DADS, Working Model 3D™ 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 its majors to consider studying in an overseas university some time during their four years at Villanova. In 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.

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For more information contact your department chair or the International Studies Office, Geraghty Hall, 1st 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, 12 student group study rooms, and a multi-media lecture hall seating 140. The building also includes student advising rooms and conference rooms.

The **Chemical Engineering** Department maintains modern laboratory facilities to support the Bachelor of 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 Independent Study 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 **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, 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 chairperson 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 chairperson and the chairperson 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 chairperson of the department offering the course and the student's department chairperson.

## **Satisfactory/Unsatisfactory 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; 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 is found under the **A**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 **A**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 Assistant Dean of Engineering, or (2) an upperclassman has approval from his advisor and chairperson.

## **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 the following major engineering professional societies: American Institute of Chemical Engineers (AIChE), American Society of Civil Engineers (ASCE), Institute of Electrical and Electronics Engineers (IEEE), American Society of Mechanical Engineers (ASME), and the International Society of Pharmaceutical Engineers (ISPE). 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.

The Villanova chapter of the Society of Women Engineers promotes the social growth and professional development of women in all fields of engineering. VUMES (Villanova University Minority Engineers & Scientists) promotes the social growth and professional development of minorities in the fields of engineering.

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.

## 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 advisor and chairperson.

## 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 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 the Office of the Dean of Engineering. *NOTE*: only courses in which a grade of **AC** (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 admission requirements must be fulfilled.

## Withdrawal from Courses

Engineering student requests for authorized withdrawal from a course without penalty (WX) will be granted automatically until the Friday after mid-term break. 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 Dean of Engineering 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 chairperson of the department in which the student is majoring. The Dean will inform the student of his decision and the reason for it.

## Withdrawal from the University

Engineering students who decide to withdraw voluntarily from the university must complete and submit a withdrawal form to the Dean of the College of Engineering. Withdrawal forms are available in the Dean's Office. After the form has been submitted, the student may also be interviewed by an administrator in the College of Engineering.

# Departments

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## Chemical Engineering

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<b>Chair:</b>	Dr. C. Michael Kelly
<b>Professors:</b>	Joye, Kelly, Punzi
<b>Associate Professors:</b>	Ritter, Skaf
<b>Assistant Professors:</b>	W. Kelly, Muske, Weinstein
<b>Office:</b>	217 Chemical Engineering Annex, tel. 610-519-4950
<b>Website:</b>	<a href="http://www.engineering.villanova.edu/chem">www.engineering.villanova.edu/chem</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 Chadderton
<b>Professors:</b>	Chadderton, Christensen, Mathers, Schuster
<b>Associate Professors:</b>	Lynch, Traver
<b>Assistant Professors:</b>	Dinehart, Glynn, Gross, Suri, Yost
<b>Office:</b>	139 Tolentine Hall, tel. 610-519-4960
<b>Website:</b>	<a href="http://www.engineering.villanova.edu/cee">www.engineering.villanova.edu/cee</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. S. S. Rao
<b>Professors:</b>	Amin, Buckley, Rao, Zygmunt
<b>Associate Professors:</b>	Bukowski, Caverly, DiMeo, Hoorfar, Kozikowski, Kresch, Mattis, Mobasseri, Perry, Singh
<b>Assistant Professors:</b>	Jupina, Konyk, McKeough, Mercedes
<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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<b>Chair:</b>	Dr. Gerard Jones
<b>Professors:</b>	Jones, McAssey, McLaughlin, Whitman

## College of Engineering

**Associate Professors:** Ashrafiuon, Chun, Jen, Kroos, Nataraj, Radhakrishnan  
**Assistant Professors:** Fleischer, Harrington, Koffke, O'Brien, Santhanam  
**Instructor:** Fulmer  
**Industrial Professor:** Casey  
**Office:** 111 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)