VII. School of Engineering

Officers of Instruction Faculty	
Charles C. Nguyen, D.Sc.	*Dean and Professor of Electrical Engineering and Computer Science*
Jandro Abot, Ph.D	*Clinical Associate Professor of Mechanical Engineering*
Bismark R. D. Agbelie, Ph.D.	*Assistant Professor of Civil Engineering*
Gregory Berhmann, Ph.D.	*Clinical Assistant Professor of Biomedical Engineering*
Ujjal Bhowmik, Ph.D.	*Clinical Assistant Professor of Electrical Engineering*
J. Steven Brown, Ph.D., P.E.	*Professor of Mechanical Engineering*
Mario J. Casarella, Ph.D.	*Professor Emeritus of Mechanical Engineering*
Lin-Ching Chang, Ph.D.	*Associate Professor of Electrical Engineering and Computer Science*
Chanseok Jeong, Ph.D.	*Assistant Professor of Civil Engineering*
John A. Judge, Ph.D.	*Associate Professor of Mechanical Engineering*
Timothy W. Kao, Ph.D., P.E.	*Professor Emeritus of Civil Engineering*
Ozlem Kilic, D.Sc.	*Associate Professor of Electrical Engineering and Computer Science*
Eric Kommer, Ph.D., P.E.	*Assistant Professor of Mechanical Engineering*
Sahana N. Kukke, Ph.D.	*Assistant Professor of Biomedical Engineering*
Sang Wook Lee, Ph.D.	*Associate Professor of Biomedical Engineering*
Hang Liu, Ph.D.	*Associate Professor of Electrical Engineering and Computer Science*
Max Liu, Ph.D., P.E.	*Assistant Professor of Civil Engineering*
Gunnar Lucko, Ph.D.	*Associate Professor of Civil Engineering*
Peter Lum, Ph.D.	*Associate Professor of Biomedical Engineering*
Xiaolong Luo, Ph.D.	*Assistant Professor of Mechanical Engineering*
Arash Massoudieh, Ph.D.	*Associate Professor of Civil Engineering*
John J. McCoy, D.Sc.	*Professor Emeritus of Civil Engineering*
Robert Meister, Ph.D.	*Professor Emeritus of Electrical Engineering and Computer Science*
Nader M. Namazi, Ph.D.	*Professor of Electrical Engineering and Computer Science*
George Nehmetallah, Ph.D.	*Assistant Professor of Electrical Engineering and Computer Science*
Sen Nieh, Ph.D.	*Professor of Mechanical Engineering*
Masataka Okutsu, Ph.D.	*Clinical Assistant Professor of Civil Engineering*
Hsien Ping Pao, Ph.D.	*Professor Emeritus of Civil Engineering*
Erion Plaku, Ph.D.	*Associate Professor of Electrical Engineering and Computer Science*
Christopher Raub, Ph.D.	*Assistant Professor of Biomedical Engineering*
Phillip A. Regalia, Ph.D.	*Professor of Electrical Engineering and Computer Science*
Patricio Simari, Ph.D.	*Assistant Professor of Electrical Engineering and Computer Science*
Michael C. Soteriades, Ph.D., P.E.	*Professor Emeritus of Civil Engineering*
Lu Sun, Ph.D.	*Professor of Civil Engineering*
Binh Q. Tran, Ph.D.	*Associate Professor of Biomedical Engineering*
Diego Turo, Ph.D.	*Clinical Assistant Professor of Mechanical Engineering*

Joseph Vignola, Ph.D.	*Associate Professor of Mechanical Engineering*
Zhaoyang Wang, Ph.D.	*Associate Professor of Mechanical Engineering*
Yun Chow Whang, Ph.D.	*Professor Emeritus of Mechanical Engineering*
Otto C. Wilson, Ph.D.	*Associate Professor of Biomedical Engineering*

Associates of the Faculty

Mostafa Ardakani, Ph.D.	*Lecturer in Civil Engineering*
Joseph M. Bishop, Ph.D.	*Lecturer in Civil Engineering*
John Bonita, Ph.D., P.E.	*Lecturer in Civil Engineering*
Charles E. Campbell Jr., Ph.D.	*Lecturer in Electrical Engineering and Computer Science*
Vincent Casella	*Lecturer in Electrical Engineering and Computer Science*
Isaac Chang, Ph.D.	*Adjunct Assistant Professor of Biomedical Engineering*
Jim Christ, Ph.D.	*Lecturer in Electrical Engineering and Computer Science*
Keefe Coburn	*Lecturer in Electrical Engineering and Computer Science*
Aysegul Cuhadar	*Lecturer in Electrical Engineering and Computer Science*
Sandor Der	*Lecturer in Electrical Engineering and Computer Science*
Jeffrey R. Didion, M.S.	*Lecturer in Mechanical Engineering*
Azad Ejaz, Ph.D.	*Lecturer in Electrical Engineering and Computer Science*
Joseph Findaro, J.D.	*Lecturer in Civil Engineering*
Christy Foreman	*Lecturer in Biomedical Engineering*
Wenjun Gu, M.S.	*Lecturer in Civil Engineering*
Shane Guan, Ph.D.	*Lecturer in Mechanical Engineering*
Lei He, Ph.D.	*Lecturer in Electrical Engineering and Computer Science*
Liling Huang	*Lecturer in Electrical Engineering and Computer Science*
James W. Hudson, B.S.	*Lecturer in Civil Engineering*
Philip C. Jones, J.D.	*Lecturer in Civil Engineering*
William A. Joyce, P.E.	*Lecturer in Civil Engineering*
Vadim Knyazev, Ph.D.	*Lecturer in Electrical Engineering and Computer Science*
Mesfin Lakew, M.S.	*Lecturer in Civil Engineering*
William LaPlante, Ph.D.	*Lecturer in Mechanical Engineering*
S. Samuel Lin, Ph.D.	*Lecturer in Civil Engineering*
Francis Linehan, M.E.E.	*Lecturer in Electrical Engineering and Computer Science*
George Mattingly, Ph.D.	*Adjunct Professor of Mechanical Engineering*
John McTyre, M.S.	*Lecturer in Civil Engineering*
Rocco Mennella	*Lecturer in Mechanical Engineering*

Mamta Nagaraja, Ph.D.	*Adjunct Assistant Professor of Mechanical Engineering*
Tien Nguyen, Ph.D.	*Adjunct Assistant Professor of Electrical Engineering and Computer Science*
Tuan Nguyen, Ph.D., P.E.	*Adjunct Associate Professor of Mechanical Engineering*
Silas C. Nichols, Ph.D.	*Lecturer in Civil Engineering*
Ken O'Connell, Ph.D., P.E.	*Lecturer in Civil Engineering*
Mark Pettinato, M.S.	*Lecturer in Biomedical Engineering*
Long Phan, Ph.D.	*Lecturer in Civil Engineering*
Sridava Rao, Ph.D.	*Lecturer in Electrical Engineering and Computer Science*
Kenneth Romney, M.S., P.E.	*Lecturer in Mechanical Engineering*
Kevin Russo, M.S.	*Lecturer in Electrical Engineering and Computer Science*
Alfonz Ruth, Ph.D.	*Lecturer in Civil Engineering*
Lawrence Schuette, Ph.D.	*Adjunct Associate Professor of Electrical Engineering and Computer Science*
Hanney Shaban, Ph.D.	*Lecturer in Electrical Engineering and Computer Science*
Jeffrey W. Shupp, M.D.	*Adjunct Assistant Professor of Biomedical Engineering*
Stephen Sullivan	*Lecturer in Civil Engineering*
Randy Swisher, Ph.D.	*Lecturer in Electrical Engineering and Computer Science*
Tongele Tongele, Ph.D.	*Adjunct Assistant Professor in Mechanical Engineering*
Nellore Venkataraman, Ph.D.	*Lecturer in Mechanical Engineering*
Adam Wolfe, Ph.D., P.E.	*Adjunct Assistant Professor of Mechanical Engineering*
Bing Xu, Ph.D.	*Lecturer in Civil Engineering*
Tse-Fou Zien, Ph.D.	*Adjunct Professor of Mechanical Engineering*

Biomedical Engineering Advisory Council

Barbara Bregman, Ph.D.	*Professor, Georgetown University, Dept. of Neuroscience, Washington, DC*
Kevin Cleary, Ph.D.	*Technical Director, Bioengineering Initiative, The Sheikh Zayed Institute for Pediatric Surgical Innovation, Children's National Health System, Washington, DC*
Diane L. Damiano, Ph.D.	*Chief, Functional & Applied Biomechanics Section, NIH, Bethesda, MD*
Joseph Hidler, Ph.D.	*Chief Operating Officer, Aretech LLC, Ashburn, VA*
Corinna Lathan, Ph.D.	*President, Anthrotronix Inc., Silver Spring, MD*
Joel B. Mylkebust, Ph.D.	*Deputy Director, Office of Science & Engineering Laboratories, FDA, Silver Spring, MD*

Civil Engineering Advisory Council

Dr. Timothy W. Kao, P.E.	*Professor Emeritus of Civil Engineering and Former Chair, Department of Civil Engineering, The Catholic University of America, Washington, DC*
Mr. Lawrence Moore, II, P.E.	*Director of Engineering, Clark Concrete Contractors, LLC, Bethesda, MD*

Dr. Dennis McCahill	*Retired*
Ms. Melissa Prelewicz	*Associate Executive Director, American Association of Engineering Societies, American Society of Civil Engineers, Reston, VA*
Dr. Steven Smith, P.E	*Principal Engineer and Group Manager, CTL Group, Washington Office, Columbia, MD*
Mr. Scott Stewart	*Principal, SK&A Structural Engineers, Washington, DC*
Mr. Bill Whiting	*Vice President, The Whiting-Turner Contracting Co., Washington DC*

Electrical Engineering and Computer Science Advisory Council

Ramesh Bhardawaj, Ph.D.	*Senior Software Technology Researcher, Naval Research Laboratories, Washington, DC*
Thomas E. Bordley, Sc.D.	*Distinguished Staff Scientist, General Dynamics Advanced Technology Systems, Washington, DC*
Tarek El- Ghazawi, Ph.D.	*Professor, IEEE, Department of Electrical and Computer Engineering, The George Washington University, Washington, DC*
Cheng Guan Koay, Ph.D.	*Senior Image Data Analyst, Walter Reed National Military Medical Center, Bethesda, MD*
Jose R. Latimer, Ph.D.	*Business Area Executive for Homeland Protection, Applied Physics Laboratory, Johns Hopkins University, Baltimore, MD*
Dunling Li, Ph.D.	*Senior Software Engineer, BST Software Solutions, Columbia, MD*
Seong Mun, Ph.D.	*Professor and Director, Institute of Advanced Study Virginia Tech, Alexandria, VA*
Jude Nitsche	*Nitsche and Associates LLC, Alexandria, VA*
Kay Stepper, Ph.D.	*Regional Business Unit Leader, Robert Bosch LLC, Plymouth, MI*

Mechanical Engineering Advisory Council

Richard Dame, Ph.D.	*President (Retired), Mega Engineering, Silver Spring, MD*
David Didion, Ph.D.	*Retired NIST Fellow, National Institute of Standards and Technology, Port Republic, MD*
Stan Halperson	*Executive Committee Member of ASME, Washington, DC*
Peter Herdic, Ph.D.	*Naval Research Laboratories, Washington, DC*
Don Marlowe	*Standards Administrator (Retired), Science and Health Communication, U.S. Food and Drug Administration, Rockville, MD*
Jude Nitsche	*Nitsche and Associates LLC, Alexandria, VA*
Steven Russell, Ph.D.	*Project Manager, Ship Systems Engineering Office of Naval Research, Arlington, VA*
Jaclyn A. Schade	*Registered Patent Agent, Pillsbury Winthrop Shaw Pittman LLP, McLean, VA*
Owen G. Thorp IV, Ph.D	*Captain, USNR, Permanent Military Professor, Weapons and System Engineering Department, US Naval Academy, Annapolis, MD*
Stephen Wilson	*Deputy Director, Ship Signatures Department, NSWC Carderock, Bethesda, MD*

History

The engineering program was established in 1896, soon after the founding of The Catholic University of America. The School of Engineering was formally established as a separate school in 1930 and was shortly thereafter renamed the School of Engineering and Architecture. In 1992, the School of Engineering and Architecture separated and became the School of Engineering and the School of Architecture and Planning. Prior to 1950, the primary focus of the school was on undergraduate professional programs,

although graduate programs had always been offered. However, research activity and graduate professional offerings have increased at a steady rate since 1950. Today the School of Engineering offers bachelor's, master's, and doctoral degrees in five academic programs, as well as master's degrees in Engineering Management and Materials Science and Engineering.

Mission

Historically, the engineering profession has placed great emphasis on technical expertise as a criterion for recognition and advancement. However, even the most thoroughly trained technical professional must be able to contribute something more to society with corresponding opportunities and obligations. As such, the environment in which an individual's training takes place affects the individual's later professional practice. If the environment were to be neutral on the issues of faith and morals, the education would be narrowly superficial. Instead engineering education in a Catholic environment instills in students a sense of morality and ethics by presenting them with the logic and rationale of a systematic set of values for social and ethical responsibility. This is a distinctive trait of engineering education at The Catholic University of America.

The Catholic University of America's School of Engineering provides a personalized learning and research environment in which faculty, staff, and students achieve excellence in research, education, and service. The program emphasizes research and scholarship of the highest possible caliber and provides personalized instruction at both the graduate and undergraduate levels.

Goals

The goals of The Catholic University of America's School of Engineering include being a leader in undergraduate Catholic engineering education; providing nationally recognized student-oriented, research-based graduate programs; offering innovative professional master's programs that serve the metropolitan Washington area and complement and enhance the undergraduate and research- based graduate programs. The School of Engineering is dedicated to educating future engineering leaders. All graduates are prepared to enter and continue the practice of engineering, to begin graduate work in engineering, or to enter other professions such as business, law, and medicine.

More specifically, the goals of the School of Engineering are:

1. School is to substantially improve efficiency of support services (i.e., academic, research, IT, alumni, outreach) and invest in its structures (i.e., physical plant) to facilitate and support its aggressive goals in the areas of education, training, and research productivity.
2. School is to establish, nurture, and grow *research, training, and career* opportunities for faculty and students through strategic cooperative and collaborative relationships with local/regional institutions and industry.
3. School will expand existing and establish unique and timely new academic programs to its undergraduate and graduate students to serve the region, nation, and world through superior technical competence, incorporating moral and ethical values, and to prepare future leaders.
4. School will achieve research pre-eminence in a number of specific areas of engineering and applied science through establishment of interdisciplinary initiatives and interdisciplinary centers of research.

Each program's curriculum ensures that graduates have an ability to apply knowledge of mathematics, science, and engineering; to design and conduct experiments, as well as to analyze and interpret data; to design systems, components, or processes to meet desired needs; to function on multi-disciplinary teams; to identify, formulate, and solve engineering problems; to understand professional and ethical responsibility; to communicate effectively; to understand the need for, and to engage in, lifelong learning; and to use the techniques, skills, and modern engineering tools necessary for engineering practice. The school works closely with the departments in assessment and improvement of the various programs. School-level efforts are focused on the core or common part of the curricula, in particular, providing a vehicle for working with departments and schools outside of engineering on curriculum development and improvement.

Student surveys and evaluation of various data collected by and maintained by the school and the office of Planning, Institutional Research, and Student Learning Outcomes Assessment are used as appropriate in improvement efforts. The dean's office also coordinates improvement efforts with other offices on campus such as career services, enrollment management, the dean for undergraduate studies, and the registrar. Technology can play an important role in solving many of the problems facing humankind. The engineer of tomorrow will have the responsibility to engineer in a socially conscious way. The engineering programs of The Catholic University of America permit maximum flexibility so that students may pursue courses of study that reflect a balance between technology and social awareness.

Undergraduate Curricula and Academic Regulations Degree Programs

The School of Engineering offers programs leading to the degrees of Bachelor of Biomedical Engineering, Bachelor of Civil Engineering, Bachelor of Electrical Engineering, Bachelor of Mechanical Engineering, and Bachelor of Science in Computer Science. The undergraduate programs in biomedical engineering, civil engineering, electrical engineering, and mechanical engineering are accredited by the Engineering Accreditation Commission of ABET, and the program in computer science is accredited by the Computing Accreditation Commission of ABET.

Academic Advising

Once admitted to the School of Engineering, each student is assigned an academic advisor, usually a full-time faculty member. Normally, students remain with their advisors for the duration of their studies. Students are required to consult with their advisors at least once a semester, but have the possibility of meeting with their advisor at any time during the academic year. Students must obtain approval from their advisors for registration and to make any course changes, such as adding or/dropping a course. The dean advises general (undecided) engineering students. Ordinarily, at the end of the first year in residence, an undecided student will be asked to designate the program in which he or she wishes to earn a degree, if he or she has not already done so. The undecided student will consult with the dean and the chair of the designated program and, once accepted, will be reassigned to an advisor from the designated program.

Transfer Students

Historically, many junior and senior engineering students have transferred to the school from community colleges and four-year liberal arts colleges. Experience with these students indicates that they are able to perform academically similarly to the way in which they performed in their previous institutions. Students who have completed pre-engineering programs may normally begin the junior year of studies. Students who wish to transfer to the school are advised to contact the appropriate department to determine which of their previous courses are transferable. The school has policies governing the acceptance of transfer students.

Transfer Credits

With preapproval from the dean, students can take courses at institutions outside of the Consortium and transfer these credits to the school, within limits set by the university. The school has a rigorous procedure to evaluate courses for equivalency taken by transfer students and courses to be taken at institutions outside of the Consortium. The dean must approve all transfer credits.

Internships

The school believes that students can benefit from academic year and summer internships, which provide opportunities for students to learn while doing actual engineering work. The Career Services Office and the school assist students in obtaining internships. The Department of Civil Engineering requires internships as an integral part of its program--the construction concentration requires two while the rest of the department requires one. The program in biomedical engineering has a long history of placing students in internships with hospitals and research laboratories in the Washington, D.C., area and is expanding its industrial internship opportunities. The electrical engineering and computer science programs have summer internship and co-op programs with the Naval Research Laboratories. The mechanical engineering program also strongly encourages its students to pursue internship opportunities.

Interdisciplinary Studies

Students may elect to pursue an interdisciplinary course of study in dual degree programs leading to an engineering or a computer science degree and a degree in an academic concentration in the School of Arts and Sciences. Interested students should contact the dean's office for more information. In addition, a program leading to the dual degrees of Bachelor of Science in Architecture, offered by the School of Architecture and Planning, and Bachelor of Civil Engineering is available to students who want to combine the practice of architecture and engineering.

Interested students should contact either the School of Architecture and Planning or the Department of Civil Engineering for specific information.

Minors

A minor, or subconcentration, in the humanities, social sciences, philosophy or religious studies is available to students who complete the requirements for the subconcentration as stipulated by the respective department or school. Normally, a subconcentration consists of six or seven courses in one disciplinary area.
Applications for the minor are available in the Office of the Dean of the School of Engineering. Engineering students can also obtain a minor in computer science. Students should check with their departments for specific requirements for the minor. Completed applications must be submitted to the Office of the Dean of the School of Engineering.

Accelerated Bachelor's/Master's Degree Programs

An accelerated bachelor's/master's program allows undergraduate students to pursue a bachelor's degree and a master's degree in a shorter time than would be required if both degrees were pursued separately. This is made possible by allowing a number of approved graduate engineering courses (500 level or greater) taken as part of the requirements for the bachelor's degree to be applied toward the master's degree. Contact the dean's office for additional information regarding admission requirements and the application process.

Study Abroad Program

The School of Engineering has established a student exchange program with Hong Kong Polytechnic University. Through the established student exchange program, qualified engineering students at CUA may study abroad during the second semester of

their junior year. The CUA engineering undergraduate programs have developed modified curricula for their study abroad students to ensure that the participating students graduate on time. Students who are interested in this program should contact the dean's office for general information and their department for specific coursework. To be eligible to participate in the study abroad program, students must be in good standing and possess a minimum cumulative GPA of 3.00 at the end of their sophomore year. For more information please see the School of Engineering Web site at: http://engineering.cua.edu

English Requirement

All students are required to take at least one English writing course, normally ENG 101, Rhetoric and Composition. The particular course depends on placement at the time of matriculation.

Mathematics Requirement

All incoming freshmen are required to take a math placement exam. Students with insufficient scores will be required to take remedial math courses, such as MATH 108 (Elementary Functions), before taking MATH 121 (Calculus I). Remedial math courses do not count toward the degree requirements. Special requirements are imposed because the study of mathematics is integral to engineering. In particular, an engineering student may not advance to the sophomore level in mathematics without a minimum grade point average of 1.50 in the freshman year mathematics courses. A minimum grade point average of 1.75 is required in the freshman and sophomore mathematics courses as a prerequisite for admission to upper-division engineering courses.

GPA Requirement for Graduation

Students must have a minimum cumulative average of 2.0 in the course of studies required for the degree program to graduate.

A student whose cumulative GPA is less than 2.0 will be placed on academic probation for the following regular semester. In other words, a student whose cumulative GPA is below 2.0 at the end of the spring semester, is on probation through the end of the following fall semester, even if the student takes Summer Session courses to raise his/her cumulative GPA. Also a student whose cumulative GPA is below 2.0 at the end of the fall semester is on probation through the end of the following spring semester. While on probation, a student may register for no more than four courses and may not participate in extra- curricular activities such as student government or athletics. A student may be academically dismissed for the following reasons: failure to gain a 2.0 cumulative

GPA after two consecutive semesters on academic probation, failure in three courses in any given semester, a cumulative GPA of less than 1.5 at the end of any academic year.

General Degree Requirements

Although the minimum number of courses required for an engineering degree is 40 credit-bearing courses, specific programs may require a somewhat larger total. In general, the curricula of the various programs are similar in the first two years and students can transfer easily between programs during this period. The coursework during the last two years is discipline specific and can be tailored to meet the student's interests. The general requirements for the degree consist of four main areas: math and science components, a liberal study component, a general engineering component, and a discipline-specific technical component.

Math and Science Component (ten courses). The math and science components for the majority of the engineering programs consist of five mathematics courses and five science courses, including laboratories.

Liberal Study Component (nine courses). The liberal study component emphasizes the religious, economical, historical, and philosophical aspects of modern civilization. It complements the technical component and illustrates that technology is only one segment of culture and learning. It consists of three religion courses, three courses in philosophy and ethics, one English composition course, and two additional liberal studies courses. The requirement of religion courses is consistent with CUA's mission and goals, while the engineering ethics courses provide opportunities for students to increase their understanding of professional and ethical responsibilities. The English composition course emphasizes the need for engineers to communicate effectively. The two additional liberal studies courses must be selected in consultation with a student's advisor from a list of approved courses. These liberal study courses provide exposure to the broad range of studies necessary to understand the impact of engineering solutions in a global and societal context and provide knowledge of contemporary issues relevant to engineering practice.

General Engineering Component (ten courses). The general engineering component is common to most disciplines. It consists of eight courses in engineering design, laboratory, CAD, computer programming, engineering mechanics, electrical networks and electronics, and two discipline-relevant courses selected from a set of four engineering courses.

Fundamentals in Engineering (FE) Exam Requirement

All students are required to take the Fundamentals in Engineering (FE) as part of ENGR 402 – Senior Seminar II. The FE exam is administered by the National Council of Examiners for Engineering and Surveying (NCEES) and is the first step in becoming a licensed professional engineer. For more information see http://ncees.org/exams/fe-exam/ It is the student’s responsibility to register and pay for the exam, and to sit for the exam at one of the approved testing sites.

Engineering Common Component ([1] [2] [3] [4])

- ENGR 102 Introduction to Engineering Design and Professionalism
- ENGR 104 Introduction to Engineering Laboratory
- ENGR 106 Computer-Aided Engineering Tools
- CSC 113 Computer Programming
- ENGR 201 Engineering Mechanics I ([5])
- ENGR 211 Thermodynamics
- ENGR 212 Electrical Networks
- ENGR 401 Senior Seminar I
- ENGR 402 Senior Seminar II

A selection of courses as specified:

- ENGR 202 Engineering Mechanics II (EE[6], ME)
- ENGR 301 Solid Mechanics (CE, ME)
- ENGR 321 Electronic Circuits I (BE, EE)
- ENGR 331 Fluid Mechanics (BE, CE, ME)

Discipline-Specific Technical Component. The discipline-specific technical component consists of at least 12 courses and program electives covering topics relevant to a particular discipline.

Standard First-Year Engineering Program

The normal program for engineering students in the first year is presented below. Students with advanced placement and interdisciplinary programs may alter this program in consultation with their advisors.

First-Year Program

Course #	Course Title	1st	2nd
MATH 121	Calculus I	4	-
MATH 122	Calculus II	-	4
ENGR 102	Introduction to Engineering Design and Professionalism	3	-
ENGR 104	Introduction to Engineering Laboratory	1	-
ENGR 106	Computer-Aided Engineering Tools	-	2
TRS 201	Faith Seeking and Understanding	-	3
PHIL 201	The Classical Mind	3	-
PHIL 202	The Modern Mind	-	3
ENG 101	Rhetoric and Composition	3	-
CSC 113	Computer Programming	3	-
PHYS 215	University Physics I	-	4
	Total	**17**	**16**

Department of Biomedical Engineering

Associate Professors	Peter Lum, *Chair*; Binh Tran*;* Otto Wilson, Jr.; Sang Wook Lee
Assistant Professors	Gregory Behrmann; Sahana Kukke; Christopher Raub
Lecturers	Kenneth A. Byrd; Patrick Mehl; Mark Pettinato, Christy Foreman
Adjunct Assistant Professors	Isaac Chang; Jeffrey Shupp
Research Ordinary Professor	Harold Szu

Mission of the Department

The mission of the Department of Biomedical Engineering at CUA is to educate men and women who can bridge engineering with life sciences in the service of human health and represent the biomedical engineering profession with distinction. Our department serves as a conduit for better understanding of biology through engineering concepts and for utilizing the complex organization of life systems in developing new technologies. The department emphasizes integrative bioengineering and regards the humanities an integral part of undergraduate education.

Undergraduate Program

The Department of Biomedical Engineering offers an undergraduate degree program leading to the Bachelor of Biomedical Engineering. Biomedical engineers solve problems in medicine or biology by applying the principles and tools of modern engineering. The undergraduate program provides a broad scientific and technical background in engineering, establishing the foundation for lifelong learning on newly emerging health care technologies.

The accredited degree program is designed to prepare the student for a professional career in biomedical engineering or to enter graduate or medical school. The premedical track satisfies the entrance requirements of most medical schools in the United States. Qualified students are encouraged to complete a master's degree through a fifth year of full-time study, with their fourth and fifth years coordinated to accommodate various interests and career objectives.

Unique features of the CUA undergraduate program include a strong internship program through partnerships with federal biomedical laboratories, industry, and local hospitals; the unique Washington location (six hospitals within one mile of campus, and a metropolitan area possessing the richest biomedical research environment in the world); the benefits of personalized education and training that come with a smaller academic environment; and well-funded initiatives in biomaterials, biomedical instrumentation, medical imaging and bio-optics, rehabilitation engineering, home care technologies, and tele-medicine which provide a nurturing environment for designing and evaluating innovative technologies for addressing real-world health care problems.

Standard Program First Year

In addition to the standard first-year engineering program all biomedical engineering majors are required to take Biology 105 and BE 491 (Seminar Biomedical Engineering).

Second Year

Course #	Course Title	1st	2nd
BE 491	Seminar: Biomedical Engineering	0	0
ENGR 201	Engineering Mechanics I	3	-
BE 202	Biomechanics	-	3
ENGR 212	Electrical Networks	-	3
ENGR 222	Engineering Mathematics I	-	4
PHYS 216	University Physics II	4	-
CSC 113	Computer Programming	3	-
MATH 221	Calculus II	4	-
ENGR 211	Thermodynamics	-	3
CHEM 103/113	General Chemistry I/Lab	5	-
CHEM 108	General Chemistry II	-	3
	Total	**19**	**16**

Third Year

Course #	Course Title		1st	2nd
BE 491	Seminar: Biomedical Engineering		0	0
BE 398	Biomechanical Design		3	0
BE 315	Intro Biomedical Systems Analysis		-	3
MATH 309	Probability & Statistics for Engineers		3	-
ENGR 321	Electronic Circuits		3	-
ENGR 331	Fluid Mechanics		3	-
ENGR 355	Electrical Laboratory I		1	-
BIOL 518	Physiology		-	4
BE 513	Biomedical Instrumentation		-	3
PHIL 362	Professional Ethics in Engineering		-	3
		Total	**16**	**16**

Fourth Year

Course #	Course Title		1st	2nd
BE 497	BMED Senior Design		3	-
BE 499	BMED Senior Project Lab		-	3
BE 501	Biomaterials		3	-
ENGR 403	Control Systems		3	-
ENGR 401	Senior Seminar I		1	-
ENGR 402	Senior Seminar II		-	1
	Program Electives		3	9
	Liberal Studies Electives		3	3
		Total	**16**	**16**

Educational Objectives of the Undergraduate Program

The educational objectives of the biomedical engineering undergraduate program are that graduates will:

1. Work in careers in biomedical engineering or related fields (e.g. other engineering disciplines, medicine, law, etc.) and will continue developing the necessary skills to obtain leadership positions and other positions of increasing responsibilities.
2. Work in research careers pursuing advanced degrees by applying their background and knowledge towards the advancement of technology and the betterment of society by contributing to educational and social institutions.
3. Continue to learn and to expand and develop their knowledge and skill sets so as to be able to adapt and thrive in a rapidly changing global environment.

Department of Civil Engineering

Professors	Lu Sun, *Chair*
Professors Emeriti	John H. Baltrukonis; Timothy W. Kao; Dennis F. McCahill; John J. McCoy; Hsien Ping 'Frank' Pao; Michael C. Soteriades
Associate Professors	Gunnar Lucko; Arash Massoudieh
Assistant Professors	Bismark R. D. Agbelie; Chanseok Jeong; Min 'Max' Liu; Masataka Okutsu
Lecturers	Mostafa K. Ardakani, Hoda Azari, Abdollah Bagheri, John Bonita, Yekai Chen, Xin Chen, Yingwu Fang, Reza Farahani, Joseph Findaro, Wenjun Gu, Sung-Hwan Jang, Zhen-Gang Ji, Charbel N. Khoury, Xuan (Sean), Kong, Mesfin Lakew, Samuel Lin, Mr. John McTyre, Gummada Murthy, Long T. Phan, Brian Pietryka, Alfonz Ruth, Haijian Shi, Nazy Sohbi, Serena Stafford, Stephen Sullivan, Richard Thompson, Jr., Ru Tian, Thomas Weaver, Feng Xie, Bing Xu, Wei Xu, Qiu Zhao

Mission of the Department

The mission of the Civil Engineering program is to provide students with a balanced education, strong in the scientific, engineering, humanistic, and social bases, so that they may attain leadership roles in their profession and "use their knowledge and skill for the enhancement of human welfare and the environment." (Code of Ethics, American Society of Civil Engineers.)

Undergraduate Program

The undergraduate professional program in civil engineering leads to the Bachelor of Civil Engineering degree. It includes studies in structural and geotechnical engineering, environmental engineering and water resource, and construction engineering and management, aimed at helping graduates pursue a career in civil engineering or to pursue graduate studies. Sufficient electives are available in the program to allow a greater concentration in one of these areas or to elect technical courses in other areas.

The Department of Civil Engineering, in conjunction with the School of Architecture and Planning, offers dual degrees in civil engineering and architecture. Interested students should contact either the department or the school for specific information.

Standard Program First Year

See standard first-year engineering program in the general engineering section.

Courses that fulfill a knowledge area of the Fundamentals of Engineering exam (FE) are MATH 121 (FE1), MATH 122 (FE1), CSC 113 (FE3), ENGR 201 (FE6).

It is recommended to join the American Society of Civil Engineers student chapter.

It is recommended that students undertake a summer internship in a civil engineering related position after the first year.

Courses in the following list are mapped to the respective knowledge areas of the FE exam.

Second Year

Course #	**Course Title**	**1st**	**2nd**
ENGR 106	Computer-Aided Engineering Tools	2	-
CHEM 107	General Chemistry	3	-
CHEM 113	General Chemistry Lab	2	-
PHYS 216	University Physics II	4	-
MATH 221	Calculus III (FE1)	4	-
ENGR 301	Mechanics of Solids (FE8)	3	-
Liberal Studies Elective (L1)		-	3
Religious Elective (R2)		-	3
CE 101	Surveying (FE18)	-	2
ENGR 202	Engineering Mechanics II (FE7)	-	4
ENGR 222	Engineering Mathematics I (FE1)	-	4
	Internship (required all civil eng.)	summer	
Total		**18**	**15**

Third Year

Course #	**Course Title**	**1st**	**2nd**
MATH 309	Probability & Stat. for Engineers (FE2)	3	-
CE 312	Theory of Structures (FE12)	3	-

ENGR 331	Fluid Mechanics (FE10)	3	-
CE 366	Soil Mechanics and Testing (FE14)	3	-
ENGR 395	Engineering Materials Lab (FE9)	1	-
MSE 395	Intro to Materials Science (FE9)	2	-
CE 302	Constr. Mgmt. Sys. & Econ. (FE5/17)	-	3
PHIL 362	Professional Ethics (FE4)	-	3
CE 372	Engineering Hydraulics (FE11)	-	3
CE 402	Structural Steel Design (FE13)	-	3
ENGR 438	Intro to Environmental Eng. (FE 16)	-	3
CE 468	Foundation Engineering (FE14)	-	3
	Internship (required only for CEM)		summer
	Internship (recommended for all CE)		summer
Total		**15**	**18**

Fourth Year

Course #	**Course Title**	**1st**	**2nd**
CE 374	Intro to Transp. Sys. & Design (FE15)	3	-
ENGR 401	Senior Seminar I (FE Preparation)	2	-
CE 403	Reinforced Concrete Design (FE13)	3	-
CE 420	Senior Capstone Design I	2	-
Selected Electives I and II		3	3
Program Electives I and II		3	3
Liberal Studies Elective (L2)		-	3
Religious Elective (R3)		-	3
ENGR 402	Senor Seminar II (FE Exam in April)	-	1
CE 421	Senior Capstone Design II	-	3
Total		**10+TBA+TBA**	**10+TBA+TBA**

Internship Requirement

Internships are a vital educational component to experience professional engineering practice and often lead to part-time or full-time employment opportunities. Undergraduate students in the Department of Civil Engineering must complete at least one summer internship (two summer internships in construction concentration) related to their civil engineering studies. These last approximately 10 weeks and are typically paid. Internships can be performed at any city, state, or country. Students are responsible to arrange for internships with industry companies. After successful completion, students must write a two-page essay reflecting upon their internship experience that is signed by a company official and submitted to the department as proof to consider the requirement fulfilled. Students are urged to actively and early use the various services, consultations, and database by the Office of Career Services and to attend all career fairs. In cases of extreme hardship, students should see their advisor for assistance or reduction, but must provide written evidence of their efforts to arrange internship.

Religion Requirement

Students in the School of Engineering must take three courses. All students must take the introductory TRS 201 Faith Seeking Understanding plus two 200/300/400 TRS courses. The distinction between 200 / 300 / 400 level is not one of difficulty, but rather of breadth. The 200 level courses serve as introductory courses in the areas of specialization within the School of Theology and Religious Studies: Biblical Studies (200 & 210); Church History (220 & 221); Moral Theology and Ethics (230); Liturgy and Sacraments (240); Spirituality (251), History & Systematic Theology (261); and Religion and Culture (280 & 290). Courses at the 300 level treat more specialized questions within these same areas. Special Topics (400 level) courses are taught in a small seminar format with enrollment restricted to a certain population of students on campus.

Concentrations

The Concentration Elective Courses are taken according to the concentration of the students. Selected electives are required by the respective program. Program electives are chosen by the student. The list of concentration elective courses for each concentration is provided below:

Structural/Geotechnical Engineering (STG)

Selected Electives

CE 414	3	Advanced Vibrations and Structural Dynamics
CE 426	3	Introduction to Finite Elements

Program Electives

CE 416	3	Prestressed Concrete
CE 463	3	Applied Hydrology

Construction Engineering and Management (CEM)

Selected Electives

CE 301	3	Construction Systems and Planning
CE 490	3	Construction Operations Analysis

Program Electives

CE 482	3	Value Engineering (in odd-numbered years)
CE 483	3	Engineering Entrepreneurship, Sustainability, and Lean Methods
CE 487	3	Estimating and Bidding
CE 489	3	Construction Scheduling Techniques
CE 494	3	Construction Law, Operations, and Project Delivery (in even-numbered years)
CMGT 474	3	Strategic Management (in Crystal City)

Environmental Engineering (ENV)

Selected Electives

BIOL 105	4	Mechanisms of Life I
CHEM 108	3	General Chemistry II

Program Electives

CHEM 44	3	Environmental Chemistry Laboratory
CE 463	3	Applied Hydrology
CE 464	3	Surface Water Quality
CE 491	3	Engineering Hydrogeology and Groundwater Flow
CE 496	3	Water and Wastewater Treatment Engineering

Transportation Engineering (TRN)

Selected Electives

CE/CENT 478	3	Transportation Systems Management and Operations
CE/CENT 473	3	Traffic Engineering and Flow Theory

Program Electives

CENT 489/APRL 489	3	Geographical Information Systems
CE/CENT 400	3	Transportation Planning
CE/CENT 470	3	Innovative Infrastructure Management
CE/CENT 472	3	Intelligent Transp. Systems & Connected Vehicles
CE/CENT/CMGT 475	3	Introduction to Systems Analysis
CENT 442	3	Web Design
CENT 454	3	Organizational Theory and Behavior
CE/CENT 425	3	Nondestructive Testing and Evaluation
CE 499	3	Transportation Safety Engineering

Educational Objectives of the Undergraduate Program

The educational objectives of the civil engineering undergraduate program are that the graduates will:

1. Engage in careers in civil engineering or related fields as effective problem solvers and/or will pursue and excel in graduate or professional studies.
2. Continue to learn and to expand their knowledge and skill sets while engaging in professional practice and/or while pursuing graduate or professional studies.
3. Adhere to moral and ethical principles while solving technological problems within complex societal and global contexts and/or while pursuing graduate or professional studies.

Standard Program

Elective courses specific to each concentration of construction concentrators, environmental engineering will be selected by the students. For the civil/architectural concentration courses please refer to the departmental course tracking sheets for details.

Internships are a vital educational component to experience professional engineering practice and often lead to part-time or full-time employment opportunities.

Undergraduate students in the Department of Civil Engineering must complete at least one summer internship (two summer internships in construction concentration) related to their civil engineering studies. These last approximately 10 weeks and are typically paid. Internships can be performed at any city, state, or country.

Students are responsible to arrange for internships with industry companies. After successful completion, students must write a two-page essay reflecting upon their internship experience that is signed by a company official and submitted to the department as proof to consider the requirement fulfilled. Students are urged to actively and early use the various services, consultations, and database by the Office of Career Services and to attend all career fairs.

In case of extreme hardship, students should see their advisor for assistance or reduction, but must provide written evidence of their efforts to arrange internship.

For the capstone design, students must take CE 520, Design of Structural Systems I (2 credits) and CE 521, Design of Structural Systems II (3 credits). In CE 520 students learn about modern tools commonly used in practice of various civil engineering disciplines while CE 521 provides students a major design experience by allowing them to work on design project.

Recommended Program Electives

CE 500 Transportation Planning
CE 504 Stress - Strain Behavior of Soils
CE 516 Prestressed Concrete
CE 562 Seepage and Slope Stability
CE 563 Applied Hydrology
CE 564 Surface Water Quality
CE 572 Intelligent Transportation Systems
CE 574 Forensic Engineering
CE 575 Introduction to Systems Analysis
CE 578 Project Management
CE 582 Value Engineering
CE 583 Eng, Entrepreneurship, Sustain, and Lean Methods
CE 587 Estimating and Bidding
CE 591 Engineering, Hydrogeology and Groundwater Flow
CE 594 Construction Law, Operations, and Project Delivery
CE 596 Water and Wastewater Treatment Engineering
CE 599 Transportation Safety Engineering
CENT 542 Web Design
CENT 554 Organizational Theory and Behavior
CMGT 574 Strategic Management (Crystal City)

Department of Electrical Engineering and Computer Science

Professors	Nader Namazi; Charles C. Nguyen; Phillip Regalia
Professors Emeriti	Andrew G. Favret; George E. McDuffie; Robert Meister
Associate Professors	Lin-Ching Chang; Ozlem Kilic, *Chair;* Hang Liu; Erion Plaku
Assistant Professors	George Nehmetallah; Patricio Simari
Clinical Assistant Professor	Ujjal Bhowmik
Lecturers	Charles Campbell Jr.; Vincent Cassella; Aysegul Cuhadar; Vinh Dang; Saiid Ganjalizadeh; Robert Kamocsai; Vadim Knyazev; Francis Linehan; Quang Nguyen; Sridava Rao; Kevin Russo; Lawrence Schuette; Hanney Shaban; Randy Swisher; David Tremper

Mission of the Department

The mission of the Department of Electrical Engineering and Computer Science is to educate men and women in the disciplines of electrical engineering and computer science in order to prepare them professionally so that they can contribute and service the needs of society with a commitment founded on moral and ethical principles.

Electrical Engineering Program

The incessant expansion of the Internet, wireless communications, information technology, network and information security, robotics, computer engineering and alternative energy technologies continues to fuel demand for electrical engineers and computer scientists. Therefore majoring in electrical engineering offers excellent professional prospects and challenging career opportunities. Our dedicated and internationally recognized faculty are committed to providing a top- notch education which prepares students to

successfully enter the job market or to continue for advanced studies at the graduate level.

We have strong technical programs in electrical engineering and computer science with carefully designed curricula. Students enjoy a friendly and cooperative learning environment which offers advantages such as small class sizes, low student-teacher ratios, personalized interaction with faculty members and student participation in funded research projects. Our instructional laboratories are equipped with state-of-the-art instrumentation and equipment. Both undergraduate and graduate students can participate in funded research activities performed in our many research laboratories that are actively involved in areas including signal processing and visualization, applied electromagnetics and optics, telecommunications and information networks, robotics and intelligent control and material properties.

Bachelor of Electrical Engineering Standard Program First Year

See standard first-year engineering program in the general engineering section.

Second Year

Course #	Course Title	1st	2nd
ENGR 201	Engineering Mechanics I	3	-
ENGR 207	Robots and Sensor	-	3
ENGR 211	Thermodynamics	-	3
ENGR 212	Electrical Networks	-	3
ENGR 222	Engineering Mathematics I	-	4
MATH 221	Calculus II	4	-
PHYS 216	University Physics II	4	-
PHIL 362	Professional Ethics in Engineering	-	3
CHEM 107	General Chemistry I	3	-
CHEM 113	General Chemistry Lab I	2	-
	Liberal Studies Elective	3	-
	Total	**19**	**16**

Third Year

Course #	Course Title	1st	2nd
MATH 309	Probability & Statistics for Engineers	3	-
ENGR 355	Electrical Laboratory I	1	-
EE 311	Signals and Systems	3	-
EE 312	Microprocessors	-	3
ENGR 321	Electronic Circuits	3	-
ENGR 326	Switching Circuits and Logic Design	3	-
EE 327	Switching Circuits and Logic Design Lab	1	-
EE 342	Electromagnetic Fields and Waves I	-	3
EE 357	Electromagnetic Laboratory	-	1
	Liberal Studies Elective	3	-
	Total	**17**	**15**

Fourth Year

Course #	Course Title	1st	2nd
EE 413	Communication Systems	3	-
EE 457	Communications Laboratory	1	-
ENGR 403	Control Systems	3	-
	Program Electives	-	6

EE 491, 492	Engineering Practice and Design I, II	2	3
	Liberal Studies Elective	3	6
ENGR 401	Senior Seminar I	1	-
ENGR 402	Senior Seminar II	-	1
	Total	**16**	**15**

Recommended Program Electives

New courses are frequently added. For this reason students should consult their advisor regarding the department's recommendations and approval of each semester's program electives.

EE 502 Optical Systems and Devices
EE 504 Introduction to Fourier Optics
EE 514 Introduction to Hardware Accelerated Computing
EE 515 Advanced Digital Signal Processing
EE 516 Power Systems
EE 519 Digital Systems Design
EE 521 Programmable Logic Devices and HDL Design
EE 522 Linear System Analysis
EE 524 Secure Programming
EE 526 Computer and Network Security
EE 530 Parallel and Heterogenous Computing
EE 531 Data Communications Networks
EE 534 Communication and Computer Network Simulation
EE 540 Introduction to Antenna Systems
EE 541 Electromagnetic Theory
EE 542 Antennas & Propagation for Wireless Communications
EE 543 Remote Sensing
EE 544 RF and Microwave Circuits
EE 545 High Resolution Radar Signal Processing
EE 546 Electrical Properties of Materials
EE 548 Optical Signal and Image Processing
EE 550 Semiconductor Optoelectronics - Materials and Devices
EE 561 Random Signal Theory
EE 563 Fundamentals of Acoustics
EE 565 Information Security
EE 569 Computer Security and Privacy
EE 572 Basics of Information Coding and Transmission
EE 576 Introduction to Robotics
EE 581 Cryptography and Steganography
ENGR 520 Mathematical Analysis for Graduate Students
ENGR 543 Wireless Sensor Networks
ENGR 570 Basics of High Performance Computing for Engineers
ENGR 652 Advanced Optical and Image Processing
PHYS 506 Introduction to Modern Physics
PHYS 528 Optics
PHYS 531 Introduction to Quantum Theory

Educational Objectives of the Electrical Engineering Program

Graduates of the electrical engineering program within a few years of graduation will:

1. Use their broad knowledge of electrical engineering as a foundation for on- going learning, and will have realized some success early in their professional careers and/or in the pursuit of graduate studies.
2. Use their creative and critical reasoning skills to solve technical problems, ethically and responsibly, in service to society.
3. Use their mathematical and scientific knowledge to solve emerging real- world problems related to power, electronics, control systems, image analysis, signal processing and communication systems, and will use their communication, organization and teamwork skills for the execution of complex technological solutions.
4. Use their communication skills in bridging the divide between advanced technology and end users in the practice of electrical engineering.

Standard Program

For the alternative energy track in electrical engineering, courses vary from the standard program. Please refer to the departmental course tracking sheets for details.

Computer Science Program

The Computer Science Program, offering a Bachelor of Science in Computer Science, is designed to prepare graduates for leading roles in the computer science profession. The core areas of this program include operating systems, information processing, programming languages, computer graphics, hardware accelerated architectures, and information security. Many computer science electives are available to broaden the student's perspective in this field. Completion of this program also prepares the graduate for further graduate studies. Areas of special interest include data and communication networks, multimedia processing, bioinformatics, information assurance, and intelligent information systems. The department also offers a computer science minor, tailoring to students from other majors seeking to expand their command of information technologies.

The setting for this education is in a modern computer environment. The concentration of in-course studies, combined with laboratory studies, enhances the abilities of the students. Other school programs including electrical, civil, biomedical, and mechanical engineering offer a broad range of courses to computer science students, as additional program electives for students with special interests.

Bachelor of Science in Computer Science Standard Program First Year

Course #	Course Title	1st	2nd
CSC 113	Intro to Computer Programming with MatLab	3	-
CSC 123	C/C++ Programming	3	-
CHEM 107/103	General Chemistry 1	3	-
CHEM 113	General Chemistry I Lab	2	-
ENG 101	Rhetoric/Composition	3	-
MATH 121,122	Calculus I, II	4	4
PHYS 215	University Physics I	-	4
PHIL 201, 202	Classical Mind, Modern Mind	3	3
TRS 201	Faith Seeking Understanding	-	3
	Liberal Studies Elective	3	-
	Total	**18**	**17**

Second Year

Course #	Course Title	1st	2nd
CSC 210	Discrete Mathematics	3	-
CSC 223	Object-Oriented Programming w/Java	3	-

CSC 280	Data Structures		-	3
ENGR 326	Switching Circuits and Logic Design		3	-
EE 327	Switching Circuits and Logic Design Lab		1	-
CSC 390	Computer Organization		-	3
CSC 212	Theory of Computing		-	3
ENGR 222	Engineering Mathematics I		-	4
	Liberal Studies Elective		6	-
PHIL 362	Professional Ethics in Engineering		-	3
		Total	**16**	**16**

Third Year

Course #	Course Title		1st	2nd
CSC 322	Introduction to Computer Graphics		3	-
CSC 323	Introduction to Computer Networks		3	-
CSC 363	Software Engineering		-	3
CSC 370	Concepts of Programming Languages		3	-
MATH 309	Probability & Statistics for Engineers		3	-
CSC 306	Introduction to Operating Systems		-	3
MATH	309, 501, 507, or 509		-	3
	Liberal Studies Elective		3	3
	Program Elective		-	3
		Total	**15**	**15**

Fourth Year

Course #	Course Title		1st	2nd
CSC 411	Analysis of Algorithm		3	-
CSC 480	Numerical Analysis and Optimization		3	-
CSC 442	Introduction to Database Management		-	3
CSC 491, 492	Senior Design I, II		2	3
CSC 312	Microprocessor Programming & Design		-	3
	CSC Electives		6	6
		Total	**14**	**15**

Educational Objectives of the Computer Science Program

The educational objectives of the computer science program are to develop alumni who possesses:

1. The broad knowledge of computer science serving as a foundation for ongoing lifelong learning, and who will have demonstrated some success early in their professional careers and/or in the pursuit of graduate studies.
2. The creative and critical reasoning skills and are solving technical problems, ethically and responsibly, in service to society.
3. Mathematical and scientific knowledge and are solving emerging real world problems related to programming, networking, information security, image analysis, and advanced computing systems, and are demonstrating that they possess the necessary communication, organization and teamwork skills for the execution of complex technological solutions.
4. The necessary communication skills to bridge the divide between advanced technology and end users in the practice of computer science.

Department of Mechanical Engineering Professor

Professors	J. Steven Brown; Sen Nieh, *Chair*
Professors Emeriti	Mario Casarella;Yun Chow Whang
Associate Professors	John A. Judge; Joseph Vignola; Zhaoyang Wang
Assistant Professors	Eric Kommer; Xiaolong Luo
Clinical Associate Professor	Jandro Abot
Clinical Assistant Professor	Diego Turo
Adjunct Professors	George Mattingly, Tse-Fou Zien
Adjunct Associate Professors	Tuan Nguyen
Adjunct Assistant Professors	Mamta Nagaraja; Tongele N. Tongele; Adam Wolfe;
Lecturers	Jeffrey Didion; Shane Guan; William LaPlante; Rocco Mennella; Kenneth Romney; Nellore Venkataraman

Mission of the Department

The mission of the Department of Mechanical Engineering is to develop professional mechanical engineers with strong technical expertise rooted in a liberal arts tradition, by nurturing a high-quality learning and research environment.

Mechanical Engineering Standard Program

The Department of Mechanical Engineering offers undergraduate degree programs leading to the degree Bachelor of Mechanical Engineering. Mechanical engineering includes activities such as the design and control of systems and components for heating and power generation, aircraft and motored vehicles, refrigeration and air conditioning, environmental protection, complex structure and mechanical systems, vibration and acoustics, micro-and-nano-devices, mechatronics, computers and robotics. The undergraduate program provides a broad scientific and technical background in engineering, establishing the foundation for lifelong learning in newly emerging technologies. Computer software is continuously integrated in the design, analysis, and laboratory phases of the curriculum. Flexibility exists in the selection of upper-level technical courses to accommodate the students' interests and diverse career goals. These elective courses can prepare students for immediate careers in mechanical engineering, further studies at the graduate level in engineering, and alternative careers in such fields as law, business, or management.

Students need to complete 130 credits to graduate. The program is individualized for each student through elective courses.

First Year

See standard first-year engineering program in the general engineering section.

Second Year

Course #	Course Title	1st	2nd
ENGR 301	Solid Mechanics	3	-
MATH 221	Calculus II	4	-
CHEM 107	General Chemistry I	3	-
CHEM 113	General Chemistry Lab	2	-
PHYS 216	University Physics II	4	-
ENGR 106	Computer Aided Engr. Tools	-	2
ENGR 202	Engineering Mechanics II	-	3
ENGR 211	Thermodynamics	-	3
ENGR 212	Electrical Networks	-	3
ENGR 222	Engineering Mathematics I	-	4
	Liberal Studies Elective	-	3
	Total	**16**	**18**

Third Year

Course #	Course Title		1st	2nd
MATH 309	Probability & Statistics for Engineers		3	-
ME 314	Fundamentals of Mechatronics		3	-
ENGR 331	Fluid Mechanics		3	-
ME 395	Engineering Materials Lab		1	-
MSE 395	Introduction to Materials Science		2	-
ME 344	System Dynamics		3	-
ME 311	Intro Energy/Energy Systems		-	3
ME 342	Junior Design		-	3
ME 362	Heat Transfer		-	3
ME 392	Mechanical Systems and Dynamics Laboratory		-	2
PHIL 362	Professional Ethics in Engineering		-	3
	Liberal Studies Elective		-	3
		Total	**15**	**17**

Fourth Year

Course #	Course Title		1st	2nd
ME 441	Senior Design		3	-
ME 442	Senior Project		-	3
ME 487	Thermal-Fluid Science Lab		2	-
ME 404	Structural Mechanics		-	3
ENGR 403	Control Systems		3	-
	ME Program Electives		6	3
	Liberal Studies Electives		-	6
ENGR 401	Senior Seminar I		1	-
ENGR 402	Senior Seminar II		-	1
		Total	**15**	**16**

Educational Objectives of the Undergraduate Program

The educational objectives of the Mechanical Engineering Program are that the graduates will:

1. Use their technical and intellectual competency, versatility, and ethical foundations while engaged in careers or advanced studies within the traditional mechanical engineering discipline as well as other fields of interest (e.g., other engineering disciplines, law, medicine, finance).
2. Be productive team members while solving problems of local, national, and international scope within a modern global, environmental and ethical framework.
3. Contribute to professional, educational, and social institutions by applying their knowledge and skill towards the advancement of technology and the betterment of society.
4. Continue to learn and further develop and expand their knowledge and skill sets.

[1] BE=Biomedical Engineering; CE=Civil Engineering; EE=Electrical Engineering; ME=Mechanical Engineering.
[2] Biomedical Engineering students take BIOL 105 (4credits), BE students take CHEM 104 (3 credits)
[3] Students who elect to take the pre med track will be required to take two semesters of organic chemistry.
[4] Courses marked by an asterisk have substantial design content. Other graduate 500 series courses taken as program electives

are subject to departmental approval. New courses are frequently added. For this reason, students should consult with their advisors regarding the department's recommendations and approval of each semester's program electives.

[5] ME and CE students take ENGR 201 (3 credits) during the 2nd semester. [6] Implies that EE selects ENGR 202.

Courses Offered

A full listing of undergraduate courses offered by the School of Engineering can be found below. Consult Cardinal Station for additional information about courses and to determine course offerings by semester.

BE	202	Biomechanics
BE	315	Introduction to Biomedical Systems Analysis
BE	398	Junior Biomechanical Design
BE	401	Biomaterials
BE	413	Biomedical Instrumentation I
BE	418	Sensor Applications in Neurorehabilitaton
BE	421	Neural Control of Movement
BE	491	Seminar in Biomedical Engineering
BE	495	BMED Internship Projects
BE	497	BMED Senior Design
BE	499	BMED Senior Project Lab
BE	499TR	Transfer of Credit
CE	101	Elementary Construction Surveying
CE	102	Introduction to Earth Science
CE	103	Introduction to Oceanography
CE	110	Computers in Construction
CE	301	Construction Systems and Planning
CE	302	Construction Management Systems and Economics
CE	312	Theory of Structures
CE	313	Theory of Structures II
CE	366	Introduction to Soil Mechanics
CE	366	Introduction to Soil Mechanics
CE	367	Soil Testing for Engineers
CE	372	Engineering Hydraulics
CE	374	Introduction to Transportation Systems and Design
CE	394	Construction Law
CE	400	Seminar on Public Policy Issues
CE	402	Structural Steel Design
CE	403	Reinforced Concrete Design
CE	411	Geographical Information Systems
CE	414	Advanced Vibrations and Structural Dynamics
CE	416	Prestressed Concrete
CE	420	Senior Capstone Design I
CE	421	Senior Capstone Design II
CE	425	Nondestructive Testing and Evaluation
CE	426	Introduction to Finite Elements
CE	432	Laboratory Project

CE	433	Laboratory Project
CE	434	Disaster - Mitigating Design and Practice for the Developing World I
CE	435	Disaster-Mitigating Design and Practice for the Developing World II
CE	438	Introduction to Environmental Engineering
CE	454	Oranizatinal Theory and Behavior
CE	463	Applied Hydrology
CE	464	Surface Water Quality
CE	468	Foundation Engineering
CE	470	Innovative Infrastructure Management
CE	472	Intelligent Transportation Systems Connected Vehicles
CE	473	Traffic Engineering and Flow Theory
CE	475	Introduction to Systems Analysis
CE	478	Transportation Systems Management and Operations
CE	482	Value Engineering
CE	483	Entrepreneurship, Sustain, and Lean Methods
CE	487	Estimating and Bidding
CE	489	Construction Scheduling Techniques
CE	490	Construction Operations Analysis
CE	491	Engineering Hydrogeology and Groundwater Flow
CE	494A	Independent Study
CE	494B	Independent Study
CE	499	Transportation Safety Engineering
CE	499TR	Transfer of Credit
CENT	223	Object-Oriented Programming with Java
CENT	301	University Math
CENT	303	Probability and Statistics for Engineers
CENT	442	Web Design
CENT	472	Intelligent Transportation ssystems Connected Vehicles
CENT	475	Introduction to Systems Analysis
CENT	475	Transportation Planning
CNGW	243	ECE: Communication Theory
CSC	104	Introduction to Computers I
CSC	105	Introduction to Computers II
CSC	106	Introduction to Computer Programming for Non-Engineers
CSC	110	Intro to Computers Using Fortran
CSC	113	Introduction to Computer Programming with MATLAB
CSC	123	C/C++Programming Course
CSC	150DTR	Transfer Credit Distribution
CSC	150MTR	Transfer Credit Concentration
CSC	151DTR	Transfer Credit Distribution
CSC	151MTR	Transfer Credit Concentration
CSC	152DTR	Transfer Credits Distribution
CSC	152MTR	Transfer Credit Concentration

CSC	153DTR	Transfer Credit Distribution
CSC	155TR	Computer Science Free Elective
CSC	203	Assembly Language Programming
CSC	210	Discrete Mathematics
CSC	212	Theory of Computing
CSC	223	Object-Oriented Programming with Java
CSC	280	Data Structures
CSC	306	Introduction to Operating Systems
CSC	311	Design & Analysis of Algorithms
CSC	312	Microprocessor Programming
CSC	322	Introduction to Computer Graphics
CSC	323	Introduction to Computer Networks
CSC	326	Switching Circuits and Logic Design
CSC	327	Switching Circuits and Logic Design Laboratory
CSC	363	Software Engineering
CSC	370	Concepts of Programming Languages
CSC	390	Computer Organization and Architecture
CSC	391	Computer Systems Architecture
CSC	411	Analysis of Algorithms
CSC	427	Fundamentals of Neural Networks
CSC	442	Introduction to Database Management
CSC	450	Fundamentals of Multimedia
CSC	471	JAVA, OOP, Network Programming
CSC	475	Introduction to Computer Vision
CSC	480	Numerical Analysis and Optimization
CSC	484	Introduction to Machine Learning
CSC	491A	Senior Design I
CSC	491B	Senior Design II
CSC	499TR	Transfer of Credit
EE	311	Signals and Systems
EE	312	Microprocessor Programming and Design
EE	313	Electric and Electronic Devices
EE	315	Electrical Lab
EE	322	Electronic Circuits II
EE	326	Switching Circuits and Logic Design
EE	327	Switching Circuits and Logic Design Laboratory
EE	342	Electromagnetic Fields and Waves
EE	356	Electrical Laboratory II
EE	357	Electromag Laboratory
EE	362	Analog and Digital Signal Processing
EE	404	Solid State Devices
EE	406	Advance Digital Logic Design
EE	413	Communication Systems and Networks

EE	415	Control Systems Analysis and Synthesis
EE	420	Hybrid Gas/Electric Vehicles
EE	422	Mixed Signal VLSI Design
EE	427	Fundamentals of Neural Networks
EE	441	Electromagnetic Theory
EE	443	Introduction to Remote Sensing and Imaging Applications
EE	445	Basics of Computational Electromagnetics
EE	457	Communications Laboratory
EE	459	Introduction to Wind Energy Technology
EE	460	Photovoltaics
EE	461	Photovoltaics Laboratory
EE	462	Introduction to Electric Power
EE	491A	Engineering Practice and Design I
EE	491B	Engineering Practice and Design II
EE	499TR	Transfer of Credit
MSE	395	Introduction to Materials Science
ENGR	102	Introduction to Engineering Design and Professionalism
ENGR	102	Introduction to Engineering Design and Professionalism
ENGR	104	Introduction to Engineering Laboratory
ENGR	106	Computer Aided Engineering Tools
ENGR	201	Engineering Mechanics I
ENGR	202	Engineering Mechanics II
ENGR	211	Thermodynamics
ENGR	212	Electric Networks
ENGR	222	Engineering Mathematics I
ENGR	222	Engineering Mathematics I
ENGR	301	Mechanics of Solids
ENGR	314	Introduction to Alternative Energy
ENGR	321	Electronic Circuits I
ENGR	331	Fluid Mechanics
ENGR	355	Electrical Laboratory I
ENGR	395	Engineering Materials Laboratory
ENGR	401	Senior Seminar I
ENGR	403	Control Systems
ENGR	408	Batteries, Fuel Cells, and Energy Storage
ENGR	438	Introduction to Enviromental Engineering
ENGR	443	Wireless Sensor Networks
ENGR	494	Independent Study
ENGR	494A	Independent Study
ENGR	495	Internship/Co-Op Program
ENGR	495A	Internship/Co-Op
ENGR	497	Brazilian Summer Program
ENGR	499TR	Transfer of Credit

CME	361	Engr Prop Of Materials
ME	311	Introduction to Energy and Energy Systems
ME	314	Fundamentals of Mechatronics
ME	342	Junior Design
ME	342	Junior Design
ME	344	System Dynamics
ME	362	Heat Transfer
ME	373	Fundamentals of Flight
ME	392	Dynamics Laboratory
ME	392	Dynamics Laboratory
ME	404	Structural Mechanics
ME	441	Senior Design
ME	441	Senior Design
ME	442	Senior Project
ME	442	Senior Project
ME	447	Modelling and Simulation of Mechanical/Thermal-Fluid Systems
ME	457	Applied Rigid Body Dynamics
ME	487	Thermal Science Lab
ME	487	Thermal Science Lab
ME	499TR	Transfer of Credit