

VIII. School of Engineering

Officers of Instruction Faculty

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

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| Zhaoyang Wang, Ph.D. | <i>Associate Professor of Mechanical Engineering</i> |
| Yun Chow Whang, Ph.D. | <i>Professor Emeritus of Mechanical Engineering</i> |
| Otto C. Wilson, Ph.D. | <i>Associate Professor of Biomedical Engineering</i> |

Associates of the Faculty

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| Ejaz Azad, Ph.D. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| Michelle Bailey, Ph.D. | <i>Lecturer in Engineering Management</i> |
| Troy Barnes, M.M.A.S., M.E.M. | <i>Lecturer in Engineering Management</i> |
| Abdella Battou, Ph.D. | <i>Adjunct Assistant Professor of Electrical Engineering and Computer Science</i> |
| John Bonita, Ph.D., P.E. | <i>Lecturer in Civil Engineering</i> |
| Charles E. Campbell Jr., Ph.D. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| Alan B. Carr, M.S. | <i>Lecturer in Engineering Management</i> |
| Vincent Casella, Ph.D. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| Isaac Chang, Ph.D. | <i>Adjunct Assistant Professor of Biomedical Engineering</i> |
| Keefe Coburn, Ph.D. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| Aysegul Cuhadar, Ph.D. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| Jeffrey R. Didion, M.S. | <i>Lecturer in Mechanical Engineering</i> |
| Azad Ejaz, Ph.D. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| Ali Farnoud | <i>Lecturer in Civil Engineering</i> |
| Joseph Findaro, J.D. | <i>Lecturer in Civil Engineering</i> |
| Jeffrey E. Fernandez, Ph.D., P.E., C.P.E. | <i>Lecturer in Engineering Management</i> |
| Christy Foreman | <i>Lecturer in Biomedical Engineering</i> |
| Jeffrey E. Giangliuli, M.S.E. | <i>Lecturer in Engineering Management</i> |
| Wenjun Gu, M.S. | <i>Lecturer in Civil Engineering</i> |
| Shane Guan, Ph.D. | <i>Lecturer in Mechanical Engineering</i> |
| Matthew Guild, Ph.D. | <i>Lecturer in Mechanical Engineering</i> |
| Hubert Seth Hall, Ph.D. | <i>Lecturer in Mechanical Engineering</i> |
| Lei He, Ph.D. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| Liling Huang | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| James W. Hudson | <i>Lecturer in Civil Engineering</i> |
| Boyd A. Jones, Ph.D. | <i>Lecturer in Engineering Management</i> |
| Philip C. Jones, J.D. | <i>Lecturer in Civil Engineering</i> |
| Vadim Knyazev, Ph.D. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| Michael P. Kushner, M.B.A., P.M.P. | <i>Lecturer in Engineering Management</i> |
| Robert LaTorre, Ph.D. | <i>Lecturer in Mechanical Engineering</i> |
| Mesfin Lakew, M.S. | <i>Lecturer in Civil Engineering</i> |
| S. Samuel Lin, Ph.D. | <i>Lecturer in Civil Engineering</i> |
| Francis Linehan, M.E.E. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| George Mattingly, Ph.D. | <i>Adjunct Professor of Mechanical Engineering</i> |

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| John McTyre, M.S. | <i>Lecturer in Civil Engineering</i> |
| Rocco Mennella | <i>Lecturer in Mechanical Engineering</i> |
| Tien Nguyen, Ph.D. | <i>Adjunct Assistant Professor of Electrical Engineering and Computer Science</i> |
| Tuan Nguyen, Ph.D., P.E. | <i>Adjunct Associate Professor of Mechanical Engineering</i> |
| Silas C. Nichols, Ph.D. | <i>Lecturer in Civil Engineering</i> |
| Ken O'Connell, Ph.D., P.E. | <i>Lecturer in Civil Engineering</i> |
| Neil Palumbo, Ph.D. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| Mark Pettinato, M.S. | <i>Lecturer in Biomedical Engineering</i> |
| Long Phan, Ph.D. | <i>Lecturer in Civil Engineering</i> |
| Sridava Rao, Ph.D. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| Kenneth Romney | <i>Lecturer in Mechanical Engineering</i> |
| Kevin Russo, M.S. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| Alfonz Ruth, Ph.D. | <i>Lecturer in Civil Engineering</i> |
| Lawrence Schuette, Ph.D. | <i>Adjunct Associate Professor of Electrical Engineering and Computer Science</i> |
| Matthew D. Sermon, M.S.E. | <i>Lecturer in Engineering Management</i> |
| Hanney Shaban, Ph.D. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| Jeffrey W. Shupp, M.D. | <i>Adjunct Assistant Professor of Biomedical Engineering</i> |
| Randy Swisher, M.S. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| Richard C. Thompson, Jr., Ph.D., M.B.A., A.I.A. | <i>Lecturer in Engineering Management</i> |
| Tongele N. Tongele, Ph.D. | <i>Adjunct Assistant Professor in Mechanical Engineering</i> |
| Nellore Venkataraman, Ph.D. | <i>Lecturer in Mechanical Engineering</i> |
| Khanh Vu, M.S. | <i>Lecturer in Electrical Engineering and Computer Science</i> |
| Mel Williams, Jr. M.S.E., VADM (ret) | <i>Associate Dean (External Affairs); Director of Engineering Management Program, Lecturer in Engineering Management</i> |
| Adam Wolfe, Ph.D., P.E. | <i>Adjunct Assistant Professor of Mechanical Engineering</i> |
| Bing Xu, Ph.D. | <i>Lecturer in Civil Engineering</i> |
| Tse-Fou Zien, Ph.D. | <i>Adjunct Professor of Mechanical Engineering</i> |

Biomedical Engineering Advisory Council

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

Civil Engineering Advisory Council

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| Dr. Timothy W. Kao, P.E. | <i>Professor Emeritus of Civil Engineering and Former Chair, Department of Civil Engineering, The Catholic University of America, Washington, DC</i> |
| Mr. Lawrence E. Moore, II, P.E. | <i>Director of Engineering, Clark Concrete Contractors, LLC, Bethesda, MD</i> |
| Dr. Dennis McCahill | <i>Retired</i> |
| Dr. Steven Smith | <i>Principal Engineer and Group Manager, CTL Group, Washington Office, Columbia, MD</i> |

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| Ms. Melissa Prelewicz | <i>Associate Executive Director, American Association of Engineering Societies, Reston, VA</i> |
| Mr. Bill Whiting | <i>Vice President, Whiting-Turner Contracting Co., Washington, DC</i> |
| Mr. Scott Stewart | <i>Principal, SK&A Structural Engineers, Washington, DC</i> |

Electrical Engineering and Computer Science Advisory Council

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

Mechanical Engineering Advisory Council

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| Richard Dame, Ph.D. | <i>President (Retired), Mega Engineering, Silver Spring, MD</i> |
| David Didion, Ph.D. | <i>Retired NIST Fellow, National Institute of Standards and Technology, Port Republic, MD</i> |
| Terry DuBois, Ph.D. | <i>US Army Communications, Electronics, Research, Development and Engineering Center, Aberdeen Proving Ground, MD</i> |
| Peter Herdic, Ph.D. | <i>Sr. Scientist, Naval Research Laboratories, Washington, DC</i> |
| Don Marlowe | <i>Standards Administrator (Retired), Science and Health Communication, U.S. Food and Drug Administration, Rockville, MD</i> |
| Jude Nitsche | <i>Principal, Nitsche and Associates LLC, Alexandria, VA</i> |
| Steven Russell, Ph.D. | <i>Project Manager, Ship Systems Engineering Office of Naval Research, Arlington, VA</i> |
| Jaclyn A. Schade | <i>Registered Patent Agent, Pillsbury Winthrop Shaw Pittman LLP, McLean, VA</i> |
| Owen G. Thorp, III, Ph.D. | <i>Captain, USNR, Permanent Military Professor Weapons and Systems Engineering Department, US Naval Academy, Annapolis, MD</i> |
| Stephen Wilson | <i>Deputy Director, Ship Signature Department, NSWC - Carderock, West Bethesda, MD</i> |

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 a master's degree in Engineering Management and Materials Science and Engineering. The school prides itself on being a small Catholic engineering school that provides quality education with a personal touch.

Students can expect close interaction with faculty, small class sizes, a small student-to-teacher ratio and a faculty dedicated to

teaching and research. All members of the full-time faculty hold doctoral degrees and are very active in funded research and scholarly publication.

The school's strong ties with local research institutions such as NASA, NIH, NIST, NRL etc., foster research collaborations and enable our faculty to bring research experience into the classroom. Students can benefit from research assistantships from funded research projects.

Goals

Goal 1: Distinction. Distinguish the CUA School of Engineering through actions and communications as the Engineering School with Teaching and Research Excellence, Ethical Character Development, Caring Service, and the advantages of Location in the Capital of the United States of America.

Goal 2: Prosperity. The School will achieve prosperity by expanding and strengthening existing programs and establishing unique and timely new academic programs that serve the region, nation, and world with superior technical competence, incorporate moral and ethical values, and prepare future leaders.

Goal 3: Opportunity. The School will provide the best opportunities for Faculty, Staff, and Students to realize their full potential.

Graduate programs in the school emphasize both theory and application of advanced engineering principles. The goal of the school is to produce professional engineers, scientists and researchers who can contribute significantly to society through their chosen profession and scientific and research activities.

Degree Programs

Through its four departments and two non-departmentalized engineering programs, the school offers graduate programs leading to the Master of Science (M.S.) degree and Doctor of Philosophy (Ph.D.) degree in the following concentration areas:

Biomedical Engineering (M.S., Ph.D.) Civil Engineering (M.S., Ph.D.) Electrical Engineering (M.S., Ph.D.) Computer Science (M.S., Ph.D.) Mechanical Engineering (M.S., Ph.D.) Engineering Management (M.S. only)
Materials Science and Engineering (M.S. only)

The curricula of the master's degree programs aimed at a particular discipline provide in-depth coverage of topics related to the discipline.

Special Regulations Admission

Admission to the School of Engineering follows the general university regulations (see Admission to Graduate Study in these *Announcements*). We present here general admission regulations pertaining only to the graduate degree programs of the School of Engineering. Additional specific requirements for admission to particular programs, if any, are given in the departmental sections. Admission to all graduate degree programs is made by the dean of the School of Engineering upon the recommendation of the chair/director of the appropriate graduate program.

Doctoral Degree Programs

The minimum grade point average, GPA, required for admission to the doctoral degree programs is 3.4. In special circumstances, program chairs and faculty may petition for students to be admitted who do not meet the GPA guideline. There is no provisional admission for the doctoral programs.

Master Degree Programs

The minimum requirement for admission to the M.S. degree program is a baccalaureate degree from an accredited university. The minimum requirement for admission to the master's degree program of a particular engineering program is an undergraduate degree from an accredited engineering program. Additional requirements may apply based on undergraduate performance. The minimum GPA required for regular admission to master's degree programs is 3.0 for bachelors-level courses. Provisional admission may be granted to students with a bachelor's-level GPA less than 3.0. Provisional admission will be converted to regular admission after the student passes a set of approved graduate level courses with a minimum GPA of 3.0.

Degree Requirements

The degree requirements for graduate studies in the School of Engineering generally follow the university requirements (see General Requirements of Graduate Studies). We present here general degree requirements pertaining only to the graduate degree programs of the School of Engineering. Additional specific degree requirements for particular programs, if any, are provided in the departmental sections.

Grade Point Average for Graduation

A minimum cumulative GPA of 3.0 in coursework taken in the School of Engineering is required for graduation in all graduate programs.

Master's Degree

The university's general requirements for graduate study for the master's and licentiate degrees apply to all master's degree programs offered in the School of Engineering. There are, however, two exceptions: competency in a foreign language is not required and a comprehensive examination is not required. The minimum requirements for the master's degree are the successful completion of an approved program of study consisting of at least 30 semester credit hours. Individual programs may require more than 30 semester credit hours. Two options are available to complete the requirements.

Non-thesis Option

A student may complete the required semester credit hours through graduate coursework with a cumulative GPA of at least 3.0.

Thesis Option

A student may write a master's thesis whose topic is approved by the appropriate graduate program. If this option is selected, the student registers for a total of six semester credit hours of master's thesis guidance. Upon approval of the written thesis, six semester credit hours, which count toward the minimum 30, will be posted to the student's academic record. The remaining number of semester credit hours of graduate coursework must be completed with a minimum cumulative GPA of 3.0.

Core Master's-Level Course

All students pursuing a master's degree in the programs of biomedical, civil, electrical and mechanical engineering are required to pass with a grade of C or better in two of the four courses: Graduate Level Applied Mathematics, Numerical Methods in Engineering, Engineering Economics and Engineering Systems Analysis. Each program may impose further restrictions regarding which courses their students must take.

Joint Master's Degree Programs

Some graduate programs in the School of Engineering participate in joint degree programs that allow students to earn two engineering master's degrees. The student must satisfy all requirements for both degrees but may be allowed to designate up to four approved graduate engineering courses to partially satisfy the requirements for both degrees. Typically, this would reduce the total number of graduate engineering courses required to earn both master's degrees from 20 courses to 16 courses. Contact the dean's office of the School of Engineering for more information.

Doctoral Degree

The university's general requirements for graduate study for the doctoral degree apply to all doctoral programs of the School of Engineering, with one exception: the foreign language competency exam is not required. The requirements for a doctoral degree (Ph.D.) of the school include:

1. A minimum of 53 semester hours of graduate work in a program of study prepared and approved in consultation with an advisor;
2. The successful passing of a comprehensive examination upon completion of the graduate coursework;
3. The approval of a dissertation proposal submitted and presented by the candidate; and
4. The approval and successful defense of the dissertation in an oral examination conducted as specified by university procedures.

Transfer of Credit

Up to six semester credit hours of graduate work earned at another accredited institution with a grade of B or higher may be applied toward course requirements for master's degrees upon recommendation of the appropriate graduate program and with the approval of the dean of the school. Up to 24 semester credit hours of graduate work earned at another accredited institution with a grade of B or higher may be applied toward course requirements for the doctoral degrees upon recommendation of the appropriate graduate program and with the approval of the dean of the school. As part of the 24 credits eligible for transfer, up to six credits of thesis coursework may be eligible for transfer. The thesis work and topic are subject to review by the department chairperson and the transfer must be approved by both the department chairperson and dean. For students who earned their master's degrees at CUA, up to 30 semester credit hours of coursework with a grade of B or above may be applied toward the course requirements for the doctoral degrees.

General Engineering

Courses Offered

A full listing of general engineering graduate courses offered by the School of Engineering is found below. Additional courses can be found in each of the following departmental sections. Consult [Cardinal Station](#) for additional information about courses and to determine course offerings by semester.

Department of Biomedical Engineering

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| Associate Professors | Sang Wook Lee; Peter Lum, <i>Chair</i> ; Binh Tran; Otto Wilson, Jr. |
| Assistant Professors | Gregory Behrmann; Sahana Kukke, Christopher Raub |
| Lecturers | Christy Foreman, Mark Pettinato |
| Adjunct Assistant Professors | Isaac Chang; Jeffrey Shupp |
| Research Ordinary Professor | Harold Szu |

The Department of Biomedical Engineering offers graduate programs leading to the degrees of Master of Science in Biomedical Engineering, and Doctor of Philosophy, Ph.D. The focus of graduate education is to provide biomedical engineers with the principles and tools of modern engineering, applied to solving problems in medicine or biology.

Courses are offered in the following areas of concentration: Biomaterials and Biotechnology, Biomechanics & Rehabilitation Engineering, Biomedical Instrumentation & Medical Imaging, Home Care Technologies & Telemedicine, Clinical Engineering.

The Biomedical Engineering Program has strong interaction with the Department of Mechanical Engineering and the Department of Electrical Engineering and Computer Science in terms of course offerings and research activities. Graduate students may follow one of two tracks-thesis or coursework designed for two distinct groups of students. The first track offers both master's and doctoral programs and is directed at those students pursuing research activities that will culminate in a thesis or dissertation. The coursework requirements are intended to prepare the student for research.

The second track offers only a master's degree program intended for recent graduates, practicing engineers and/or medical professionals interested in specialized areas pertinent to career objectives. These professional degree programs enable the engineer or scientist to become familiar with new developments and advances in technologies. These programs allow flexibility in course selection, including those outside the department.

Qualified CUA undergraduate students are encouraged to pursue graduate studies via the accelerated master's program.

Admission

In addition the school's admissions guidelines (under Special Regulations) for regular admission status to the master's and doctoral degree programs in biomedical engineering, students will be admitted based upon enrollment availability and their ability to meet the following recommended entrance requirements:

Students must have received a bachelor's degree in engineering, science or mathematics from an accredited institution and, in addition must satisfy:

All minimum university requirements

A cumulative undergraduate GPA of at least a 3.0 out of 4.0 (master's) or 3.4 out of 4.0 (doctoral)

Students not meeting the above minimum requirements may receive provisional admission (master's only) as recommended by the graduate committee and/or department chair. Performance of provisional students will be reviewed after one semester of graduate study for transfer to regular admission status.

Students from non-engineering disciplines may be required to take prerequisite courses (e.g., statics, dynamics, electrical circuits, differential equations, fluid mechanics, etc.), as appropriate.

Master's Degree

Graduate students plan their program in consultation with an advisor and may elect to pursue a broad master's degree program without specific concentration or to major in one of the areas identified above. Maximum flexibility in scope of studies is afforded by utilization of courses offered in other departments of the university or other local universities through the Consortium of Universities of the Washington Metropolitan Area.

Requirements for the master's degree programs follow those established for the school. Please refer to Degree Requirements.

Doctoral Degree

Requirements for the doctoral degree program follow those established for the school. Please refer to Degree Requirements.

Typical Courses Offered

Please consult the registrar's Web site at <https://cardinalstation.cua.edu> for descriptions of courses offered in the current semester.

Courses Offered

A full listing of graduate courses offered by the department is found below. Consult **Cardinal Station** for additional information about courses and to determine course offerings by semester.

Department of Civil Engineering

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| Professor | Lu Sun, Chair; Gunnar Lucko |
| Professors Emeriti | John J. Baltrukonis; Timothy Kao; Dennis F. McCahill; John J. McCoy; Hsien Ping 'Frank' Pao; Michael C. Soteriades |
| Associate Professor | Arash Massoudieh |
| Assistant Professors | Bismark Agbelie; Chanseok Jeong; Min 'Max' Liu; Masataka Okutsu, |
| Lecturers | Ali Farnoud, 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, 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 |

The goal of the educational programs in civil engineering is to produce graduates who are schooled in engineering fundamentals and capable of doing advanced engineering work. To this end, programs offered in the Department of Civil Engineering are professional in nature and lead to the Master of Science degree, and the Doctor of Philosophy, Ph.D. Major areas include fluid and solid mechanics, structures and structural mechanics, geotechnical engineering, environmental engineering and management, systems engineering, transportation engineering, and construction engineering and management. The available courses include laboratory studies, applied mathematics, engineering analysis, engineering design and a variety of introductory and advanced level courses in various areas of engineering and applied science and construction management. The department also participates in an interdisciplinary graduate program in engineering management leading to the Master of Science, M.S. degree.

Admission

Please refer to Admission under Special Regulations for the school.

Master's Degree

Graduate students plan their program in consultation with an advisor and may elect to pursue a broad Master of Science (M.S.) degree program major in one of the areas identified above. The minimum requirements for the master's programs in civil engineering are the successful completion of 30 semester credit hours. Maximum flexibility scope of studies is afforded by utilization of courses offered in departments of the university or other area universities through the Consortium of Universities of the Washington Metropolitan Area.

Doctoral Degree Programs

Candidates for the Ph.D. degree in civil engineering plan their program in consultation with an advisor. The program of studies is tailored individually to meet the needs of the student and the academic and professional standards of the department. Maximum flexibility in scope studies is afforded by utilization of courses offered in other departments of the university or other area universities through the Consortium of Universities of the Washington Metropolitan Area.

Other requirements for the doctoral degree program follow those established for the school. Please refer to Degree Requirements.

For students interested in pursuing a Ph.D. degree, a Master's thesis is strongly recommended.

Courses Offered

A full listing of graduate courses offered by the department is found below. Consult **Cardinal Station** for additional information about courses and to determine course offerings by semester.

Engineering Management Program

Adjunct Associate Professors: Michelle Bailey, Troy Barnes; Alan B. Carr; Jeffrey E. Fernandez; Jeffrey E. Giangliuli; Boyd A. Jones; Michael P. Kushner; Matthew D. Sermon; Richard C. Thompson, Jr.; Mel Williams, Jr., Associate Dean (External Affairs) and Director.

Mission

To provide excellence in engineering management education for graduate students to enhance their careers and to accelerate their learning as they leverage new engineering and technological advances while leading, managing, and serving a diverse workforce within their respective organizations.

The Engineering Management Program offers students the opportunity to earn a Certificate in Engineering Management or a Master of Science degree. The Engineering Management Program curriculum enhances management performance, develops managerial skills, and promotes the use of technology and engineering techniques to resolve the production, operations, regulatory, and financial issues facing today's professional in business, industry and government. It is designed to provide the student with knowledge of the theory and practice of management as it specifically pertains to engineering and technology-oriented organizations and activities. The program is oriented to the management of engineering processes within the broader context of a company or agency enterprise.

New- Online Education. Effective in the Spring semester of 2018, Engineering Management Program courses will be available in a *Fully Online* delivery method (e.g. available to globally distant students). For local Washington DC area students, the *preferred* delivery method will be "online-hybrid" with about 75% Online and about 25% Face to Face in classroom with the Professor.

Master of Science (Engineering Management)

The Master of Science curriculum enhances management performance and develops managerial skills. It is designed to provide the student with knowledge of the theory and practice of management as it specifically pertains to engineering and technology-oriented organizations and activities. The program is oriented to the management of engineering processes within the broader context of a company or agency enterprise. Three tracks are offered to allow the student to focus on their career preference:

Engineering Management and Organization

This track was developed to provide a graduate-level foundation for the practice of managing engineering organizations. It is appropriate for those that will assume leadership positions in technically oriented organizations.

Project and Systems Engineering Management

This track was developed to provide a graduate level foundation for the practice of managing projects associated with development and life cycle management of a product. It is appropriate for project managers and system engineers in management roles or those that will be in those positions.

Technology Management

This track was developed to provide a graduate-level foundation for the practice of managing technology development, and implementation of sustainment activities. It is appropriate for those that will assume leadership positions in technology development or sustainment organizations.

Each track has seven core courses that give the foundation for engineering management and electives that allow students to focus their degree to their personal career plan. Nine semester hours (three courses) are used to tailor the degree program to the student's specific needs.

The Master of Science (Engineering Management) degree program requires completion of 30 semester credit hours. The School of Engineering offers a wide range of specialties relating to mechanical engineering, civil engineering, electrical engineering, computer science, and biomedical engineering. Elective courses up to six credits may be transferred from accredited educational institutions into the program. Our partnership with the Nuclear Power Directorate allows transfer of 12 credits for completion of the U.S. Navy Officer Nuclear Power School Program.

A maximum of 6 credit hours of studies may be transferred from another institution. No course with a grade of less than B (3.0) is transferrable. Grades earned in transferred courses are not included in computing the required GPA of 3.0. Up to 9 credit hours may be transferred from the Defense Acquisition University (DAU). Specific restrictions are addressed on the DAU Partnership page.

Other substitutes may be appropriate depending on the student's educational objectives.

The Engineering Management master's degree program results in an engineering/scientific degree, rather than a business degree; therefore the program candidate should have an engineering, physical science or mathematics degree with appropriate technical or

engineering experience. (Depending on experience, candidates without mathematics-based degree may be accepted for the program. Prerequisites may be required.)

A minimum of 30 semester credit hours is required, but a thesis is not required. All M.S. candidates for graduation must have earned at least a 3.0 cumulative grade point average in courses leading to the degree. For more information go to <http://engineering.cua.edu/engrmgmt>.

Certificate of Engineering Management

Four Professional Certificates are available:

Engineering Management Professional Certificate

This program is designed to provide specialized graduate-level education and to further professional continuing education for those persons who will assume major administrative positions in industry or government organizations.

Program Management Professional Certificate

This program is designed to provide specialized graduate-level education and to further professional continuing education or certification (beyond or prior to Project Management Institute certification) for those who will act as program or product managers in industry and government.

Systems Engineering Professional Certificate

This program is designed to provide specialized graduate-level education and to further professional continuing education or certification (beyond or prior to International Council on Systems Engineering (INCOSE) certification) for those persons who will act as the technical/systems engineering lead in major programs, organizations or functions in industry or government.

Management of Information Technology Professional Certificate

This program is designed to provide specialized graduate-level education and to further professional continuing education or certification for those persons who will be responsible for management of information technology resources in industry and government.

These certificate programs provide an understanding of the core engineering management theory and tools that underpin technical management practices.

The Engineering Management Professional Certificate is awarded upon successful completion of 15 semester credit hours (five courses) of key program courses. To meet student needs one course could be substituted by an appropriate elective course from the School of Engineering or an approved transferred course.

For a course to be transferred, students must have earned a grade of B or better. The certificate is awarded after completion with a grade of C or better in all courses counted toward the certificate requirements.

Courses Offered

A full listing of graduate courses offered by the department is found below. Consult [Cardinal Station](#) for additional information about courses and to determine course offerings by semester.

Class Locations

Engineering Management classes are held at the Crystal City Crowne Plaza Hotel or on the CUA campus in northeast DC. The degrees offered at off campus sites have been approved by the governing board of CUA and are equivalent to those given on campus. The State Council of Higher Education for Virginia (SCHEV) has certified the CUA School of Engineering to operate in Virginia.

Department of Electrical Engineering and Computer Science

| | |
|--------------------------------------|---|
| Professors | Nader Namazi; Charles C. Nguyen |
| Professors Emeriti | Andrew G. Favret; George E. McDuffie; Robert Meister |
| Associate Professors | Lin-Ching Chang; Ozlem Kilic, <i>Chair</i> ; Hang Liu; Erion Plaku |
| Assistant Professors | George Nehmetallah; Patricio Simari |
| Clinical Assistant Professors | 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 |

The Department of Electrical Engineering and Computer Science offers graduate programs leading to the degrees of Master of Science (M.S.) and Doctor of Philosophy (Ph.D.). Programs offered are Computer Graphics, Computer Engineering, Communication Systems, Network Security, Sensors and Remote Sensing, Microwave, Optics and Materials, and Signal and Image Processing.

The faculty is actively engaged in several research areas including computer graphic display of medical images, Web-based communication, ATM-based high-speed networks, computer and satellite communications, interaction of electromagnetic radiation with biological systems, image microoptical devices, image motion detection and estimation, communication intelligence, information visualization, biomedical imaging, computational intelligence and image understanding. A majority of the research projects is funded by industries and government agencies such as NASA, the Navy, the Army, NIH, and NSF.

Admission

Students pursuing degree programs should apply for regular admission. The minimum requirement for regular admission to the M.S. program is a bachelor's degree in engineering, science or mathematics from an accredited institution. Students lacking certain requirements for regular admission to the M.S. program can apply for a provisional admission.

Performance of provisional students will be reviewed after two semesters of graduate study for possible transfer to regular admission. The minimum requirements for regular admission to the M.S. program in computer science is a bachelor's degree with undergraduate background in computer science that includes the equivalent of the following topics: data structures, computer organization and assembly language, programming languages, theoretical computer science, and discrete structures. A student will be provisionally admitted to the M.S. program if he or she has one or more deficiencies. The deficiency courses must be successfully completed before the provisional status is converted to regular status. Admission to the doctoral degree programs is based upon academic performance at the bachelor and master's levels. For other admission requirements, please refer to Admission under Special Regulations.

M.S. Program

Two options are available in the M.S. program. The non-thesis option requires 30 semester credit hours of approved coursework. The thesis option requires a minimum of 24 semester credit hours of approved coursework plus a thesis comprising six semester credit hours of master's thesis guidance. The approved coursework must include at least 18 semester credit hours of approved electrical engineering courses. The remaining courses must be in engineering and science disciplines and approved by the graduate coordinator of the department.

The M.S. degree program in computer science has two options, the thesis option and the non-thesis option. For both options, each student must submit a program of study to the department for approval upon entering the program. The program of study must contain a minimum of 30 semester credit hours of approved graduate-level courses comprising at least 18 semester credit hours of core courses and 12 semester credit hours of elective courses.

The core courses must be selected from courses in four areas of concentration: computer science foundations, computer systems, software systems, and computing methodologies, such that at least three semester credit hours are chosen from each of the above areas of concentration.

Doctoral Degree Program

The program of studies is individually tailored to meet the needs of the student and to fit with the department research areas and facilities. Students must pass a comprehensive examination in major and minor areas after completing all required coursework.

The Ph.D. degree requires a minimum of 54 semester hours of formal graduate coursework beyond the bachelor's degree. The major includes at least nine semester credit hours and minor includes at least six credit hours at the graduate levels in one of the listed topic areas. Additional areas that must meet minimum requirements are chosen in consultation with the advisor. For additional degree requirements, see Degree Requirements.

Courses Offered

A full listing of graduate courses offered by the department is found below. Consult [Cardinal Station](#) for additional information about courses and to determine course offerings by semester.

Materials Science and Engineering

Associate Professors Bipradas Dutta; John Philip; Abhijit Sarkar

Research Ordinary Professors Lawrence Cook

Clinical Associate Professors Jandro Abot, Director

Adjunct Assistant Professors Sugata Chowdhury

Lecturers

The Materials Science and Engineering (MSE) program offers graduate courses leading to the degree of Master of Science, M.S. Two options are available in the M.S. program. The non-thesis option requires 30 semester credit hours of approved coursework. The thesis option requires a minimum of 24 semester credit hours of approved coursework plus a thesis comprising six semester credit hours of master's thesis guidance.

The approved coursework must include at least 18 semester credit hours of approved MSE core courses. The core courses are described in a later section. The remaining courses must be in engineering and science disciplines and approved by the director of the program. For both options, each student must submit a program of study to the program director for approval upon entering the program.

Mission

The goal of the professional Master of Science (MS) program in MSE is to produce graduates who are schooled in materials science, engineering fundamentals and capable of doing advanced engineering work. Major areas include metals, ceramics, glasses and composites and focuses on physical, mechanical, electrical and structural and electrical properties of materials. Other areas of specialization include nanotechnology. The available courses include a variety of introductory and advanced level courses in various areas of engineering and applied science, applied mathematics and laboratory studies. Graduate students plan their program in consultation with the program director and pursue the MS degree program with a specific concentration in one of the areas identified above. Maximum flexibility scope of studies is afforded by utilization of courses offered in departments of the university or other area universities through the Consortium of Universities of the Washington Metropolitan Area.

Admission

Students pursuing the MS degree in MSE should apply for regular admission. The minimum requirement for regular admission is a bachelor's degree in engineering, science or mathematics from an accredited institution. For foreign students, satisfactory scores (according to CUA guidelines) in TOEFL or a similar testing agency is additionally required. The minimum requirement for regular admission to the MS program in MSE is a bachelor's degree with undergraduate background in engineering, computer science, any science discipline including biology and mathematics. For other admission requirements, please refer to Admission under Special Regulations.

Courses Offered

A full listing of graduate courses offered by the department is found below. Consult [Cardinal Students](#) for additional information about courses and to determine course offerings by semester.

Special Topics Courses

Computational Materials Science, , Nanotechnology, Composite Materials, Corrosion Engineering, are some of the courses that are offered.

Department of Mechanical Engineering

Professors J. Steven Brown; Sen Nieh, *Chair*

Professors Emeriti Mario Casarella; Yun Chow Whang

Associate Professors Jandro Abot, John A. Judge, Xiaolong Luo, Joseph Vignola, Zhaoyang Wang

Clinical Assistant Professors Diego Turo

Adjunct Professors George Mattingly, Tse-Fou Zien

Adjunct Associate Professors Tuan Nguyen

Adjunct Assistant Professors Tongele N. Tongele, Adam Wolfe

Lecturers Jeffrey Didion; Shane Guan; Matthew Guild, Hubert Seth Hall, Robert LaTorre, Rocco Mennella; Kenneth Romney; Nellore Venkataraman

The Department of Mechanical Engineering offers graduate programs leading to the degrees of Master of Science (M.S.) and Doctor of Philosophy (Ph.D.). The programs are:

Professional Master's Program

For recent graduates and practicing engineers interested in specialized areas to enhance their careers, the program emphasizes advances in existing and emerging technologies. Master's thesis is optional.

Master's Program (pre-doctoral)

For students interested in pursuing a Ph.D. degree, a Master's thesis is strongly recommended.

Doctoral Program

For students pursuing a Ph.D. degree, this program emphasizes strong foundations in mechanical engineering as well as advanced topics in a specialized area of concentration.

Research Areas

- Acoustics
- Active Control and Intelligent Materials/Systems
- Advanced and Non-Linear Dynamics
- Aerospace and Aeronautic Engineering
- Air Pollution Control and Global Warming/Climate Change
- Biofabrication & Microfluidics
- Clean Energy / Power Production and Use
- Combustion and Multiphase Systems
- Composite Materials
- Computational Methods (FEM and CFD)
- Electronic Packaging and 3-D Imaging
- Heat/Mass Transfer and Thermodynamics
- HVAC and Refrigeration
- Lab-On-A-Chip Mechatronics and MEMS
- Nano-Mechanics and Sensors
- Robotic Mechanics
- Structural and Experimental Mechanics
- Three-Dimensional Imaging
- Vibration and Noise Reduction of Mechanical Systems

Admission

Please refer to Admission under Special Regulations.

Master's Degree Program

Candidates for graduate studies plan their program in consultation with an advisor. Maximum flexibility in scope of studies is afforded by utilization of courses offered in other departments of the university or other area universities through the Consortium of Universities of the Washington Metropolitan Area. Requirements for the master's degree programs follow those established for the school with the specification of ENGR 520 (Mathematical Analysis for Graduate Students) and one of the following two courses, ENGR 516 (Computational Methods for Graduate Students) or ENGR 518 (Experimental Techniques for Graduate Students). The department offers the following areas of specialty: 1) Energy and Environment, 2) Acoustics, Vibration and Structures and 3) Nano-mechanics and MEMS. Please refer to Degree Requirements.

Doctoral Degree Program

Requirements for the doctoral degree program follow those established for the school. Please refer to Degree Requirements. Note that the comprehensive examination is directed at assessing a student's preparation in advanced topics for doctoral research, and understanding of the research literature and a student's ability to define the frontiers of the proposed areas of investigation. The department offers two areas of specialty for doctoral study: 1) Thermal-Fluid Sciences, and 2) Mechanics, Acoustical and Nano Systems.

Courses Offered

A full listing of graduate courses offered by the department is found below. Consult [Cardinal Station](#) for additional information about courses and to determine course offerings by semester.

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| BE | 501 | Biomaterials |
| BE | 502 | Advanced Biomechanics |
| BE | 504 | Biomechanics of Hard Tissue |
| BE | 506 | Mechanics of Soft Tissue |
| BE | 508 | Biomedical Applications of Origami |
| BE | 513 | Biomedical Instrumentation I |
| BE | 514 | Introduction to Biomedical Optics |
| BE | 515 | Biomedical Signal Processing |
| BE | 516 | Bioelectromagnetics |
| BE | 518 | Biomedical Sensors |
| BE | 520 | Medical Robotics |
| BE | 521 | Neural Control of Movement |
| BE | 522 | Human Locomotion |
| BE | 523 | Biomechanical Assessment of Locomotion Disorders |
| BE | 524 | Prosthetics & Orthotics |
| BE | 525 | Biomedical Heat and Mass Transfer |
| BE | 526 | Biomedical Transfer Processes |
| BE | 527 | Cell and Tissue Engineering |
| BE | 528 | Rehabilitation Engineering |
| BE | 529 | Clinical Engineering Facilities & Regulatory |
| BE | 530 | Human Computer Interfaces |
| BE | 531 | Neural Stimulation in Rehabilitation |
| BE | 532 | Sensory Motor Integration |
| BE | 533 | Human Factors Engineering and Ergonomics |
| BE | 534 | Experimental techniques in motor neuroscience |
| BE | 535 | Optimization of Human Performance |
| BE | 536 | Mechanics of Dance and Sports |
| BE | 540 | Home Care Technologies Seminar |
| BE | 541 | Home Care Technologies I: Foundations |
| BE | 542 | Home Care Technologies II:Product Evaluation |
| BE | 543 | Home Care Technologies III: Product Design and Manufacturing |
| BE | 544 | Innovations in Healthcare Service Delivery |
| BE | 546 | Medical Device Design and Regulation |
| BE | 548 | Medical Reliability Engineering |
| BE | 550 | Nano-Medicine |
| BE | 552 | Biotechnology & Biomedicine |
| BE | 554 | Bioinformatics |
| BE | 556 | BONE |
| BE | 558 | Biomedical Engineering Innovation and Entrepreneurship |
| BE | 560 | Computational Models of Complex Biomedical Systems |

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| BE | 581 | Medical Imaging |
| BE | 582 | Medical Image Processing |
| BE | 586 | Ultrasound Imaging & Therapy |
| BE | 595 | BMED Grad Internship Projects |
| BE | 597 | Biomedical Research Methods |
| BE | 613 | Advanced Topics in Medical Instrumentation |
| BE | 617 | Soft Computing-BioMonitoring and Bio-Control |
| BE | 621 | Advanced Topics in Neural Control |
| BE | 651 | Computations in Genetic Engineering |
| BE | 671 | Cardio-Pulmonary Biomechanics |
| BE | 681 | Advanced Topics in Optical Imaging |
| BE | 683 | Principles and Biomedical Applications of Fluorescence |
| BE | 721 | Advanced Neuro-Mechanical Modeling |
| BE | 728 | Advanced Topics in Rehabilitation Engineering |
| BE | 729 | Advanced Topics in Biomaterials |
| BE | 733 | Mathematical Modeling in Biology |
| BE | 734 | Molecular Dynamics and Simulation |
| BE | 797 | Special Topics in Biomedical Engineering |
| CE | 501 | Advanced Mechanics of Solids |
| CE | 502 | Introduction to Continuum Mechanics |
| CE | 503 | Introduction to Elasticity |
| CE | 504 | Stress-Strain Behavior of Soils |
| CE | 506 | Advanced Structural Systems |
| CE | 511 | Applied Plastic Design and Limit Analysis |
| CE | 514 | Advanced Vibrations and Structural Dynamics |
| CE | 516 | Prestressed Concrete |
| CE | 517 | Infrastructure Evaluation and Service Life Extension |
| CE | 518 | Experimental Techniques for Graduate Students |
| CE | 524 | Matrix and Computer Methods in Structural Analysis |
| CE | 525 | Nondestructive Evaluation and Condition Assessment of Structures |
| CE | 526 | Introduction to Finite Elements |
| CE | 529 | Computational Fluid Mechanics |
| CE | 534 | Disaster - Mitigating Design |
| CE | 538 | Introduction to Environmental Engineering |
| CE | 538 | Environmental Engineering |
| CE | 541 | Environmental Engineering Chemistry |
| CE | 542 | Environmental Chemistry Laboratory |
| CE | 543 | Environmental Microbiology & Biological Processes |
| CE | 555 | Environmental Law and Policy |
| CE | 556 | Sustainable Development Principles and Practice |
| CE | 560 | Case Studies in Geotechnical and Geo-environmental Engineering |
| CE | 562 | Seepage and Slope Stability |
| CE | 563 | Applied Hydrology |

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| CE | 564 | Surface Water Quality |
| CE | 565 | Water Resources Engineering |
| CE | 570 | Pavement Management System |
| CE | 571 | Pavement Theory & Design |
| CE | 572 | Intelligent Transportation Systems |
| CE | 573 | Traffic Engineering and Flow Theory |
| CE | 574 | Forensic Engineering-Scientific Failure Investigation |
| CE | 575 | Introduction to Systems Analysis |
| CE | 576 | Systems Design |
| CE | 577 | Econometrics |
| CE | 578 | Transportation Systems Management and Operations |
| CE | 579 | Harbors and Coastal Engineering |
| CE | 581 | Practical Construction Law |
| CE | 582 | Value Engineering |
| CE | 583 | Engineering Entrepreneurship, Sustainability, and Lean Methods |
| CE | 585 | Graduate Research Methods |
| CE | 586 | Advanced Cementitious Material |
| CE | 587 | Estimating and Bidding |
| CE | 588 | Construction Operational Management |
| CE | 589 | Construction Scheduling Techniques |
| CE | 590 | Construction Operational Analysis |
| CE | 591 | Engineering Hydrogeology and Groundwater Flow |
| CE | 594 | Construction Law, Operations and Project Delivery |
| CE | 596 | Water and Wastewater Treatment Engineering |
| CE | 598 | Hazardous Waste Treatment |
| CE | 599 | Transportation Safety Engineering |
| CE | 603 | Inelastic Stress Analysis |
| CE | 604 | Constitutive Modeling of Frictional Materials |
| CE | 611 | Management Information Systems and GIS in Civil Engineering |
| CE | 614 | Earthquake Engineering and Seismic Design |
| CE | 615 | Soil Dynamics and Geotechnical Earthquake Engineering |
| CE | 622 | Variational Methods in Engineering |
| CE | 630 | Pavement Theory and Design Principles |
| CE | 670 | Risk and Reliability in CE Systems |
| CE | 675 | Advanced Operations Research |
| CE | 714 | Passive and Active Control of Large Structural Systems |
| CE | 732 | Theoretical Hydrodynamics |
| CE | 767 | Advanced Geotechnical and Structural Systems |
| CENT | 503 | Reinforced Concrete Design |
| CENT | 506 | Advanced Structural Systems |
| CENT | 508 | Bridge Inspection |
| CENT | 509 | Geosynthetics in Civil Engineering |
| CENT | 513 | Pavement Asset Management |

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| CENT | 525 | Nondestructive Testing and Evaluation |
| CENT | 542 | Web Design and Programming |
| CENT | 550 | Computer Programming & Appl. |
| CENT | 551 | Project Management |
| CENT | 552 | Decision Analysis |
| CENT | 553 | Risk Management |
| CENT | 554 | Organization Theory & Behavior |
| CENT | 566 | Geotechnical Engineering & Lab |
| CENT | 568 | Foundation Engineering |
| CENT | 570 | Pavement Management System |
| CENT | 573 | Traffic Flow Theory & Engineering |
| CENT | 575 | Introduction to System Analysis |
| CENT | 578 | Transportation Systems Management and Operations |
| CENT | 601 | Human Resource Management |
| CENT | 611 | Geographical Information System |
| CENT | 651 | Selected Imaging Techniques in Civil and Transportation Engineering |
| CNGW | 743 | ENCE: Soil Dynamics and Earthquake Engineer |
| CNMD | 529 | 0102: ARSC 101 |
| CNMD | 530 | ENAE 692:Introduction to Space Robotics |
| CNMD | 743 | ENCE: Soil Dynamics and Earthquake Engr |
| CNMD | 789A | GEOL: Seismology |
| CEE | 515 | Digital Signal Processing |
| CEE | 524 | Intro to Digital Signal Proces |
| CEE | 527 | Neural Networks |
| CEE | 548 | Theo& Design- Synchronous Machines |
| CEE | 549 | Optoelectronics |
| CEE | 561 | Random Signal Theory |
| CEE | 566 | Computer Control Systems |
| CEE | 644 | Optical Communications |
| CSC | 502 | Engineering and Computer Science Management |
| CSC | 504 | Compiler Construction |
| CSC | 507 | Unix System Programming |
| CSC | 508 | X Window Programming |
| CSC | 509 | Web Design &Programming |
| CSC | 511 | Computational Complexity |
| CSC | 513 | Fundamentals of Computer Graphics |
| CSC | 514 | Introduction to Hardware Accelerated Computing |
| CSC | 515 | Mobile Programming |
| CSC | 519 | Digital System Design |
| CSC | 520 | Topics in Computer Science |
| CSC | 521 | Programmable Logic Devices and HDL Design |
| CSC | 522 | Operating Systems |
| CSC | 524 | Secure Programming |

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| CSC | 525 | Embedded Systems Programming |
| CSC | 526 | Computer and Network Security |
| CSC | 527 | Fundamentals of Neural Networks |
| CSC | 530 | Introduction to Data Analysis |
| CSC | 531 | Data Communications Networks |
| CSC | 532 | System Simulation |
| CSC | 533 | Optimization |
| CSC | 534 | Communication and Computer Network Simulation |
| CSC | 541 | Database Systems |
| CSC | 542 | Artificial Intelligence |
| CSC | 551 | Pattern Recognition |
| CSC | 564 | Advanced Software Engineering |
| CSC | 565 | Information Security |
| CSC | 569 | Computer Security and Privacy |
| CSC | 575 | Human-Computer Interface |
| CSC | 576 | Introduction to Robotics |
| CSC | 581 | Cryptography and Steganography |
| CSC | 582 | Computer Graphics and Game Programming |
| CSC | 583 | Geometry Processing in Computer Graphics and Vision |
| CSC | 584 | Introduction to Machine Learning |
| CSC | 593 | Directed Study |
| CSC | 597 | Computer Security & Privacy |
| CSC | 611 | Logic for Computing Scientists |
| CSC | 612 | Analysis of Algorithms |
| CSC | 613 | Combinatorial Algorithms and Intractability |
| CSC | 620 | Digital Forensics Technology |
| CSC | 621 | Computer Networks |
| CSC | 623 | Real-Time Systems |
| CSC | 633 | Software Requirements & Specifications |
| CSC | 635 | Software Verification, Validation, and Testing |
| CSC | 636 | Distributed Computing |
| CSC | 641 | Data Mining |
| CSC | 650 | Intelligent Multimedia |
| CSC | 651 | Multimedia Processing and Information Retrieval |
| CSC | 671 | Cyber-Security Laws, Ethics and Policies |
| CSC | 675 | Visual Intelligence and Computer Vision |
| CSC | 681 | Security Architecture and Analysis |
| CSC | 691 | Advanced Computer Architecture |
| CSC | 693 | Advanced Topics in Cyber Security |
| CSC | 728 | Visualization |
| CSC | 775 | Human-Computer Interface |
| CSC | 991 | Graduate Design |
| EE | 502 | Optical Systems and Devices |

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| 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 System 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 | 527 | Fundamentals of Neural Networks |
| EE | 530 | Parallel and Heterogeneous 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 and Propagation for Wireless Communications |
| EE | 543 | Intro to Remote Sensing and Imaging Applications |
| EE | 544 | RF and Microwave Circuits |
| EE | 545 | Basics of Computational Electromagnetics |
| EE | 546 | Electrical Properties of Materials |
| EE | 548 | Optical Signal and Image Processing |
| EE | 549 | Parallel Programming for large-scale Computational Problems |
| 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 |
| EE | 617 | Adaptive Signal Processing |
| EE | 618 | Optimum Signal Processing |
| EE | 621 | Fundamentals of Kalman Filtering and Smoothing |
| EE | 625 | System Optimization |
| EE | 627 | Neural Networks and Bioinformatics |
| EE | 628 | Computational and Molecular Imaging |
| EE | 631 | Broadband Integrated Services Digital Networks |
| EE | 634 | Digital Image Processing |
| EE | 642 | Electro-Optics and Photonics |
| EE | 643 | Photonic Communication Network Devices |
| EE | 644 | Optical Communications |
| EE | 645 | Optical Communication Networks |
| EE | 646 | Optical Internet |

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| EE | 647 | Intelligent Broadband Multimedia Networks |
| EE | 652 | Wireless Communications |
| EE | 656 | Digital Communications |
| EE | 657 | Spread Spectrum Communications |
| EE | 659 | Satellite Communications |
| EE | 671 | Statistical Signal Processing |
| EE | 672 | Error Control Coding |
| EE | 710 | Wavelet Theory and Applications |
| EE | 712 | Communication Theory |
| EE | 717 | Advances in Adaptive Signal Processing |
| EE | 725 | Information Theory and Source Coding |
| EE | 731 | Computer Communication Networks |
| EE | 740 | Numerical Methods in Electromagnetics |
| EE | 741 | Advanced Electromagnetic Scattering Phenomena |
| EE | 742 | Time Domain Electromagnetics |
| EE | 746 | Electromagnetic Radiation and Scattering |
| EE | 771 | Detection and Estimation Theory |
| EE | 772 | Detection and Estimation Theory II |
| MSE | 501 | Introduction to Materials Engineering |
| MSE | 511 | Optical and Magnetic Materials: Properties and Synthesis |
| MSE | 519 | Experimental Methods in Materials Engineering |
| MSE | 522 | Mechanical Properties of Materials |
| MSE | 531 | Introduction to Soft Materials |
| MSE | 532 | Computational Materials Science |
| MSE | 542 | Electrical Properties of Materials |
| MSE | 550 | X-ray Diffraction and Electron Microscopy |
| MSE | 551 | Physical Properties of Materials |
| MSE | 562 | Corrosion Engineering |
| MSE | 571 | Artificial Organ Engineering |
| MSE | 581 | Introduction to Nanotechnology |
| MSE | 582 | Modeling in Materials Science and Engineering |
| MSE | 582 | Industrial Processing of Materials |
| MSE | 590 | Glass Science |
| MSE | 591 | Composite Materials |
| CCE | 505 | Decision Analysis |
| CCE | 546 | Manag Engr Econ |
| CCE | 547 | Managerial Engineering Economics |
| CCE | 570 | Project Management |
| CCE | 575 | Introduction to Systems Analysis |
| CMGT | 505 | Decision Analysis |
| CMGT | 508 | Technology Management |
| CMGT | 510 | Information Systems for Managers |
| CMGT | 515 | Software Management Decisions for Engineering Leaders |

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| CMGT | 547 | Managerial Engineering Economics |
| CMGT | 561 | Engineering Ergonomics |
| CMGT | 562 | Engineering Risk Management |
| CMGT | 570 | Project Management |
| CMGT | 572 | Organizational Theory and Behavior |
| CMGT | 573 | Planning and Control of Organizations |
| CMGT | 574 | Strategic Management |
| CMGT | 575 | Introduction to Systems Analysis |
| CMGT | 580 | Introduction to Systems Engineering Management |
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| ENGR | 501 | Introduction to Mechatronics |
| ENGR | 503 | Control Systems |
| ENGR | 504 | Modern Control Systems |
| ENGR | 506 | Basic System Design of Space Payloads |
| ENGR | 507 | Testing & Data Analysis of Space Payloads |
| ENGR | 510 | Strategic Standardization |
| ENGR | 516 | Computational Methods for Graduate Students |
| ENGR | 518 | Experimental Techniques for Graduate Students |
| ENGR | 520 | Mathematical Analysis for Graduate Students |
| ENGR | 522 | Mechanical Properties of Materials |
| ENGR | 526 | Electrical Properties of Materials |
| ENGR | 529 | Computational Fluid Mechanics |
| ENGR | 535 | Introduction to Climate Change & Energy |
| ENGR | 536 | Environmental Protection & Energy |
| ENGR | 538 | Introduction to Environmental Engineering |
| ENGR | 540 | Reliability Engineering |
| ENGR | 541 | Transport Phenomena in Biological Systems: Engineering Applications |
| ENGR | 543 | Wireless Sensor Networks |
| ENGR | 544 | Introduction to Multiphase Systems |
| ENGR | 545 | High-Resolution Radar Signal Processing |
| ENGR | 545 | High-Resolution Radar Signal Processing |
| ENGR | 547 | Intermediate Thermodynamics |
| ENGR | 552 | Introduction to Imaging Technologies |
| ENGR | 565 | Nonlinear Dynamics and Chaos |
| ENGR | 570 | Basics of High Performance Computing for Engineers |
| ENGR | 575 | Introduction to Systems Analysis |
| ENGR | 576 | Introduction to Robotics |
| ENGR | 583 | Mech. Design & Optimization of Electronic Syst. |
| ENGR | 584 | Introduction to Nanotechnology |
| ENGR | 585 | Optimization Methods for Engineering Systems |
| ENGR | 621 | Kalman Filtering |
| ENGR | 623 | Numerical and Analytical Methods in Partial Differential Equations and Inverse Problems |

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| ENGR | 626 | Wave Propagation Analysis |
| ENGR | 627 | Multiphysics Finite Element Analysis |
| ENGR | 631 | Broadband Int Ser Digital Networks |
| ENGR | 634 | Digital Image Processing |
| ENGR | 652 | Advanced Optical & Imaging Processing |
| ENGR | 693 | Directed Research Masters |
| ENGR | 696 | Master's Thesis Research |
| ENGR | 696B | Master's Thesis Continuation |
| ENGR | 696CR | Master's Thesis Credit Conferral |
| ENGR | 724 | Multiphysics Finite Element Analysis |
| ENGR | 733 | NonLinr Dynamics: Physiologicl Systems |
| ENGR | 753 | Active Vibration Control |
| ENGR | 755 | Adaptive Control |
| ENGR | 758 | Adv Active Vibration Control |
| ENGR | 778 | Adaptive Control Systems |
| ENGR | 781 | Nonlinear Control |
| ENGR | 797 | Special Topics |
| ENGR | 798 | Special Topics II |
| ENGR | 993 | Directed Research - Doctoral |
| ENGR | 993A | Directed Research - Doctoral |
| ENGR | 996 | Doctoral Dissertation Research |
| ENGR | 998A | Doctoral Comprehensive Examination (w/Classes) |
| ENGR | 998B | Doctoral Comprehensive Examination (w/o Classes) |
| ME | 502 | Introduction to Elec. Packaging and MEMS |
| ME | 503 | Structural Mechanics |
| ME | 504 | Finite Element Methods |
| ME | 505 | Programming & Software Tools in Mechanical Engineering |
| ME | 507 | Mechanical Systems and Control |
| ME | 510 | Modern Control Systems |
| ME | 517 | Engineering Optimization Methods |
| ME | 524 | Hydro and Coastal Energy Technology |
| ME | 526 | Alternative Energy Engineering |
| ME | 527 | Renewable Energy & Technology |
| ME | 529 | Environmental Protection for Energy Systems |
| ME | 530 | Applied Energy Systems |
| ME | 531 | Optimal Design of Energy Systems |
| ME | 532 | Design of Power and Propulsion Systems |
| ME | 533 | Energy Conservation and HVAC |
| ME | 534 | Design of HVAC and Refrigeration |
| ME | 535 | Design and Optimization of Thermal Systems |
| ME | 536 | Thermal Environmental Engineering |
| ME | 537 | Air Pollution and Control |
| ME | 538 | Design of Solar Systems & Wind Power |

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| ME | 539 | Combustion and Incineration |
| ME | 541 | Conduction and Radiation |
| ME | 543 | Heat Exchanger: Design and Analysis |
| ME | 544 | Intro to Multiphase Systems |
| ME | 547 | Intermediate Thermodynamics |
| ME | 548 | Intermediate Heat Transfer |
| ME | 549 | Intermediate Fluid Mechanics |
| ME | 550 | Combustion and Waste Management |
| ME | 551 | Infrared Systems |
| ME | 552 | Introduction to Flight Dynamics |
| ME | 554 | Aerospace Design |
| ME | 557 | Advanced Dynamics |
| ME | 558 | Introduction to Ocean Engineering |
| ME | 559 | Fundamentals of Ocean Acoustics |
| ME | 560 | Introduction to Acoustics |
| ME | 561 | Acoustics & Wave Propagation |
| ME | 563 | Acoustics Media & Design |
| ME | 564 | Structural Acoustics |
| ME | 565 | Atmospheric Acoustics |
| ME | 566 | Advanced Vibrations and Structural Dynamics I |
| ME | 568 | Experimental Vibration and Acoustics |
| ME | 572 | Computer Controlled Mechanical Systems |
| ME | 573 | Marine Bioacoustics |
| ME | 574 | Orbital Mechanics and Mission Design |
| ME | 575 | Transduction |
| ME | 576 | Aerodynamics |
| ME | 577 | Applied Mechatronics |
| ME | 578 | Ocean Acoustics |
| ME | 579 | Acoustic Matamaterials |
| ME | 580 | Introduction to MEMS and Microfabricatiion |
| ME | 581 | Introduction to Microfluidics and Lab-on-a-Chip Technologies |
| ME | 582 | Introduction to Mechanical Fundamentals of Electronic Systems |
| ME | 583 | Mechanical Design and Optimization of Electronic Systems |
| ME | 584 | Introduction to Nanotechnology |
| ME | 585 | Machine Vision & Imaging Tech. in M.E. |
| ME | 588 | Robotics and Mechatronics |
| ME | 589 | Smart Structures |
| ME | 622 | Turbulence |
| ME | 640 | Advanced Thermodynamics |
| ME | 642 | Advanced Heat Transfer |
| ME | 645 | Advanced Fluid Dynamics |
| ME | 647 | Multiphase Flows |
| ME | 648 | Heat Exchangers-Theory and Applications |

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| ME | 651 | Advanced Topics of Infrared Systems |
| ME | 654 | Computational Structural Mechanics |
| ME | 656 | Optimal Control |
| ME | 657 | Advanced Dynamics |
| ME | 660 | Intermediate Acoustics |
| ME | 661 | Acoustics Metrology & Materials |
| ME | 663 | Transduction in Acoustics/Vibration |
| ME | 664 | Modal Analysis |
| ME | 666 | Advanced Vibrations and Structural Dynamics II |
| ME | 668 | Active and Passive Vibration Control |
| ME | 669 | Nonlinear Vibration |
| ME | 681 | Micro- & Nano-scale Fluid Mechanics |
| ME | 701 | Finite Element Method: Theory and Applications |
| ME | 702 | Advanced Topics in Acoustics |
| ME | 703 | Advanced Problems in Vibration and Acoustics |
| ME | 704 | Advanced Problems in Vibrations and Acoustics II |
| ME | 721 | Advanced Computational Fluid Dynamics |
| ME | 726 | Advanced Combustion and Multiphase Systems |
| ME | 728 | Advanced Problems in Pollution Control |
| ME | 733 | Turbulent Flows |
| ME | 741 | Advanced Problems in Thermal Science |
| ME | 751 | Advanced Topics in Vibration Control |
| ME | 752 | Advanced Topics in Mechanics |
| ME | 754 | Advanced Computational Structural Analysis |
| ME | 756 | Advanced Problems in Controls |
| ME | 760 | Advanced Topics in Acoustics |
| ME | 761 | Acoustic Imaging |