VILLANOVA UNIVERSITY

College of Engineering

Graduate Engineering Catalog

2024-2025

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While this catalog was prepared based on the best information available at the time of publication, all information, including statements of fees, course offerings, admissions, and graduation requirements, is subject to change without notice or obligation.

General Information

Villanova University is a co-educational Roman Catholic institution, founded by the Order of Saint Augustine in 1842, in Villanova, Pennsylvania. A premier institution of higher education, Villanova provides a comprehensive education rooted in the liberal arts; a shared commitment to the Augustinian ideals of truth, unity and love; and a community dedicated to service to others.

A wide variety of undergraduate and graduate degree programs are offered through the University's six colleges: the College of Liberal Arts & Sciences, the Villanova School of Business, the College of Engineering, the College of Professional Studies, the M. Louise Fitzpatrick College of Nursing, and the Charles Widger School of Law. With a total enrollment that surpasses 10,000 undergraduate, graduate and law students, Villanova is the oldest and largest Catholic university in the Commonwealth of Pennsylvania. It is located twelve miles west of the historic city of Philadelphia.

The University offices are open Monday through Friday from 9 a.m. to 5 p.m.

The Office of the Associate Dean for Graduate Studies and Research is in Room 301, Center for Engineering Education and Research (CEER).

The University campus is situated in Villanova, Pennsylvania, on Lancaster Avenue (U.S. Route 30), six miles west of City Line, Philadelphia, Pennsylvania.

The postal address is 800 E. Lancaster Avenue, Villanova, Pennsylvania 19085-1681. The University telephone number is 610-519-4500; the College of Engineering telephone number is 610-519-6723; the fax number is 610-519-5859.

Prospective students may obtain additional information on the University website.

Villanova University is an affirmative action institution complying with the requirements of Executive Order 11246 as Amended by 11375; Title IX; and the Rehabilitation Act of 1973, Sections 503 and 504. Villanova is authorized under Federal law to enroll nonimmigrant alien students. Note: The pronoun "he" as used in this publication usually refers to both male and female students.

Academic Calendar 2024-2025

Summer 2024

Date	Event
Wednesday, May 29	Classes begin
Tuesday, June 4	Last day for late registration and for dropping and/or adding courses.
Thursday, June 15	September Graduation Deadline – Last day to apply in the myNOVA portal for September graduation
Friday, June 24	Last day to submit Application for Ph.D. Qualifying Examinations for exams held second week of Fall semester
Wednesday, June 19	Juneteenth – No classes
Thursday, July 4	Independence Day – No classes

Date	Event
Tuesday, July 9	Last day for withdrawing from courses or changing from credit to audit
Monday, July 29	• Final examinations will be held July 31 or the last scheduled class day • Thesis/Dissertation Final Copy Deadline All Grade Change Forms associated with Thesis/Dissertation must be electronically submitted AND Advisor Approval Form must be submitted to Graduate Programs Office for those expecting to complete degree requirements by the end of the Fall Semester. (Students must then post online.) Advisor Approval form/instructions to upload to ProQuest can be found under the PhD Program and Thesis tabs respectively. Graduate Policies, Procedures, and Forms
Thursday, August 1	Final Grades Due (12:00 noon)
Friday, August 25	myNOVA portal opens for May graduation applications.
Friday, September 6	Last day for "N" grade conversion to be received by Registrar (Summer 2024 semester)

Fall 2024

In any fall semester where the University calendar does not naturally include a total of 14 weekly class meetings, plus a final exam period, the instructor is expected to schedule an additional class meeting time.

Date	Event
Monday, August 26	Classes begin
Sunday, September 1	Last day for late registration and for dropping and/or adding courses
Monday, September 2	Labor Day - No classes
Wednesday, September 11 (Tentative)	Ph.D. Math Qualifying Examination
Friday, September 13 (Tentative)	Ph.D. Discipline Specific Qualifying Examination
Friday, September 13	December Graduation Deadline - Last day to apply in the myNOVA portal for December graduation
Monday, October 14	Semester Recess
Monday, October 21	Classes Resume
Wednesday, November 13	Last day for Authorized Withdrawal without Academic Penalty (WX)
Wednesday, November 27	Thanksgiving Recess
Monday, December 2	Classes Resume
Monday, December 2	Last day to submit Application for Ph.D. Qualifying Examinations for exams held second week of Spring semester
Friday, December 6	Thesis/Dissertation Final Copy Deadline All Grade Change Forms associated with Thesis/Dissertation must be electronically submitted AND Advisor Approval Form must be submitted to Graduate Programs Office for those expecting to complete degree

Date	Event
	requirements by the end of the Fall Semester. (Students must then post online.) Advisor Approval form/instructions to upload to ProQuest can be found under the PhD Program and Thesis tabs respectively. Graduate Policies, Procedures, and Forms
Thursday, December 12	Final day of classes
Saturday, December 14 – Friday, December 20	Final Examinations (no exams on Sat./Sun.)
Monday, January 6, 2025	Final Grades Due (12:00 Noon)
Friday, January 31, 2025	Last day for submission of work to remove "N" grade (Fall 2024 Semester)
Friday, February 14, 2025	Last day for "N" grade conversion to be received by Registrar (Fall 2024 Semester)

Spring 2025

In any Spring semester where the University calendar does not naturally include a total of 14 weekly class meetings, plus a final exam period, the instructor is expected to schedule an additional class meeting time.

Date	Event
Monday, January 13	Classes begin
Sunday, January 19	Last day for late registration and for dropping and/or adding courses
Monday, January 20	Martin Luther King Day – No classes
Wednesday, January 22 (Tentative)	Ph.D. Math Qualifying Examination
Friday, January 24 (Tentative)	Ph.D. Discipline Specific Qualifying Examination
Wednesday, January 31	May Graduation Deadline - Last day to apply in the myNOVA portal for May graduation.
Thursday, February 1	myNOVA portal opens for September graduation applications
Friday, March 1	myNOVA portal opens for December graduation applications
Monday, March 3	Semester recess
Monday, March 10	Classes Resume
Wednesday, April 2	Last day for Authorized Withdrawal without Academic Penalty (WX)
Thursday, April 17	Easter Recess
Tuesday, April 22	Classes Resume

Date	Event
Tuesday, April 29	Thesis/Dissertation Final Copy Deadline All Grade Change Forms associated with Thesis/Dissertation must be electronically submitted AND Advisor Approval Form must be submitted to Graduate Programs Office for those expecting to complete degree requirements by the end of the Spring Semester. (Students must then post online.) Advisor Approval form/instructions to upload to ProQuest can be found under the PhD Program and Thesis tabs respectively. Graduate Policies, Procedures, and Forms
Thursday, May 1	Final day of classes
Saturday, May 3 – Friday, May 9	Final Examinations (No exams on Sunday, May 4)
Tuesday, May 12	Final Grades Due Spring 2023 Semester (12 noon)
TBD	Graduate Awards Event
Saturday, May 17	Commencement and Baccalaureate Mass
Friday, June 27	Last day for submission of work to remove "N" grade (Spring 2025 Semester).
Friday, July 11	Last day for "N" grade conversion to be received by Registrar (Spring 2025 Semester)

Administration

Officers of Administration

Role	Name
President	Peter M. Donohue, O.S.A., Ph.D.
Provost	Patrick G. Maggitti, Ph.D.
Executive Vice President	Roger Demareski
Vice Provost for Academics	Craig M. Wheeland, Ph.D.
Vice President and General Counsel	E. Michael Zubey, Jr.
Vice President for Finance	Neil J. Horgan
Vice President for Student Life	Kathy Byrnes, Esq.
Vice President for University Advancement	Kevin W. Noller
Vice President for University Communication and Marketing	Ann E. Diebold

Engineering Administration

Role	Name
Drosdick Endowed Dean, College of Engineering	Michele Marcolongo, Ph.D. 610-519-5860
Associate Dean, Academic Affairs	David Jamison 610-519-4959
Associate Dean, Graduate Studies	Garrett Clayton, Ph.D. 610-519-4985
Associate Dean, Students and Strategic Planning	Stephen Jones, Ph.D. 610-519-5439
Chairs:	
Chemical Engineering	Chris Kitchens, Ph.D. 610-519-5498

Role	Name
Civil and Environmental Engineering	Eric Musselman, Ph.D. 610-519-7631
Electrical and Computer Engineering	Bijan G. Mobasseri, Ph.D. 610-519-4958
Mechanical Engineering	Sridhar Santhanam, Ph.D. 610-519-4996

Tuition and Fees

Item	Cost
Tuition	$1,595/credit
General University Fees	$100/semester

Payment of Tuition

Tuition payment is due no later than the first day of class. This requirement applies to all students, including those who register too late to receive a bill.

To complete the registration process, advance registered students must pay their accounts by the first day of class or they are subject to a late payment fee.

Refund of Tuition

Graduate students who obtain approval for withdrawal from a course or the program are entitled to a tuition refund in accordance with the following policy.

Tuition reversals as a result of official withdrawal will be made according to the following schedule. Excluded from the reversal calculation will be the costs related to on-campus housing and university meal plans. Activity, library, and medical fees are not reversible. There will be no reversal for unauthorized withdrawals. Students who do not register or who notify the Registrar's Office prior to the first day of class that they will not enroll are entitled to a full tuition reversal.

In addition to the University's reversal schedule and in accordance with the Higher Education Amendments of 1992, if a student completely withdraws from the University and has utilized Federal Title IV funds (e.g. Federal Pell Grant, Federal Supplemental Educational Opportunity Grant [SEOG], Academic Competitiveness Grant, National SMART Grant, Federal Perkins Loan, Federal Direct Stafford Student Loan, Federal Direct PLUS, Federal Direct Graduate PLUS), during the semester in which they withdraw, the University will observe the federally mandated process in determining what, if any amount of money must be returned to the federal program (s)

Tuition Reversal schedule for classes that run the full semester

Segment of Semester	Tuition Reversal
Up to first week	80%
Up to second week	60%
Up to third week	40%
Up to fourth week	20%
Beyond fourth week	No reversal

Academic Standards of Progress

The purpose of this policy is to provide graduate students with information on Villanova University's Satisfactory Academic Progress Standard for Federal Title IV Sources of Aid (Federal Direct Federal Direct Unsubsidized Loan and Federal Direct Graduate PLUS Loan). This document describes the qualitative and quantitative standards that make up this policy, how standards are measured, and how financial aid is reinstated if eligibility is lost during enrollment.

Process Overview

The Office of Financial Assistance is required in accordance with Federal Title IV regulations to monitor satisfactory academic progress for students who receive federal financial assistance. In order to continue to receive financial aid while enrolled at Villanova University, graduate students must maintain the minimum standards as defined below. The satisfactory academic progress standards for financial aid that are listed below are either the same or stricter than the individual Colleges' academic policy for students enrolled in the same academic program who are not receiving financial assistance.

Students must make both quantitative and qualitative progress towards their educational goals each academic year to receive federal financial assistance. Villanova University's academic year consists of two regular semesters (fall and spring) and the summer sessions.

Qualitative Standard

Graduate and Doctoral Students must maintain a minimum cumulative grade point average (GPA) of 3.00 calculated at the end of the academic year in order to be considered a student making satisfactory academic progress for financial aid consideration. Only credits earned at Villanova University will affect the cumulative GPA calculation. The grade point average from transfer coursework at a previous college or university will not affect a student's Villanova University grade point average.

Quantitative Standard

Students must pass the minimum number of credit hours during the academic year that is associated with their enrollment status for that academic year. For example, if a student is enrolled full-time in the College of Engineering, the student would be enrolled in a minimum of 18 credits for the academic year and must complete a minimum of 18 credit hours. If a student is enrolled half-time in the Villanova School of Business, which is a minimum of 3 credit hours per semester, then the student must complete at least 6 credit hours for the academic year. The following chart defines how the quantitative standard applies to students by their college and enrollment status.

For Graduate Students	**College of Engineering**
Minimum Full-Time Credits Attempted Annually	12 or more
Minimum Half-time Credits Attempted Annually	6 to 11
Minimum Less-than Half-time Credits Attempted Annually	1 to 5
Credits Required for SAP (Satisfactory Academic Progress)	**College of Engineering**
Minimum Credits Required if Full-time for SAP	12
Minimum Credits Required if Half-time for SAP	6
Minimum Credits Required if Less-than Half-time for SAP	All attempted hours must be complete

Credits are considered successfully completed when a grade of A, B, or C is earned. **Failures ("F" and "NF"), INCOMPLETES ("N"), WITHDRAWALS ("W," "WX", "Y"), MISSING GRADES ("NG"), Grade of Audit ("AU"), Grades of "In Progress" ("IP") are not successfully completed credits.**

Repeated Coursework

As defined by the U.S. Department of Education, Villanova University will include and fund any repeated coursework previously taken by the student in his or her enrollment status one time. Villanova University will only allow a student to retake previously passed coursework one time and count the coursework in the student's enrollment status (e.g., the student is retaking the coursework in an attempt to meet an academic standard such as a better grade) for financial aid consideration.

A student **may not receive Federal funds** to retake previously passed coursework if the student is required to retake the course due to the student failing other coursework. For example, if the student is enrolled in four classes in the fall semester and fails one of those courses, the Dean may require the student to repeat the previously passed three courses along with the course that the student failed. If the student retakes the four courses in the spring, only the course that the student failed may be counted toward the student's enrollment status.

If a graduate/doctoral student is repeating the same course for thesis or dissertation continuation, this can be counted towards academic progress. There are no other exceptions.

Pace (Maximum Timeframe)

Within the Satisfactory Academic Progress Policy, Villanova University is required to establish a maximum time frame in which graduate and doctoral students must complete their program of study in order to remain eligible for financial aid funds. The maximum time frame for graduate/doctoral degree completion at Villanova is as follows:

	College of Arts and Sciences	**College of Engineering**	**College of Nursing**	**Villanova School of Business**
Graduate Students (either M.S or M.A)	6 years	7 years	5 years	5 years if full-time, 10 years if part-time
Doctoral students	10 years	7 years if full-time, 9 years if part-time	8 years	N/A

Once a student reaches the maximum amount of credits attempted as specified by the program(s) for graduation, the student will be ineligible to receive further Federal Title IV aid. Students in this category may submit appeals in accordance with the Appeals section of this policy.

Measuring Academic Progress

Academic Records are reviewed by the Office of Financial Assistance at the end of each academic year in May after spring grades are entered. Measurement begins with the Fall semester and ends with the last summer session. Students who were enrolled during the Fall and/or Spring semesters and who failed to meet the qualitative and/or quantitative requirements for academic progress can attempt to complete additional credits and raise their cumulative GPA during the summer sessions at Villanova University. Upon completion of additional credits, a new determination of academic progress will be made.

All financial assistance applicants are subject to the Satisfactory Academic Progress Standards regardless of whether or not they received financial assistance previously.

When the Minimum Standard of Academic Progress is Not Achieved

A student who does not make satisfactory academic progress will be placed on financial assistance suspension until the requirements are met. During this suspension, a student is denied Federal aid. The student will be notified in writing of the financial assistance suspension.

Unsatisfactory Conduct

Adherence to University regulations, set forth in the University Catalog and Student Handbook (The "Blue Book"), is required for successful completion of a program of studies at Villanova. The University reserves the right, under appropriate procedures, to require the withdrawal of any student whose conduct is unsatisfactory or is not making satisfactory progress toward competing his/her degree.

Appeals

If a student has failed to achieve satisfactory academic progress, the student can appeal the decision to the Office of Financial Assistance. The appeal must be submitted in writing along with an academic plan using the Satisfactory Academic Progress (SAP) Policy form found on the Office of Financial Assistance website and specify the extenuating circumstances which prevented the student from achieving academic progress. The following types of mitigating circumstances may be considered when a student appeals: injury or extended illness of the student, death in the family, or a change in educational objectives. Mitigating circumstances do not include the withdrawal from classes to avoid failing grades, pursing a second major or a second degree. The student must explain what has changed that will allow him/her to make satisfactory academic progress by the end of the semester. A copy of the student's academic plan developed in conjunction with the student's faculty advisor, academic dean or his/her representative also must be submitted. The Office of Financial Assistance may request additional documentation and/or require a personal interview with the student.

Students must appeal within two weeks of receiving a notice from the Office of Financial Assistance of the financial aid suspension. Appeals will not be accepted after the two-week period has passed and the student will be responsible for all charges on their student account. The student will receive a reply from the Office of Financial Assistance within two weeks of receipt of their appeal. A graduate or doctoral student can receive a SAP appeal waiver once.

A student who is denied assistance based on qualitative or quantitative standards will be considered for assistance when standards have been achieved.

Academic Plan

The academic plan is a written document developed by the student and his/her college that ensures that the student is able to meet the University's Satisfactory Academic Progress Standards by a specific point in time. It could include qualitative and quantitative requirements necessary to achieve that plan. The academic plan could take the student to completion of their program rather than meeting the University's Satisfactory Academic Progress standard at a specific point in time as determined by an appropriate academic official.

Financial Aid Probation

Villanova University will assign this status to a student who fails to make satisfactory academic progress and who has successfully appealed and had eligibility for aid reinstated. If the Office of Financial Assistance determines that the Academic Progress Standards can be waived for one semester, the student will be placed on Financial Aid Probation. As part of the student's Financial Aid Probation, the office requires a student, along with their academic advisor, to develop and submit an academic plan that includes a strategy of improving progress and reaching the student's educational goals. A student placed on Financial Aid Probation may receive Federal and Villanova University funds for one semester. The student will be required to meet the University's Satisfactory Academic Progress standards at the end of the semester or meet the terms and conditions of their academic plan as well as the plan established by the academic advisor.

At the end of the probationary semester, the Office of Financial Assistance will determine if academic progress requirements have been met or if the student continues on the path of the designated

academic plan. If requirements have been met, the probationary status will be removed. If academic requirements have not been met, and the student has deviated from the academic plan, the student may not receive Federal funds for the following semester.

A student may only be granted one semester of Financial Aid Probation during their academic career.

Reinstatement of Financial Aid

Once financial assistance has been discontinued, it will be reinstated provided:

- The student has successfully achieved the required number of credits and cumulative grade point average; and,
- The student has requested reinstatement in writing.

Reinstatement is not automatic. The student is responsible for making certain that the grades and credits completed have been properly posted with the Office of the Registrar prior to requesting reinstatement of financial assistance. Students are encouraged to file all financial assistance application forms by Villanova University's established deadline so that once reinstatement has been achieved, he or she can be considered for assistance as quickly as possible.

Students Returning After a Year or More

If a student previously left the university after failing to make satisfactory academic progress and returns to the university, the student is required to appeal his/her status. The student must submit an academic plan. If the appeal is granted, the student is placed on financial aid probation for one semester. The student's academic status will be reviewed after the semester to determine if the student successfully made satisfactory academic progress.

Policies and Procedures

Academic Integrity Policy

Statement of Purpose

Academic integrity is vital to any university community for many reasons. Students receive credit for doing assignments because they are to learn from those assignments, and the vast majority do so honestly. A student who submits work that is not his/her own, or who cheats on a test or plagiarizes a paper is not learning, is receiving credit dishonestly and is, in effect, stealing from other students. As a consequence, it is crucial that students do their own work. A student who uses someone else's work or ideas without crediting that source, or whom otherwise performs dishonestly in a course, is plagiarizing or cheating. Such dishonesty threatens the integrity not only of the individual student, but of the university community as a whole.

Academic integrity lies at the heart of the values expressed in Villanova University's mission statement and inspired by the spirit of Saint Augustine. When one comes to Villanova, one joins an academic community founded on the search for knowledge in an atmosphere of cooperation and trust. The intellectual health of the community depends on this trust and draws nourishment from the integrity and mutual respect of each of its members.

The information in this document applies to both on-campus (that is, in-class) students as well as distance education (or on-line) students.

The University Academic Integrity policy forms the basis for this document and can be found here.

Code of Academic Integrity

The following are rules and examples regarding academic dishonesty. Since academic dishonesty takes place whenever anyone undermines the academic integrity of the institution or attempts to gain an unfair advantage over others, this list is not and cannot be exhaustive. Academic integrity is not simply a matter of conforming to certain rules; it must be understood in terms of the broader academic purposes of a Villanova education.

1. Cheating

While taking a closed-book and closed-note test or examination, students shall rely on their own mastery of the subject and not attempt to receive help in any way not explicitly approved by the instructor. For example, students shall not use notes, study aids, or another's work. Such cheating includes trying to give or obtain information about a test when the instructor states that it is to be confidential. It also includes trying to take someone else's exam or trying to have someone else take one's own exam.

2. Fabrication

Students shall not falsify, invent, or use in a deliberately misleading way information, data, or citations in any assignments. This includes making up or changing data or results or relying on someone else's results. It also includes citing sources that one has not actually used or consulted.

3. Assisting in or contributing to academic dishonesty

Students shall not help or attempt to help others to commit an act of academic dishonesty.

This includes situations in which one student copies from or uses another student's work. In such situations, both students are likely to be penalized equally severely. Students are responsible for ensuring that their work is not used improperly by others. This does not include team projects where students are told by their instructor to work together.

4. Plagiarism

Students shall not rely on or use someone else's words, ideas, data, or arguments without clearly acknowledging the source and extent of the reliance or use. The most common way to acknowledge this reliance or indebtedness is to use footnotes, references, or other documentation. It is the student's responsibility to show clearly when and where they are relying on others, partly because others may want to learn from the same sources from which the original writer learned.

Since this indebtedness takes a variety of forms, some definitions and examples of plagiarism follow:

a. *Using someone else's words without acknowledgement.* If you use someone else's words, not only must you indicate the source, but you must also put them within quotation marks or use some other appropriate means of identifying the words, and mathematical equations, whether or not they have been formally published.
b. *Using someone else's ideas, data, or argument without acknowledgement, even if the words are your own.* If you use someone else's examples, train of thought or experimental results, you must acknowledge that use. Paraphrasing, summarizing, or rearranging someone else's words, ideas, or results does not alter your indebtedness.
c. *Acknowledging someone else in a way that will lead a reader to think your indebtedness is less than it actually was.* For example, if you take a whole paragraph worth of ideas from a source and include as your final sentence a quotation from the source, you must indicate that your indebtedness includes more than just the quotation. If you simply put a page number after the quotation, you will lead the reader to think that only the quotation comes from the source. Instead, make clear that you have used more than the quotation.

The examples above constitute plagiarism regardless of the source. The words or ideas of a roommate, an encyclopedia, or notes from another class, require acknowledgment just as much as the words or ideas of a scholarly book. Introductions and notes to books also require acknowledgment.

The examples above constitute plagiarism even in cases where the student uses material accidentally or unintentionally. A paper can be plagiarized even if you have forgotten that you used a certain source, or even if you have included material accidentally without remembering that it was taken from some other source. One of the most common problems is that students write a draft of a paper without proper documentation, intending to go back later to "put in the references." In some cases, students accidentally hand such papers in instead of the footnoted version, or they forget to put in some of the footnotes in their final draft. The fact that the wrong draft was submitted is not a defense against an accusation of plagiarism. Students are held accountable for the work that they actually submit, rather than the work that they intended to submit. Furthermore, students are responsible for proper documentation of drafts of papers, if those drafts are submitted to the professor. In general, students are responsible for taking careful notes on sources, and for keeping track of their sources throughout the various states of the writing process. Notes must clearly identify the information you have obtained and where you acquired it, so that later you can acknowledge your indebtedness accurately. Do not look at a source without having something handy with which to take such notes.

You need not provide footnotes for items that are considered common knowledge. What constitutes common knowledge, however, varies from academic field to academic field, so you should consult with your instructor. In general, the harder it would be for someone to find the fact you have mentioned, the more you need to footnote it.

5. Multiple submissions of work

Students shall not submit academic work for a class which has been done for another class without the prior approval of the instructor.

In any assignment, an instructor is justified in expecting that a certain kind of learning will be taking place. Submitting something done previously may preclude this learning. Consequently, if a student hands in work done elsewhere without receiving his/her instructor’s approval, he/she is violating academic integrity and will face penalties.

6. Unsanctioned collaboration

When doing out-of-class projects, tests, homework, or other assignments, students must work individually unless collaboration has been expressly permitted by the instructor. Students who do collaborate without express permission of their instructor must inform the instructor of the nature of their collaboration. If the collaboration is unacceptable, the instructor will determine the appropriate consequences (which may include treating the situation as an academic integrity violation.)

7. Taking un-earned credit

Taking credit for work in a team project even when the student has made little or no contribution to the work of the team misrepresents the truth and violates the academic integrity code.

8. Other forms of dishonesty

Behaving honestly in an academic setting includes more than just being honest in one’s academic assignments; students are expected to be honest in all dealings with the University. Certain kinds of dishonesty, though often associated with academic work, are of a different category than those listed above. These kinds of dishonesty include (but are not limited to) the following:

a. Misrepresenting oneself or one’s circumstances to an instructor (for example, in requesting a makeup exam or due date for an assignment, or in explaining an absence).

b. Forging part of, or signatures on, official documents (including both University documents, such as drop-add slips or excused absence slips, and relevant outside documents, such as doctor's notes).
c. Stealing or damaging library books.
d. Unlawfully copying computer software.

These serious offenses will be handled by the University's disciplinary procedures.

Penalties

1. University Penalty

Students who violate the code of Academic Integrity are referred to the Associate Dean for Graduate Studies and Research for a University penalty. There are two kinds of penalty. A full academic integrity violation is a Class I violation. Typically, a student with two Class I violations will be expelled from the school. In some cases, the Dean may choose to treat a violation of the Academic Integrity Code as a Class II violation. Class II violations are usually appropriate for less serious cases, or in cases where there are mitigating circumstances. Typically, a student may receive only one Class II violation; all subsequent violations are treated as Class I violations.

Students who have committed an academic integrity violation will be expected to complete an educational program, supervised by the student's college Associate Dean for Graduate Studies and Research, or his/her designee, to help the student come to a fuller understanding of academic integrity. Students who fail to complete the educational program to the satisfaction of the Dean, and within the timelines specified by the Dean, will have a hold placed on their transcript until the program has been completed.

Students who wish to dispute an academic integrity penalty may take their case to the Board of Academic Integrity which is described on the web page

2. Individual Course Penalty

The academic penalty will also be applied, and this will be determined by the student's instructor. A student who violates the academic integrity code with a Class I violation in a course will receive an F for the course. Students may appeal their grade through the normal University procedure for resolving grade disputes.

Supplement 1

The Office of the Provost and Falvey Library have collaborated to create the Academic Integrity Gateway, a web site with information about academic integrity and avoiding plagiarism. All graduate students are ***required*** to visit the Gateway, read and understand the Villanova University Academic Integrity Code and Policy and associated writings on "Academic Integrity, Avoiding Plagiarism, and Writing College Papers," and complete the five interactive quizzes. This is normally less than a one-hour activity. Students may return at any time to use the web site as resource for writing papers.

Attendance

Attendance policies are determined by the instructors of the various courses. The instructor's class attendance policy must appear in the syllabus and at a minimum must allow for the University's excused absences listed below. Enforcement of such attendance policies lies with those instructors. If the instructor thinks a student has too many absences (total of excused and unexcused), then the instructor should discuss the student's attendance with the appropriate Assistant or Associate Dean of the instructor's college in order to determine if the student should withdraw or receive an incomplete.

Where possible, students should inform their instructors if they plan to be late or absent from class. In all cases, students should be prepared to provide documentation to petition for excused absences to

the appropriate Assistant or Associate Dean of their college. Excused absences do not count toward a failure in the course for first year students. Absence from class does not release the student from work assigned. Students who miss an in-class obligation (exam, presentation, etc.) due to an excused absence will not be penalized - the instructor may offer a make-up test, arrange an alternative time for a presentation, exempt a student from the assignment, or provide another arrangement.

The University's list of excused absences for all students includes the following:

- participation in special academic events (e.g., conferences, field trips, project competitions)
- participation in official university business (e.g., student representatives attending meetings related to university governance)
- attendance at significant events involving the immediate family (e.g., funerals, weddings)
- religious holidays - see the University's policy on Religious Holidays
- legally required absence (jury duty, court appearance, short-term military service)
- documented serious illness or disability (see below how to document)

If instructors want to verify that the absence qualifies as an excused absence under the university list or verify that the student is permitted to participate in the activity, they should contact the designated Assistant or Associate Dean of the student's College.

Confidential Records

Nature of Confidential Records. All personally identifiable information related to particular students used to make decisions about students or for transmittal to others outside the University other than public records as defined above is considered confidential information. This information includes but is not necessarily limited to: academic evaluations; general counseling and advising records; disciplinary records; financial aid records; letters of recommendation; medical or health records; clinical counseling and psychiatric records; transcripts, test scores, and other academic records; and cooperative work records.

Disclosure of Confidential Information to the Student-Right of Review. A currently or previously enrolled student has the right to inspect and review official records, files, and data directly related to the student as a student. Access will be provided in the presence of a staff member. This right does not extend to applicants, those denied admission, or those admitted who do not enroll. Where such information involves other students, the student is entitled to inspect or to be informed of that portion of the information which pertains to himself or herself only. Requests under FERPA of 1974 have been accepted since January 1, 1975 and are responded to within 45 days. Only in rare situations will the response period ever approach this limit. Offices may require that requests for access be submitted in writing, and may ask for, but not require, the reason for the request.

Definition of Official Records. For purposes of this section, the terms "official records, files, and data" include materials on students pertaining to their status as students held by any unit or department of the University which is intended for University use or is to be available to parties outside the University. It does not include:

A. letters of recommendation or statements of reference for students obtained or prepared before January 1, 1975, pursuant to implied or expressed promises of confidentiality or letters of recommendation or statements of reference to which students have waived the right of access;
B. employment records of students as University employees;
C. campus law enforcement records held in the Campus Security Office;
D. clinical, medical counseling, or psychiatric records (these records or copies thereof may be reviewed by a physician or other appropriate professional of the student's choice);
E. financial records of the parents of the student or any information contained therein;
F. private records kept by individual faculty or administrators possibly used as memory aids unless intended for transmittal to others;

G. institutional records of students which may be maintained by the University in a computer printout or similar format (so long as this computerized information is not intended to be distributed outside the University), as long as the original source of computer information is available in the office or department having jurisdiction for the records.
H. records which contain only information relating to a person after that person was no longer a student at the University; for example, information collected by the University pertaining to accomplishments of its alumni.

Right to Explanation. A student is entitled, upon reasonable request, to an explanation of any information contained in official records directly related to the student. The student has the opportunity for a hearing to challenge the content of such records to ensure that they are not inaccurate or misleading, or otherwise in violation of privacy or other rights; to correct or delete any such inaccurate, misleading, or otherwise inappropriate data; or to insert into the records a written explanation.

The substantive judgment of a faculty member about a student's work (grades or other evaluations of work assigned) is not within the scope of such hearings. A student may challenge the factual and objective elements of the content of students' records but not the qualitative and subjective elements of grading.

Hearing Procedure. The procedure to be followed should a student object to items included in his or her personal records is:

A. the student should discuss the objection with the individual responsible for the office where the student record is maintained;
B. if not satisfied, the student should discuss the objection with the individual to whom that person reports;
C. if not satisfied, the student should discuss the objection with the appropriate vice president or designee;
D. if not satisfied, the student should file a written request for a formal hearing with the Vice President for Student Life, Dougherty Hall, Room 202. The hearing will be conducted in accordance with the requirements of the Family Educational Rights and Privacy Act.

Waiver of Access. Students may be invited but not required to waive their right of access to confidential letters of recommendation for admission, honors or awards or career planning and placement. Students will suffer no prejudice in admission, financial aid, or other University services by reason of not executing the waiver. If the waiver is signed, the applicant may request a list of all persons making confidential recommendations or statements.

Disclosure of Confidential Information to Third Parties. Third parties do not have access to personally identifiable records or information pertaining to students as students without the written consent of the student specifying the records to be released and to whom the records are to be released. Excepted from this restriction are:

A. University officials who require access on an internal need-to-know basis for legitimate educational purposes, such as academic, disciplinary, health, or safety matters; University officials may include, without limitation, the President, Vice-Presidents, Deans, Directors, Department Chairs, faculty members, general counsel, judicial officers, counselors, resident advisors, coaches, and admission officers;
B. students in their official capacity as file clerks working in University offices;
C. disclosure of appropriate academic records to officials of other educational institutions to which the student seeks or intends to enroll (on condition that the student, upon request, is entitled to a copy of such records) if the student previously directed that the record be sent;
D. records released pursuant to judicial order (on condition that an effort is made to notify the student of the subpoena);
E. records released in connection with the student's application for, or receipt of, financial aid;
F. appropriate federal and state officials or authorities consistent with federal regulations;

G. organizations conducting studies for, or on behalf of, educational agencies or institutions;
H. accrediting organizations in order to carry out their accrediting functions;
I. parents of a dependent student as defined in section 152 of the Internal Revenue Code of 1954;
J. in the case of emergency, the University may release personal information to protect the health and safety of students.

Course Numbering

Courses designated 7000 to 7999 are graduate courses to which qualified undergraduate students are admitted for undergraduate credit with the permission of the Department Chairperson. Courses designated 8000 to 9999 are normally intended for graduate students only.

Disclosure of Student Records

Villanova University, in accordance with the Family Educational Rights and Privacy Act (FERPA) of 1974, also known as the Buckley Amendment, permits its students to inspect their records whenever appropriate, and to challenge specific parts of them when they feel it is necessary to do so.

Graduate Grading System

Grades are recorded at the end of each semester or summer session. The student receives his grades on the University NOVASIS website. Any inaccuracy must be reported by mail to the Registrar immediately.

The work of the student is graded according to the following scale:

A Outstanding
A -
B +
B Good
B -
C +
C Fair
F Failure

AU Audit
IP In Progress
N Incomplete
WX Approved Withdrawal

Students are not required to repeat courses in which the grade of F has been received, unless the courses are specifically required by the program in which they are enrolled, the decision resting with the chairperson of their major department.

An N (incomplete) grade indicates the instructor is not prepared to give a definite grade for the course in view of the student's not having completed all the assigned work. The N grade automatically becomes an F if the work is not completed and submitted to the instructor. For the fall semester, students must submit all work by the last Friday in January. For the spring semester, all work must be submitted by the last Friday in June. Faculty members, in turn, submit grade changes within two weeks of these dates to the Registrar. Change of grades to C+ or higher cannot be made without the approval of the professor, the department head, and the Dean of the Engineering College.

Grades are part of the student's permanent record. Grade changes other than conversion of N grades can be made only with special permission from the Dean's Office.

In graduate study, the student is expected to do more than pass the required courses. In addition, students must maintain a specific average. This average, known as the grade point average, derived from the grades and credit hours of the courses taken, is computed by multiplying the number of credits for each course the student has attempted by the authorized quality points for the grades received and dividing the total quality points by the total credit hours attempted. The grade A merits 4 quality points; A- = 3.67; B+ = 3.33; B = 3; B- = 2.67; C+ = 2.33; C = 2; F = 0; N = 0.

The student is required to maintain a grade point average of at least 3.00 and cannot be approved for the comprehensive examination or graduation unless this average has been maintained.

Graduate Status

Full Time: Minimum credit load for full-time status is 6 credits for fall or spring semester. Students may also be considered full-time if their credit load in a semester falls below this minimum, but they meet any of the following conditions:

1. The student is a graduate assistant or tuition scholar. Graduate assistants and tuition scholars must be enrolled in at least one course, which may be credit-bearing or non-credit-bearing.
2. The student is enrolled in Thesis (3 cr) or Dissertation (3 cr), Independent Study (3cr.).
3. The student is enrolled in Thesis Continuation (0 cr), Dissertation Continuation (0 cr), or Independent Study Continuation (0 cr).

Part Time: 3 credits

Inactive: A graduate student is deemed inactive if (s)he not enrolled in a graduate course four consecutive fall and spring semesters (summers not counted).

Graduation

Students who expect to be graduating have the responsibility of applying for graduation. Please see Commencement Information for Graduate Engineering Students under the Graduation tab for semester deadlines to complete the required Prospective Graduate Form in MyNova.

Language Requirements

There is no language requirement in any of the graduate programs of the College of Engineering. However, foreign students are required to submit their scores on the Test of English as a Foreign Language (TOEFL) or IELTS in their application for admission. A score of at least 90 (TOEFL iBT) or 7.0 (overall IELTS band) is required.

Length of Degree Programs

Normally degree requirements must be completed within seven-years. This time period is counted from the student's first registration to the date of completing the degree. For part-time PhD students the maximum completion time is 9 years.

Leave of Absence

Students requesting a leave of absence (medical, military, parental, or personal) must submit an email detailing the reasons for the Leave Request to the graduate program director who will forward it to the Graduate Dean for review.

There are several different types of leave that students may request:

Personal, Military, Medical and Family Leaves

Students receiving financial aid should consult with the Office of Financial Assistance to understand how leaves of absences may affect their loans. All students should work with Bursar's Office to ensure any outstanding balance is settled before their leave goes into effect. International students requesting a leave of absence should consult with the Office of International Students before submitting their paperwork to the Program Director. Finally, all students should also consult with their personal health insurance provider about implications for their coverage during any period of leave from the university.

Personal Leave of Absence

Students who find it necessary to interrupt their studies may apply in writing to their Graduate Program Director for a personal leave of absence. A personal leave of absence is defined as any leave of absence other than one granted for medical or family reasons or for military service (see below). The Graduate Director must approve the request for a leave of absence before the petition is sent to the Graduate Dean for review. A total of no more than **two** semesters of personal leave of absence are allowed in a student's graduate career. Up to **two** semesters of leave may be granted at any one time. Leaves of absence for personal reasons **extend** time to degree requirements, including any deadlines regarding qualifying or comprehensive exams.

Additional leaves for medical reasons, family, or military duties, when properly approved, will *not* be counted against the two-semester limit for leaves of absence. No degree requirements can be completed during leaves of absence, nor can a student graduate during a leave of absence. However, personal leaves of absence will not alter deadlines for completing work in a course for which an incomplete grade was received.

Military Leave of Absence

A student who is called to active military duty will be permitted a military leave of absence. The student should report the obligation for military service in writing to the Dean as soon as reasonably possible after the student receives orders. Please consult the Dean to request refunds. The student's courses will be marked with a "WX" grade. Approved periods of military leave of absence will extend the time permitted to complete degree requirements and to graduate.

Medical Leave of Absence

A student may experience physical or psychological conditions that significantly impair the student's ability to function successfully or safely in his or her role as a student. In such cases, the student may decide that time away from the University for treatment and recovery can help restore functioning to a level that will enable the student to return to the University and perform successfully in and out of the classroom. The University has an interest in students receiving appropriate care not only for their own well-being, but also for the well-being of the larger community with whom the student interacts.

When a student initiates a MLOA, Villanova University may establish criteria regarding the student's eligibility for returning to the campus community. The criteria include, but are not limited to, compelling evidence that the condition that precipitated the need for the MLOA has been sufficiently treated or ameliorated to the point where it will no longer adversely affect the student's or the community's safety or functioning.

The MLOA request may be made at any time during the semester but must be completed no later than the last day of classes in a semester, including the requisite evaluation and any related paperwork for the Dean's office. Requests not completed by the last day of classes will be considered late requests and will be considered for the following semester barring exceptional circumstances.

The Graduate Dean's office will make the final determination whether the MLOA will be granted, in consultation with University's health professionals. The Dean's office will specify the terms of the MLOA including conditions for return to the University following the leave. At a minimum, a MLOA will be for

one semester and, depending on the timing of the request and the nature of the circumstances, the MLOA may involve additional semesters to allow sufficient time for full recovery, a sustained period of stability, and to increase the student's opportunity for success upon return to the University. When the student seeks to return to the University, the Dean's office granting the leave will determine whether the student has satisfied the conditions and is permitted to return.

Three steps are required for approval of a MLOA are:

- The student must schedule an appointment with the Student Health Center or the University Counseling Center for a MLOA evaluation.
- The student must schedule an appointment with the Dean of Graduate Studies to discuss and review the MLOA request.
- The student must complete the MLOA Request Form and submit it to the Dean of Graduate Studies.

Approved periods of medical leave *will extend* the time permitted to complete degree requirements and to graduate.

Family Leave of Absence

The Graduate School offers support for graduate students who need to take leave in connection with the birth of and/or full time care of a new child during their period of enrollment. The goal in offering this support is to allow graduate students to continue their studies with as little disruption as possible. Family leave is intended to enable the graduate student to continue to make progress toward the degree. Consequently, it does not grant additional semesters of funding, nor does it change the length of time permitted to complete degree requirements and to graduate. This policy requires communication and cooperation in good faith between the student seeking the leave, the faculty, and the student's department. The terms of the policy are as follows:

1. To be eligible for family leave, the graduate student must be the primary and full-time caregiver of a newborn child or a child newly placed in the home.
2. The graduate student must submit a written request no less than three months before the expected date of the start of the leave (if possible) to the Program Director who will forward it with a recommendation to the Graduate Dean for review.
3. Graduate students may take up to six weeks of family leave within the first six weeks immediately following the birth, adoption, or foster placement of a child. The six weeks of family leave must be taken consecutively immediately following the birth or placement of the new child. Students seeking parental leave shall provide documentation to the Graduate School sufficient to demonstrate that they are the full-time primary care provider of the child.
4. During family leave, the graduate student may attend classes and work on course assignments to the extent possible, but the student's program director should advise the professors in these courses to be flexible about attendance and assignment deadlines during the period of leave. Upon the student's request, the student will be granted Incompletes in these courses, with the understanding that the courses should be completed by the end of the following semester.

FUNDING

When a leave is approved prior to the start of a new semester, funding will not continue for the leave period. Students who are approved for any type of leave after the add/drop date may continue to receive funding until the end of the semester when the leave was started.

Funding cannot be "banked" and taking a leave of any kind does not extend funding time upon return. Funding is only available for the original time period offered.

Probation

A student whose G.P.A. falls below the required minimum of 3.0 is placed on probation. A student on probation who fails to improve his academic performance may be withdrawn from the program by the Dean of Engineering upon recommendation by the department chairperson.

Public Records

Information concerning the following items about individual students is public:

- From the Office of the Registrar - full name, address, telephone number, date of birth, major field of study, dates of attendance, class year, degrees and awards received, most recent previous educational institution attended.
- From the Department of Athletics - participation in officially recognized University athletics, weight and height of members of athletic teams.
- From the Student Activities Office - participation in officially recognized University activities and student organizations.

The foregoing public information may be released or published without the student's consent. However, students who do not wish such information to be released or made public, may inform the appropriate office in writing at the time the information is originally sought from students.

Quantitative Degree Requirements

Candidates for the master's degree must complete the courses prescribed by the chairperson of their department. Depending on the program, 30 semester hours credit with a grade point average of at least 3.00 is required for the degree.

Thesis

In those cases where a thesis is required or elected, the student is expected to do as a minimum the equivalent of six semester hours of work toward the thesis. The thesis is almost always prepared under the supervision of a faculty member of the major department who is prepared to undertake the supervision of the student's research. Students will need to have frequent conferences with their thesis advisor and, therefore, should not expect to receive supervision by mail. Research may be initiated by the student at a time approved by the department, but not until after the thesis topic forms have been approved by the department. Some departments may require a scholarly report in lieu of or in addition to a thesis. Consult departmental sections for details.

Transfer of Credits

Transfer credits toward graduate engineering degrees will, in general, be granted for appropriate academic work completed with a grade of "B" or better (or equivalent) at an accredited university and the requested transfer credit(s) were not used to fulfill any previous degree requirements. A maximum of six graduate credits may be transferred toward graduate degree requirements and normally these credits must have been earned within the seven-year period in which a student is expected to complete the degree. Transfer credits are not included in the calculation of the grade point average.

Withdrawal from a Course

Engineering student requests for authorized withdrawal from a course will be automatically approved by the Dean of Engineering until the date given in the academic calendar. After that date the student must present a valid reason for the request, such as serious personal or medical problems. The Dean of

Engineering will decide whether or not to grant these requests based on the information supplied by the student, recommendations from the faculty member teaching the course and the chairperson of the department in which the student is majoring. The Dean will inform the student of his decision and the reason for it.

Withdrawal from the Program

Graduate students in engineering who withdraw voluntarily from the program for any reason should notify the Dean of Engineering of this fact in writing by emailing Dr. G.F. Jones. Graduate students who are withdrawn and wish to resume their studies in engineering must request approval for their readmission to the program in writing from the Dean of Engineering.

G.I. Bill

The Yellow Ribbon Program

GI Bill® is a registered trademark of the U.S. Department of Veterans Affairs (VA). The Yellow Ribbon Program offers participating students additional funding towards the cost of tuition and fees.

Villanova will fully fund the tuition and fees for up to 60 qualifying students for the 2021-2022 academic year. Breaking down that number (60), this is how the benefit will be applied at Villanova: 45 undergraduate students, 10 graduate students and 5 law school students will be eligible for funding covering tuition and fees.

Villanova's Yellow Ribbon Program funds will be awarded to qualifying students on a first-come, first-served basis. To be considered, qualifying students must:

- Be using Chapter 33, Post-9/11 VA Education benefits at the 100% eligibility level and be a full-time student. Full-time is 12 credits or more undergrad, 6 credits or more graduate, per term.
- Be accepted for enrollment to a degree program or be currently enrolled in a degree program at Villanova University.
- Submit an updated Certificate of Eligibility provided to you by the VA to Villanova University's School Certifying Official (SCO).

Recipients will be selected based upon the date the application is submitted and when all conditions are met.

Students who have been approved for Yellow Ribbon funding will continue to receive the benefit, provided the conditions above are still met. You will not be required to submit a Yellow Ribbon application each term. However, you will need to submit an Enrollment Verification form each term you plan to use your benefits. Students will be contacted by Villanova's Certifying Official (SCO) when they have been selected to receive Yellow Ribbon funds. Please submit your Yellow Ribbon application electronically utilizing the form.

Post 9/11 GI Bill®

The Post 9/11 GI Bill® provides financial support for education and housing to individuals with at least 90 days of active duty service on or after September 11, 2001, or for individuals discharged with a service-connected disability after 30 days. You must have received an honorable discharge to be eligible for the Post 9/11 GI Bill®. Your benefit will be based on your length of active duty service.

Approved training includes both undergraduate and graduate degrees, as well as some certificate programs.

Transfer of Post 9/11 GI Bill® Benefits to Dependents (TEB)

Service members in the Post 9/11 GI Bill® program are able to transfer unused educational benefits to their spouse or children effective August 1, 2009.

After you have received transferred entitlement you need to apply with the VA to use the benefit.

Details about the **transfer of eligibility program** are available on the Department of Defense website.

Chapter 30 – Montgomery GI Bill® – Active Duty

To qualify for Chapter 30 benefits, you must have entered active duty on or after July 1, 1985 and made contributions to the Montgomery Fund while on active duty. A monthly benefit is paid to students based on the training time and/or training program. You may receive up to a maximum of 36 months of benefits under this program. Veterans have 10 years from their discharge date to use the benefits.

Chapter 31 – Veteran Readiness and Employment

This program is designed to assist veterans with service-connected disabilities obtain and maintain gainful employment that is consistent with their interests, aptitudes and abilities and that can be supported through the current labor market. Apply here.

Eligibility

- Veterans who have received, or will receive, a discharge that is 'other than dishonorable'
- Have a service-related disability rating of at least 10% or a memorandum rating of 20% or more from the Department of Veteran Affairs

Chapter 35 – Dependents Educational Assistance

The Survivors' and Dependents' Educational Assistance (DEA) Program offers education and training opportunities to eligible dependents of veterans who are permanently and totally disabled due to a service-related condition or of veterans who died while on active duty or as a result of a service-related condition.

Chapter 1606 – Montgomery GI Bill – Selected Reserves and National Guard

If you are a member of the Selected Reserves, you may be eligible for this program. The Selected Reserves includes the Army Reserve, Navy Reserve, Air Force Reserve, Marine Corps Reserve, Coast Guard Reserve, Army National Guard and the Air National Guard. You must have a six-year obligation to service in Selected Reserves and have completed basic training.

PA National Guard Education Benefits

Education Assistance Program (EAP)

EAP is a state-funded program; it provides educational assistance for eligible members of the Pennsylvania National Guard. EAP funding is awarded regardless of financial need. In addition, reductions or adjustments of PA State Grants cannot be as a result of a service member receiving EAP. The amount of each award will be based on enrollment status (full-time or part-time).

Programs and Courses

Graduate Degree Programs in Engineering

Doctor of Philosophy

- Doctor of Philosophy in Engineering

Master of Science

- Master of Science in Biochemical Engineering
- Master of Science in Biomedical Engineering
- Master of Science in Chemical Engineering
- Master of Science in Civil Engineering
- Master of Science in Computer Engineering
- Master of Science in Cybersecurity
- Master of Science in Electrical Engineering
- Master of Science in Mechanical Engineering
- Master of Science in Sustainable Engineering
- Master of Science in Water Resources and Environmental Engineering

Certificate Programs

- Biochemical Engineering Certificate
- Computer Architecture Certificate
- Cybersecurity Certificate
  - Concentration in Cyber-Physical and Control Systems Security
- Dam Engineering
- Doctoral Program Supplemental Certificates
- Electric Power Systems Certificate
- Electro-Mechanical Systems Certificate
- High Frequency Systems Certificate
- Machinery Dynamics Certificate
- Mechanics/Materials Certificate
- Modeling and Simulation Certificate
- Nonlinear Dynamics & Control Certificate
- Sustainable Engineering Certificate
- Thermofluid Systems Certificate
- Urban Water Resources Design Certificate
- Wireless and Digital Communications Certificate

Non-Engineering Courses

Graduate course descriptions from the departments of Biology, Chemistry, Computer Science, and Mathematical Sciences are provided in the Graduate Catalog of the College of Arts and Sciences. It should be noted that graduate physics course choices can be provided on an individual basis, with special permission. To pursue these options, contact the Physics Chairperson.

Master of Science Program

The College of Engineering currently has master's degree programs offered by the following departments: Chemical, Civil and Environmental, Electrical and Computer, and Mechanical Engineering. In addition to the traditional master's degree designations in each of these four engineering disciplines,

the Civil and Environmental, and the Electrical and Computer Engineering Departments provide the opportunity to pursue a graduate degree in more highly specified areas within their respective fields, i.e., Water Resources and Environmental Engineering and Computer Engineering. Also available are concentrations within each of the disciplines.

Students who successfully complete any of the following degree programs receive a master's degree.

- Master of Science in Biochemical Engineering
- Master of Science in Biomedical Engineering
- Master of Science in Chemical Engineering
- Master of Science in Civil Engineering
- Master of Science in Cybersecurity
- Master of Science in Computer Engineering
- Master of Science in Electrical Engineering
- Master of Science in Mechanical Engineering
- Master of Science in Sustainable Engineering
- Master of Science in Water Resources and Environmental Engineering

Classes are held in the late afternoon and evening and are open to both part-time and full-time graduate students.

OBJECTIVES

The primary objectives of the engineering graduate programs are: (1) to educate full- and part-time students in order to enhance their technical competence and continue their professional development, and (2) to prepare full- and part-time students for further graduate study at the doctoral level.

ADMISSION

Admission Requirements

All applicants to graduate programs in the College of Engineering at Villanova must possess a bachelor's degree. For those applicants who hold a degree from a U.S. college or university, the school must be a regionally or nationally accredited institution of higher education. In some cases, the Chemical Engineering Department may request the GRE (General Test) of an applicant who holds a degree from a US institution. In addition, if the native language of the applicant is not English, the Test of English as a Foreign Language (TOEFL) or IELTS is required.

Prospective graduate students must apply for admission into a specific engineering graduate degree program in the College of Engineering. The normal credential for admission into a specific engineering graduate degree program is an undergraduate degree in the field of engineering that corresponds to the graduate degree awarded by that program (e.g., a Bachelor's Degree in Chemical Engineering is the normal credential for pursuing a Master's Degree in Chemical Engineering). This bachelor's degree should be from an undergraduate engineering program that is accredited by the Accreditation Board of Engineering and Technology (ABET).

Prospective students may apply to any graduate program even though they hold a bachelor's degree in a different engineering discipline, a related scientific or technical field, a non-technical area, or an engineering degree from an undergraduate program not accredited by ABET (such as a non-U.S. institution). If admitted, such students will be required to take specified undergraduate courses in order to make up any deficiencies in their undergraduate preparation for graduate studies in that particular graduate program. The number and type of undergraduate courses specified will depend on the graduate degree sought and will be in addition to the graduate courses required for that degree.

The primary criteria used to evaluate the academic potential of the applicant for admission to graduate studies are:

1. The collegiate scholastic record in terms of the quality and consistency of performance and the difficulty of the curriculum;
2. The final undergraduate cumulative Grade Point Average (GPA), which should be a 3.0 or better;
3. Recommendation forms (with optional letters attached) from professors and, if appropriate, employers who know the candidate sufficiently well to assess academic potential;
4. Scores earned on standardized tests such as the GRE (General Test) or TOEFL, if required/ submitted.

Admission to Individual Graduate Courses

Students who wish to take graduate courses for credit or audit without completing a certificate or degree program may apply for admission to those specific courses (a maximum of two such courses may be taken). The normal credential for admission to any such course will be an undergraduate degree, plus evidence that the background of the student includes sufficient preparation to predict success in the course selected.

The student must complete an online application form, Individual Course Application (ICA), for admission to graduate courses in the College of Engineering, and transmit this to the department offering the course, along with their undergraduate transcript.

The educational background of the applicant will be evaluated by the department offering the course. If the student is deemed to be qualified, admission to the course(s) will be granted by the department.

Acceptance to individual course(s) does not imply acceptance to any other graduate program in the College of Engineering. If, after completing the course(s), the student wishes to apply to a degree or certificate program of the College, he must apply to that program in the normal manner. The individual courses taken may be counted towards the graduate degree if a "B" or higher is earned.

Admission Procedure

Inquiries regarding application materials, catalogs, etc. are directed to the department that offers the degree program of interest.

A complete application for admission must contain the following materials:

1. A completed application form
2. Two recommendation forms, with optional letters attached
3. Transcripts of all undergraduate and graduate course work
4. In the case of non-U.S. citizens: Visa application information form, TOEFL (or IELTS) score, passport copy, and required financial documentation

The completed application materials are submitted by the applicant prior to the following dates:

For Entrance in	For whom	Application Deadline
Fall semester	• for foreign students from non-U.S. institutions • for foreign students from U.S. institutions • for U.S. citizens	April 1 July 1 August 1
Spring semester	• for foreign students from non-U.S. institutions • for foreign students from U.S. institutions • for U.S. citizens	October 1 November 1 December 1
Summer semester	• for foreign students from non-U.S. institutions • for foreign students from U.S. institutions • for U.S. citizens	N/A April 1 May 1

After completed application packages are received, they are reviewed by the department that offers the degree program to which admission has been requested. An email notification is sent when the decision letter is posted in the student's application portal.

Distance Learning Program

Through our E-Learning program, professors and students who are separated by physical distance are able to bridge the instructional gap and can complete a graduate engineering degree entirely online. Whether you are pursuing a graduate certificate or a master's degree, our online degree program provides the flexibility you need, without compromising the quality of your education.

E-Learning students have identical course material, instructors and semester pacing as students in the on-campus classroom. In fact, because our program is synchronous, you're welcome to attend class on campus whenever your schedule permits. Your diploma will not indicate that you completed your degree via "E-Learning," it will simply reflect that you earned your degree from Villanova University's College of Engineering.

Online Program Features:

- Participate in real-time by logging in from anywhere in the world with internet access.
- Access archived class material at your convenience, 24/7.
- Download class material so you can review it anywhere – no connection required.
- Earn your degree entirely online or supplement online courses with those on campus.
- Access your lectures years from now. Your class is a virtual reference library.

Online Degrees Available via E-Learning*

Master's Degrees

- Biochemical Engineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Cybersecurity
- Electrical Engineering
- Mechanical Engineering
- Sustainable Engineering
- Water Resources and Environmental Engineering

Certificates

- Biochemical Engineering
- Cybersecurity and Concentration in Cyber-Physical and Control Systems Security
- Dam Engineering
- Electric Power Systems
- Electro-Mechanical Systems
- High Frequency Systems
- Machinery Dynamics
- Mechanics/Materials
- Modelling and Simulation
- Nonlinear Dynamics & Control
- Sustainable Engineering
- Thermofluid Systems
- Urban Water Resources Design
- Wireless and Digital Communications

*While these degrees and certificates can be completed online, not every course in the program is available online.

Degrees

Chemical and Biological Engineering

Biochemical Engineering

Degree Type Certificate

Working professionals are often interested in gaining more experience, developing sharper skills and increasing their knowledge in a specific area. Graduate certificates allow you to accomplish this in only four or five courses. Courses successfully taken as part of a certificate program can also be applied toward a degree in that field if you apply and are accepted into the related master's program.

The certificate program in Biochemical Engineering is a concentration of courses that introduce the fundamentals of Biochemical Engineering, and topics supporting the Biotechnology and Pharmaceutical industries. Students wishing to obtain a Master's in Chemical Engineering, but with a concentration in Biochemical Engineering can earn the Biochemical Engineering Certificate. Click here for details on the MS in Biochemical Engineering.

The Biochemical Engineering Certificate consists of the two required courses and two elective courses.

Required Courses

Fall Semester (even years)

Item #	Title	Credits
CHE 8588	Biochemical Engineering I	3

Spring Semester (odd years)

Item #	Title	Credits
CHE 8589	Biochemical Engineering II	3

Elective Courses

Two electives are to be selected from the following list of courses, subject to the approval of the Chemical Engineering Department.

Select 1 of the following:

Item #	Title	Credits
CHE 7587	Biopharm Facility Design	3
CHE 8586	Biomaterials & Drug Delivery	3
CHE 8591	Gene & Cell Therapy	3
CHE 8592	Protein Engineering	3
CHE 8663	Systems Biology	3

Plus, any 2nd elective course in the list of electives above or:

Item #	Title	Credits
CHE 7693	Core Biochemistry	
CHE 8564	Fluid Dynamics	3
CHE 8563	Transport Phenomena	3
CHE 7005	Global Pharmaceutical Business	3

Biochemical Engineering

Degree Type Master of Science

Master of Science Program Information

Villanova's MSBChE program provides real-world knowledge for practical application covering hot-button topics including Biopharmaceutical Design and Biomaterials and Drug Delivery. This degree exposes students to upstream and downstream bioprocess fundamentals and provides the tools to design and optimize pharmaceutical facilities, processes, and products, using state-of-the-art analysis and technology.

Admission Requirements
Admission Criteria: For applicants **with** a chemical engineering or related undergraduate degree

For both the master's degree program and the Certificate programs, you must apply to be admitted, and admission is not automatic. Admission generally requires an undergraduate degree in Chemical Engineering and a minimum undergraduate GPA of 3.0. If you did not receive your undergraduate degree at an accredited U.S. school, you will be required to take the TOEFL exams.

Admission Criteria: For applicants **without** a chemical engineering or related undergraduate degree

If your undergraduate degree is not in Chemical Engineering, you will be considered for admission into the certificate programs, but admission is not automatic. Further, for admission into the master's degree Program in Biochemical Engineering, you will need to satisfy the Admission Criteria for applicants without a chemical engineering or related undergraduate degree:

Requirement 1: Undergraduate GPA

- Bachelor's degree in chemistry, biochemistry, biology, physics, mathematics: ≥ 3.25/4.0
- Bachelor's degree in CE, ME, or Biomedical Engineering from an ABET accredited institution: ≥ 3.0/4.0
- Bachelor's degree in another biological or physical science or another engineering discipline: ≥ 3.25/4.0

Requirement 2: Completed Undergraduate courses (with a cumulative GPA ≥ 3.0/4.0)

- Calculus I, Calculus II, Differential Equations
- General Chemistry I, II; Physics I
- 2 upper level science courses appropriate to the student's undergraduate major

Requirement 3: GRE scores

- Quantitative Reasoning: ≥ 155/170 (new scale)
- Analytical writing: ≥ 4.0/6.0
- Slightly lower GRE scores will be allowed if the undergraduate GPA is higher than the minimum listed.

Requirement 4: Chemical Engineering Background

- Successful completion of the 3 requirements above and one of the options listed below will ensure admission into the MSBChE program on a probationary basis, once a complete MSBChE application is submitted:

- **Option 1**: **Critical ChE topics covered during UG**

- Student must provide evidence of having learned critical chemical engineering topics (i.e mass balances, fluid flow, diffusive and convective mass transport mass transport, thermodynamics, reaction kinetics, etc.) as an undergraduate.
- Such evidence can include course syllabi and textbooks.
- Applicants missing critical topic(s) may be required to take undergraduate course(s) in that topical area before beginning the MS program. See option 2 (Villanova University undergraduate courses) and option 3 (Michigan State bridging courses)

(OR)

- **Option 2: Undergraduate Chemical Engineering courses at Villanova**
  - Complete the following 6 core undergraduate chemical engineering courses with a GPA ≥ 3.0 /4.0:
  - Fall semester, 3 courses:
    - CHE 2031 - Intro Chemical Processes
    - CHE 3031 - Heat Transfer
    - CHE 3131 - CHE Thermodynamics II
  - Spring semester, 3 of 4 courses (to be selected based on student background, academic performance and academic advisement)
    - CHE 2032 - Chem Engr Thermo I
    - CHE 2232 - Fluid Mechanics
    - CHE 3032 - Mass Transfer
    - CHE 3332 - ChemE Reactor Engineering I
  - Note: these courses will not earn the student credit toward the completion of the 30-credit MSBChE degree but will represent one of the prerequisite requirements for admission into the program.

(OR)

- **Option 3: Michigan State bridging courses**
  - Complete CHE 804, 805 Foundations of Chemical Engineering I, II, offered online by Michigan State University
  - Complete each course with a GPA ≥ 3.5/4.0 (repeat if necessary, until the required minimum grade is achieved.)
  - Note: these courses will not earn the student credit toward the completion of the 30-credit MSBChE degree but will represent one of the prerequisite requirements for admission into the program.

Please Note: Successful completion of Requirements 1, 2, 3 and 4 will ensure admission into the MSBChE program on a probationary basis, once a complete application has been submitted.

Degree Requirements

All students pursuing a master's degree in Biochemical Engineering are required to take the following for a total of 30 credits with a **minimum GPA of 3.0**

- Two (2) core courses in Biochemical Engineering (3 credits per course, 6 credits total)
- Minimum of three (3) additional courses in Biochemical Engineering (3 credits per course, 9 credits total)
- Maximum two (2) courses in Bioengineering (3 credits per course)
- PLUS, the following based on whether the student is pursuing a thesis:

Thesis Option

- Maximum three (3) bio-science courses (3 credits per course)
- Maximum three (3) courses in Chemical Engineering (3 credits per course)
- M.S. Thesis (6 credits)

Total Credits: 6 (core) + 9 (Biochemical Engineering) + 9 (Bio-science, Bioengineering and/or Chemical Engineering) + 6 (thesis) = 30

Non-Thesis Option

- Maximum two (2) courses in Bioengineering (3 credits per course)
- Maximum four (4) bio-science courses (3 credits per course)
- Maximum four (4) courses in chemical engineering (3 credits per course)

Total Credits: 6 (core) + 9 (Biochemical Engineering) + 15 (Bio-science, Bioengineering and/or Chemical Engineering) = 30

Available courses for a master's degree in Biochemical Engineering are listed below. Students may take courses not listed below, but they should get approved by the program director.

Required Courses (offered annually)

Item #	Title	Credits
CHE 8588	Biochemical Engineering I	3
CHE 8589	Biochemical Engineering II	3

Elective Courses (biochemical)

Item #	Title	Credits
CHE 7005	Global Pharmaceutical Business	3
CHE 7587	Biopharm Facility Design	3
CHE 7651	Survey of Biomass Conversion	3
CHE 8586	Biomaterials & Drug Delivery	3
CHE 8591	Gene & Cell Therapy	3
CHE 8592	Protein Engineering	3
CHE 8663	Systems Biology	3

Elective Courses (biochemical and chemical)

Item #	Title	Credits
CHE 7002	Quantitative Safety Tech	3
CHE 7570	Polymer Science & Engineering	3
CHE 7580	CHE Economics	3
CHE 8550	Chem Eng Reactors	3
CHE 8551	Chem Kinetics and Catalysis	3
CHE 8558	Process Design I	3
CHE 8563	Transport Phenomena	3
CHE 8565	Heat Transfer	3
CHE 8572	Separation Processes II	3
CHE 8575	Thermodynamics	3
CHE 8579	Adv Process Modeling/Analysis	3
ME 8010	Special Topics in ME	3

Bioscience Courses

- Graduate courses that are provided by Department of Biology and approved by the program director

Thesis

Item #	Title	Credits
CHE 9024	CHE Thesis I	3
CHE 9025	CHE Thesis II	3

Class Schedule

Note: Tentative Chemical Engineering Department Graduate Course Offerings. All scheduled course offerings are subject to change due to instructor availability and other factors. For course descriptions, refer to the Chemical Engineering Department course descriptions.

Fall 2024 and every two years thereafter

(ex: FA2026)

Item #	Title	Credits
CHE 7580	CHE Economics	3
CHE 7651	Survey of Biomass Conversion	3
CHE 8591	Gene & Cell Therapy	3
CHE 8563	Transport Phenomena	3
CHE 8550	Chem Eng Reactors	3
CHE 8565	Heat Transfer	3
CHE 8588	Biochemical Engineering I	3

Spring 2025 and every two years thereafter

(ex: SP2027)

Item #	Title	Credits
CHE 8563	Transport Phenomena	3
CHE 8571	Separation Processes I	3
CHE 8589	Biochemical Engineering II	3
CHE 8592	Protein Engineering	3
CHE 7595	Special Topics in CHE	3

Summer 2025 and every three years thereafter

(ex: SU2028)

Item #	Title	Credits
CHE 7570	Polymer Science & Engineering	3

Fall 2025 and every two years thereafter

(ex: FA2025)

Item #	Title	Credits
CHE 8558	Process Design I	3
CHE 8663	Systems Biology	3
CHE 8575	Thermodynamics	3
CHE 8531	Zeolite	3
CHE 8588	Biochemical Engineering I	3

Spring 2026 and every two years thereafter

(ex: SP2026)

Item #	Title	Credits
CHE 8551	Chem Kinetics and Catalysis	3
CHE 8572	Separation Processes II	3
CHE 8579	Adv Process Modeling/Analysis	3
CHE 8586	Biomaterials & Drug Delivery	3
CHE 8589	Biochemical Engineering II	3

Summer 2026 and every three years thereafter

(ex. SU2026)

Item #	Title	Credits
CHE 7587	Biopharm Facility Design	3
	Total Credits	30

Chemical Engineering

Degree Type Master of Science

Villanova University's Master of Science in Chemical Engineering (MSCHE) program is intended to supplement the education of full-time practicing chemical engineers. The flexible curriculum is built around a core of chemical engineering fundamentals and electives and is designed to provide the graduate student the mastery of wide range of subjects.

Admission Requirements
Admission Criteria: For applicants **with** a chemical engineering undergraduate degree

For both the master's degree program and the certificate programs, you must apply to be admitted, and admission is not automatic. Admission generally requires an undergraduate degree in Chemical Engineering and a minimum undergraduate GPA of 3.0. If you did not receive your undergraduate degree at an accredited U.S. school, you will be required to take the TOEFL exams.

Students with an undergraduate degree in Chemical Engineering who are admitted into the M.S. Ch.E. degree program will need to complete **30 credits (10 courses)** at the graduate level, with a minimum

GPA of 3.0. To earn a degree, a student will be required to complete a curriculum that includes 3 required courses, 2 (of 5) elective courses, and 5 additional courses. Additional information on the curriculum distribution requirements can be found below..

Admission Criteria: For applicants **without** a chemical engineering undergraduate degree

If your undergraduate degree is not in Chemical Engineering, you will be considered for admission into the certificate programs, but admission is not automatic. Further, for admission into the Master's Degree Program in Chemical Engineering, you will need to satisfy the Admission Criteria for applicants without a Chemical Engineering undergraduate degree:

Requirement 1: Undergraduate GPA

- Bachelor's degree in chemistry, biochemistry, biology, physics, mathematics: ≥ 3.25 / 4.0
- Bachelor's degree in civil or mechanical engineering from an ABET accredited institution: ≥ 3.0 / 4.0
- Bachelor's degree in another biological or physical science or another engineering discipline: ≥ 3.25 / 4.0

Requirement 2: Completed Undergraduate courses (with a cumulative GPA ≥ 3.0 / 4.0)

- Calculus I, Calculus II, Differential Equations with Linear Algebra
- General Chemistry I, II; Physics I, II (An additional upper level science course can substitute for Physics II)
- 2 Upper level science courses appropriate to the student's undergraduate major

Requirement 3: GRE scores

- Quantitative Reasoning: ≥ 155/170 (new scale)
- Analytical writing: ≥ 4.0/6.0
- Slightly lower GRE scores will be allowed if the undergraduate GPA is higher than the minimum listed.

Requirement 4: Undergraduate Chemical Engineering course content

*To satisfy Requirement 4, **select 1 of the 2 options below**.*

- **Option 1: Villanova University undergraduate courses**
  Complete 7 core undergraduate chemical engineering courses with a GPA ≥ 3.0 /4.0, usually completed over a 2-year period.
  - Fall semester, 4 courses:
    - CHE 2101 - Thermodynamics 1
    - CHE 2201 - Fluid Dynamics
    - CHE 3201 - Mass Transfer
    - CHE 3202 - Reactor Design
  - Spring semester, 3 of 4 courses (to be selected based on student background, academic performance, and academic advisement):
    - CHE 1102 - Material Balances
    - CHE 2102 - Thermodynamics 2
    - CHE 2202 - Heat Transfer
  - *Note: these courses will **not** earn the student credit toward the completion of the MSChE degree but will represent one of the prerequisite requirements for admission into the program. However, upon successful completion of the 7 courses shown with Option 1, students without an undergraduate degree in chemical engineering who are admitted into the MSChE program will only need to complete 30 credits at the graduate level to complete the MSChE degree requirements.*

(OR)

- **Option 2: Michigan State bridging courses**
  Complete CHE 804, 805 Foundations of Chemical Engineering I, II; offered online by Michigan State University; complete each course with a GPA ≥ 3.5/4.0 (repeating if necessary, until the required minimum grade is achieved.)

*Note: these courses will **not** earn the student credit toward the completion of the MSChE degree but will represent one of the prerequisite requirements for admission into the program. Upon successful completion of the 2 courses shown with Option 2, students without an undergraduate degree in chemical engineering who are admitted into the MSChE program will need to complete 36 credits at the graduate level to complete the MSChE degree requirements.*

Please Note: Successful completion of Requirements 1, 2, 3 and 4 will ensure admission into the MSChE program on a probationary basis, once a complete application has been submitted.

Degree Requirements

For Admitted Students with an Undergraduate Degree in Chemical Engineering or without an undergraduate degree in Chemical Engineering who are admitted having completed Option 1 of Requirement 4, above.

For admitted students **who completed an undergraduate degree in chemical engineering or without an undergraduate degree in Chemical Engineering but who are admitted having completed Option 1 of Requirement 4, above**, the Master of Science in Chemical Engineering program requires at least 30 credits of course work (10 courses) chosen so as to satisfy the following curriculum distribution requirements:

3 Required courses:

Item #	Title	Credits
CHE 8575	Thermodynamics	3
CHE 8563	Transport Phenomena	3
CHE 8551	Chem Kinetics and Catalysis	3

2 of the following 6 elective courses:

Item #	Title	Credits
CHE 8571	Separation Processes I	3
CHE 8572	Separation Processes II	3
CHE 8558	Process Design I	3
CHE 8550	Chem Eng Reactors	3
CHE 8565	Heat Transfer	3
CHE 8588	Biochemical Engineering I	3

- **5 additional courses** generally selected from among all CHE offerings (maximum of 4 at the 7000-level) chosen as part of a plan of study developed in consultation with your academic advisor
- A minimum of 24 credits (8 courses) must be Chemical and Biological Engineering department course offerings, subject to the approval of the graduate student's advisor; a maximum of 2 courses may be taken outside of the Chemical and Biological Engineering department (and will normally be "counted" as 7000-level electives when determining satisfaction of the program requirements)
- A maximum of 6 credits may be replaced by an independent study or thesis project, which, if elected, will be guided by a member of the department faculty. Projects may take the form of experimental research, process design, theoretical analysis or a literature survey, and the selected topic is subject to review and approval by the department's graduate committee. Full-time students receiving financial aid are required to complete the six credit research project and prepare a thesis.

For Admitted Students without an Undergraduate Degree in Chemical Engineering

For admitted students **who did not complete an undergraduate degree in chemical engineering engineering but who successfully complete the CHE804/805 sequence (Option 2, above)**, the Master of Science in Chemical Engineering program requires at least 36 credits of course work (12 courses) chosen to satisfy the following curriculum distribution requirements:

3 Required courses:

Item #	Title	Credits
CHE 8575	Thermodynamics	3
CHE 8563	Transport Phenomena	3
CHE 8551	Chem Kinetics and Catalysis	3

3 of the following 6 elective courses:

Item #	Title	Credits
CHE 8571	Separation Processes I	3
CHE 8572	Separation Processes II	3
CHE 8558	Process Design I	3
CHE 8550	Chem Eng Reactors	3
CHE 8565	Heat Transfer	3
CHE 8588	Biochemical Engineering I	3

- **6 additional courses** generally selected from among all CHE offerings (maximum of 4 at the 7000-level) chosen as part of a plan of study developed based on consultation with their academic advisor.
- A minimum of 30 credits (10 courses) must be Chemical and Biological Engineering department course offerings; subject to the approval of the graduate student's advisor, a maximum of 2 courses may be taken outside of the Chemical and Biological Engineering department (and will normally be "counted" as 7000-level electives when determining satisfaction of the program requirements)
- A maximum of 6 credits may be replaced by an independent study or thesis project, which, if selected, will be guided by a member of the department faculty. Projects may take the form of experimental research, process design, theoretical analysis or a literature survey, and the selected topic is subject to review and approval by the department's graduate committee. Full-time students receiving financial aid are required to complete the six-credit research project and prepare a thesis.

Class Schedule

Note: Tentative Chemical Engineering Department Graduate Course Offerings. All scheduled course offerings are subject to change due to instructor availability and other factors. For course descriptions, refer to the Chemical Engineering Department course descriptions.

Fall 2024 (and every two years thereafter)

Item #	Title	Credits
CHE 7580	CHE Economics	3
CHE 8563	Transport Phenomena	3
CHE 8565	Heat Transfer	3
CHE 8588	Biochemical Engineering I	3
CHE 8591	Gene & Cell Therapy	3

Spring 2025 (and every two years thereafter)

Item #	Title	Credits
CHE 7587	Biopharm Facility Design	3
CHE 8550	Chem Eng Reactors	3
CHE 8571	Separation Processes I	3
CHE 8589	Biochemical Engineering II	3
CHE 8592	Protein Engineering	3

Summer 2025 (and every three years thereafter)

Item #	Title	Credits
CHE 7570	Polymer Science & Engineering	3

Fall 2025 (and every two years thereafter)

Item #	Title	Credits
CHE 8531	Zeolite	3
CHE 8558	Process Design I	3
CHE 8663	Systems Biology	3
CHE 8575	Thermodynamics	3
CHE 8588	Biochemical Engineering I	3

Spring 2026 (and every two years thereafter)

Item #	Title	Credits
CHE 7595	Special Topics in CHE	3
CHE 8551	Chem Kinetics and Catalysis	3
CHE 8572	Separation Processes II	3
CHE 8586	Biomaterials & Drug Delivery	3
CHE 8589	Biochemical Engineering II	3

Summer 2026 (and every three years thereafter)

Item #	Title	Credits
CHE 7561	Air Pollution Control	3

Offered Annually

Item #	Title	Credits
CHE 8588	Biochemical Engineering I	3
CHE 8589	Biochemical Engineering II	3

Dam Engineering

Degree Type Certificate

This program provides students with focused knowledge in the design and analysis of dams. Graduate students (MS or PhD) will be able to plan, assess, design and construct dams and related infrastructure. The certificate program will provide students with a multidisciplinary CEE educational experience, with required courses in both water resources and geotechnical engineering.

A unique aspect of this certificate program is that it leverages the expertise of our geotechnical faculty and builds upon our strong reputation in the field of water resources.

Four required courses for certificate:

Item #	Title	Credits
CEE 8501	Surface Water Hydrology	3
CEE 8503	Open Channel Hydraulics	3
CEE 8106	Embankments and Slopes	3
CEE 8111	Analysis & Design of Dams	3

Students will be required to meet the course prerequisites and maintain a "B" average. Candidates without an ABET approved Bachelor's degree in Civil Engineering may be required to complete prerequisites depending on their academic background. Courses completed for the certificate would apply toward a MSCE or MSWREE should the student wish to continue.

	Total Credits	12

Urban Water Resources Design

Degree Type Certificate

This program is geared to Civil Engineers and Water Resource Professionals engaged in design of urban hydraulic and hydrologic systems in the built environment. The certificate consists of four graduate level courses. Program length can vary between 4 and 6 semesters depending upon when the student starts the program. All courses are offered in the evening, and through real time e-learning. The courses included as part of the certificate are:

Required Courses: (Take 3 of 4)

Item #	Title	Credits
CEE 8501	Surface Water Hydrology	3
CEE 8503	Open Channel Hydraulics	3
CEE 8508	Urban Hyd & Storm Water Mgmt	3
CEE 8511	River Dynamics	3

Elective Courses:

Item #	Title	Credits
CEE 7010	Lake, Stream & Wetland Ecology	3
CEE 7211	Water Res Planning & Mgmt	3
CEE 8502	Watershed Modeling	3
CEE 8512	River Mechanics & Engineering	3
CEE 8601	Special Topics Engr	3

Students will be required to meet the course prerequisites and maintain a "B" average. Candidates without an ABET approved Bachelor's degree in Civil Engineering may be required to complete prerequisites depending on their academic background. Courses completed for the certificate would apply toward a MSCE or MSWREE should the student wish to continue.

	Total Credits	12

Civil Engineering

Degree Type Master of Science

Villanova's MSCE program is modern, relevant and comprehensive, and is offered with these possible concentrations:

- Geotechnical Engineering
- Structural Engineering
- Transportation Engineering
- Water Resources and Environmental Engineering
- Interdisciplinary Program (Combines two of the above areas of interest)

The combination of Environmental Engineering and Water Resources Engineering is formalized in the MS in Water Resources & Environmental Engineering degree; however, students who qualify for the MSCE degree may elect the MSCE degree.

Admission Requirements
Departmental Admission Criteria

- The applicant must demonstrate the ability to master graduate-level studies. The evaluation is based on a review of the formal application submitted, transcripts from all previous colleges attended, and letters of recommendation.
- All International applicants (unless he/she has earned a degree from a 4-year US college or university) must also provide evidence of adequate proficiency in the English language determined by:
  - TOEFL or IELTS examination scores

For complete details, refer to the Application Requirements for all graduate level applicants in the College of Engineering.

MSCE Admission Criteria

- To earn the MSCE degree, the candidate would normally hold a Bachelor of Science in Civil Engineering (BSCE) degree from an Accreditation Board for Engineering and Technology (ABET) accredited program or its equivalent. A candidate with a degree in another engineering or related field is eligible provided he/she can present evidence of proficiency in:
  - Mathematics
  - Basic and engineering science
  - Computer literacy
  - Engineering design consistent with ABET's Criteria for Basic Level Programs

- In the absence of such evidence, the candidate will be required to complete the undergraduate engineering design courses and their appropriate undergraduate prerequisites, including mathematics and basic science courses consistent with the BSCE program at Villanova. Engineering technology courses cannot be used to fulfill undergraduate prerequisites. The undergraduate courses will be in addition to the graduate courses required for the MSCE degree.

Frequently Asked Questions:

1. **Are undergrad prerequisite courses offered online via Distance Learning?**
   We do not offer the undergraduate classes via Distance Learning. These courses are typically day classes.
2. **Are the application requirements the same if a student is only applying for an individual course?**
   Yes.
3. **How do I know if a prerequisite course is sufficient?**
   If the course is required at another institution's ABET-accredited BSCE program, then it is sufficient. Otherwise, the student can refer to the Villanova University Course Catalog to match course descriptions or consult with the CEE Department.

Degree Requirements

The Master of Science in Civil and Environmental Engineering (MSCE) program requires:

- A minimum of 30 earned semester credits of graduate work with a minimum of 21 graduate credits in Civil and Environmental Engineering courses.
- A Plan of Study must be approved by the advisor and chairperson prior to the completion of the student's first semester of graduate study. For approval, the plan must indicate a topical focus and direction commensurate with a master's degree program.
- Students can choose to pursue a thesis or non-thesis track.

Class Schedule

Note: Tentative Civil Engineering Graduate Course Offerings. All scheduled course offerings are subject to change due to instructor availability and other factors. For course descriptions, refer to the Civil Engineering course descriptions.

Fall 2024

Item #	Title	Credits
CEE 7511	Microbiology Enviro EGR	3
CEE 7520	Environmental Compliance Sys.	3
CEE 7211	Water Res Planning & Mgmt	3
CEE 8501	Surface Water Hydrology	3
CEE 8503	Open Channel Hydraulics	3
CEE 8104	Geoenvironmental Engineering	3
EGR 7012	Management for Engineers	3
CEE 9030	CE Resrch/Investigation	3
CEE 9031	Thesis I	3
CEE 9032	Thesis II	3
CEE 9080	Thesis Continuation	

Spring 2025

Item #	Title	Credits
CEE 7513	Fate-Trans. Contaminants	3
CEE 8708	Bio Treatment Processes	3
CEE 8502	Watershed Modeling	3
CEE 8511	River Dynamics	3
CEE 8108	Geotechnical Earthquake Eng	3
CEE 7405	Wood Design	3
CEE 8434	Structural Dynamics	3
CEE 8435	Reinforced Concrete	3
CEE 8449	Applied Finite Elements CEE	3
EGR 7011	Business Basics for Engineers	3
CEE 9030	CE Resrch/Investigation	3
CEE 9031	Thesis I	3
CEE 9032	Thesis II	3
CEE 9080	Thesis Continuation	

Summer 2025

Item #	Title	Credits
CEE 7502	Fundamentals Env Eng Processes	3
CEE 7010	Lake, Stream & Wetland Ecology	3
CEE 7111	Intro Hydraulics & Hydrology	3
CEE 8551	Special Topics in Water Resour	3
CEE 8105	Advanced Geotechnical Engr.	3
CEE 8111	Analysis & Design of Dams	3
CEE 8207	Des of Sustainable Transp Sys	3
CEE 7402	Forensic Engineering	3
CEE 8439	CE Materials	3
CEE 8460	Tall Building Design	3
CEE 9030	CE Resrch/Investigation	3
CEE 9031	Thesis I	3
CEE 9032	Thesis II	3
CEE 9080	Thesis Continuation	
	Total Credits	30

Water Resources and Environmental Engineering

Degree Type Master of Science

Villanova's Master of Science in Water Resources and Environmental Engineering (MSWREE) program presents an engineering view of these fields, although students with science backgrounds constitute a significant portion of the total enrollment. Students may develop an interdisciplinary program that includes geotechnical engineering courses.

The MSWREE is nationally-recognized for its:

- **Cutting edge research and collaborative opportunities** in the Villanova Urban Stormwater Partnership (VUSP) and the campus's Green Infrastructure Stormwater Research Park.
- **Distinguished leadership** including Villanova Center for Resilient Water Systems and VUSP director Dr. Robert Traver, a sought-after stormwater expert and past president of the American Academy of Water Resources Engineers; and Dr. Metin Duran, a nationally recognized environmental engineering expert in wastewater treatment and microbial water quality.

Admission Requirements
Departmental Admission Criteria

- The applicant must demonstrate the ability to master graduate-level studies. The evaluation is based on a review of the formal application submitted, transcripts from all previous colleges attended, and letters of recommendation.
- All International applicants (unless he/she has earned a degree from a 4-year US college or university) must also provide evidence of adequate proficiency in the English language determined by:
  - TOEFL or IELTS examination scores

For complete details, refer to the Application Requirements for all graduate level applicants in the College of Engineering.

MSWREE Admission Criteria

- A candidate is eligible to pursue the MSWREE degree provided he/she can present evidence of proficiency in:
  - Mathematics
  - Basic science
  - Engineering science
- In the absence of such evidence, the candidate will be required to complete the following undergraduate prerequisites at proficient levels:
  - Four semesters of mathematics through Differential Equations
  - Two semesters of Chemistry
  - One semester of Newtonian Physics
  - Statics
  - Fluid Mechanics

*For comparison purposes, you may review descriptions of undergraduate Engineering courses here.

- The undergraduate prerequisites for the MSWREE degree may be completed at Villanova or their equivalent taken elsewhere. Departmental pre-approval of undergrad prerequisite courses taken elsewhere is encouraged to ensure the courses are sufficient. Engineering technology courses cannot be used to fulfill undergraduate prerequisites. The undergraduate courses will be in addition to the graduate courses required for the MSWREE degree. It is recommended that applicants requiring undergraduate prerequisite courses begin their graduate study in the Summer term.

Frequently Asked Questions:

1. **Are undergrad prerequisite courses offered online via Distance Learning?**
   We do not offer the undergraduate classes via Distance Learning. These courses are typically day classes.
2. **Are Statics and Dynamics one or two courses?**
   Statics and Dynamics are commonly taught as two separate classes. The dynamics course requirement is waived IF the Fluid Mechanics course does not require it, but most Fluid Mechanics courses do require Dynamics.
3. **Are Chemistry or Physics labs required to meet prerequisites?**
   No.
4. **Are the application requirements the same if a student is only applying for an individual course?**
   Yes.
5. **How do I know if a prerequisite course is sufficient?**
   If the course is required at another institution's ABET-accredited BSCE program, then it is sufficient. Otherwise, the student can refer to the Villanova University Course Catalog to match course descriptions or consult with the CEE Department.

Degree Requirements

The Master of Science in Water Resources and Environmental Engineering program (MSWREE) requires:

- A minimum of 30 earned semester credits of graduate work, with a minimum of 21 graduate credits in Civil and Environmental Engineering courses
- Two (2) Environmental Engineering courses from the following:

Item #	Title	Credits
CEE 7511	Microbiology Enviro EGR	3
CEE 7513	Fate-Trans. Contaminants	3
CEE 7701	Aquatic Chem Environ EGR	3
CEE 8707	Phys/Chem Treatment Proc	3
CEE 8708	Bio Treatment Processes	3

- Two (2) Water Resources courses from the following:
  (NOTE: CEE 7111 is only for students who do not have a BS in Civil Engineering.)

Item #	Title	Credits
CEE 7111	Intro Hydraulics & Hydrology	3
CEE 8501	Surface Water Hydrology	3
CEE 8502	Watershed Modeling	3
CEE 8503	Open Channel Hydraulics	3
CEE 8508	Urban Hyd & Storm Water Mgmt	3
CEE 8511	River Dynamics	3

- One of the following:

Item #	Title	Credits
CEE 8502	Watershed Modeling	3
CEE 8508	Urban Hyd & Storm Water Mgmt	3
CEE 8511	River Dynamics	3
CEE 8707	Phys/Chem Treatment Proc	3
CEE 8708	Bio Treatment Processes	3

- Choice of a thesis track or non-thesis track
- A Plan of Study, which must be approved by the advisor and chairperson prior to the completion of the student's first semester of graduate study
- Students may develop an interdisciplinary MSWREE degree program that includes geotechnical engineering courses

Class Schedule

Note: Tentative Water Resources and Environmental Engineering Graduate Course Offerings. All scheduled course offerings are subject to change due to instructor availability and other factors. For course descriptions, refer to the Water Resources and Environmental Engineering course descriptions.

Fall 2024

Item #	Title	Credits
CEE 7511	Microbiology Enviro EGR	3
CEE 7520	Environmental Compliance Sys.	3
CEE 7211	Water Res Planning & Mgmt	3
CEE 8501	Surface Water Hydrology	3
CEE 8503	Open Channel Hydraulics	3
CEE 8104	Geoenvironmental Engineering	3
CEE 7412	Modern Structural Analysis	3
CEE 8436	Prestressed Concrete	3
CEE 8437	Structural Steel	3
CEE 8462	Design of Bridge Substructures	3
EGR 7012	Management for Engineers	3
CEE 9030	CE Resrch/Investigation	3
CEE 9031	Thesis I	3
CEE 9032	Thesis II	3
CEE 9080	Thesis Continuation	

Spring 2025

Item #	Title	Credits
CEE 7513	Fate-Trans. Contaminants	3
CEE 8708	Bio Treatment Processes	3
CEE 8502	Watershed Modeling	3
CEE 8511	River Dynamics	3
CEE 8108	Geotechnical Earthquake Eng	3
CEE 7405	Wood Design	3
CEE 8434	Structural Dynamics	3
CEE 8435	Reinforced Concrete	3
CEE 8449	Applied Finite Elements CEE	3
EGR 7011	Business Basics for Engineers	3
CEE 9030	CE Resrch/Investigation	3
CEE 9031	Thesis I	3
CEE 9032	Thesis II	3
CEE 9080	Thesis Continuation	

Summer 2025

Item #	Title	Credits
CEE 7502	Fundamentals Env Eng Processes	3
CEE 7010	Lake, Stream & Wetland Ecology	3
CEE 7111	Intro Hydraulics & Hydrology	3
CEE 8551	Special Topics in Water Resour	3
CEE 8105	Advanced Geotechnical Engr.	3
CEE 8111	Analysis & Design of Dams	3
CEE 8207	Des of Sustainable Transp Sys	3
CEE 7402	Forensic Engineering	3
CEE 8439	CE Materials	3
CEE 8460	Tall Building Design	3
CEE 9030	CE Resrch/Investigation	3
CEE 9031	Thesis I	3
CEE 9032	Thesis II	3
CEE 9080	Thesis Continuation	
	Total Credits	30

Electrical and Computer Engineering

Computer Architecture

Degree Type Certificate

The Computer Architecture Certificate covers the theory, design, implementations, and applications of computer architecture. Design methodology of computer architecture is rapidly changing due to advancement in microprocessors, integrated circuits and neural and VLSI circuits. Applications of computer architecture are many, including supercomputers, signal processing, communication systems, control systems, and large-scale information processing systems.

Certificate Requirements:

Requirements for the Computer Architecture Certificate include four required courses and an elective course from the indicated list of courses. Students are expected to have a strong background in design and microprocessors at the undergraduate level.

Core Courses:

Item #	Title	Credits
ECE 8405	Computer Organ & Design	3
ECE 8440	Hardware Sys Des & Modeling	3
ECE 8448	Embedded Systems Architecture	3
ECE 8473	UNIX and C Programming	3

Elective Courses: (Choose one from the following list)

Item #	Title	Credits
ECE 8410	Trusted Computing	3
ECE 8425	Microproc & Microcomp	3
ECE 8455	Adv. Digital Des. Using FPGAs	3
ECE 9090	ECE Project	3
	Total Credits	15

Cybersecurity

Degree Type Certificate

The Cybersecurity Graduate Certificate covers the major security areas related to our interdependent network of information technology infrastructures, which includes the Internet, telecommunications networks, computer systems, and embedded processors and controllers in critical industries.

Certificate Requirements

Five courses, including at least three security courses. The security courses can be selected from the core, systems, policy, and/or operations specialization areas, and must include at least one of the core courses.

Core Courses

Item #	Title	Credits
ECE 8476	Cryptography & Netwk. Security	3
ECE 8484	Cybersec. Threats and Defense	3

Systems Specialization

Item #	Title	Credits
ECE 8410	Trusted Computing	3
ECE 8450	Design of Secure Comput System	3
ECE 8481	Post-Quantum Cryptographic ENR	3
ECE 8485	Control Systems Security	3
ECE 8492	Secure Software Development	3

Policy Specialization

Item #	Title	Credits
ECE 8494	Legal Aspects of Comp Security	3

Operations Specialization

Item #	Title	Credits
ECE 8486	Ethical Hacking	3
ECE 8491	Blockchain Techno and Uses	3

Electives

In addition to the following courses, any of the core and specialization area courses may be used as electives.

Item #	Title	Credits
ECE 7428	Computer Comm Networks	3
ECE 8405	Computer Organ & Design	3
ECE 8408	Mob Computing & Wireless Net	3
ECE 8448	Embedded Systems Architecture	3
ECE 8473	UNIX and C Programming	3
ECE 8487	Advanced Machine Learning	3
ECE 9030	Independent Study	3
ECE 9031	Research I	3
ECE 9032	Research II	3
ECE 9090	ECE Project	3
CSC 8210	Hlthcare Safety Secur Law&Eth	3
CSC 8301	Design and Ana of Algs	3
CSC 8310	Programming Languages	3
CSC 8510	Theory of Computability	3
CSC 8453		3
CSC 8490	Database Systems	3
CSC 8515	Machine Learning	3
CSC 8540	Software Engineering	3
CSC 8566	Internet of Things	3
CSC 9010	Special Topics	3
MAT 7770	Number Theory	3
MAT 8650	Abstract Algebra	3
MAT 8790	Selected Topics I	3

The graduate certificate in Cybersecurity with a Concentration in Cyber-Physical and Control Systems Security requires the following four courses, plus one elective from the cybersecurity or elective course lists:

	Total Credits	15

Electric Power Systems

Degree Type Certificate

The Electric Power Systems Certificate supports the training and continuing education needs of the engineers who operate electric power systems. It provides a broad range of courses, from the static and dynamic behavior of the electric power systems to the theory of operation and practical considerations of power apparatus.

Certificate Requirements:

The Electric Power Systems Certificate consists of (3) required courses and two (2) elective courses from the lists below.

Required Courses

Item #	Title	Credits
ECE 7805	Electric Machinery	3
ECE 7810	Power System Modeling	3
EGR 8301	Control Systems Engineering	3

Elective Courses: (Choose two from the following list)

Item #	Title	Credits
ECE 7000	Renewable Energy Policy	3
ECE 7580	Intro to Power Electronics	3
ECE 7800	Renewable Energy Systems	3
ECE 7830	Intro. to Electric Drives	3
ECE 7831	Design&Model of Electric Vehic	3
ECE 8580	Power Electronics	3
ECE 8815	Smart Energy Systems	3
ECE 8820	Power System Dynamics	3
EGR 7850	Electrochemical Power Sources	3
EGR 8302	Digital Control	3
	Total Credits	15

High Frequency Systems

Degree Type Certificate

The High Frequency Systems Certificate covers material in microwave theory and techniques, antennas and photonics. The material covered by this certificate provides students the tools to understand, design and implement telecommunication systems for a variety of terrestrial and space applications.

Certificate Requirements:

The High Frequency Systems Certificate consists of (4) required courses and two (1) elective course from the lists below.

Required Courses

Item #	Title	Credits
ECE 8562	Introduction to Photonics	3
ECE 8670	Microwave Thry & Tech I	3
ECE 8671	Micro Thry and Tech II	3
ECE 8675	Antenna Theory I	3

Elective Courses: (Choose one from the following list)

Item #	Title	Credits
ECE 8566	RFIC Design	3
ECE 8676	Antenna Theory & Design II	3
ECE 8760	Optical Communications	3
	Total Credits	15

Wireless and Digital Communications

Degree Type Certificate

The Wireless and Digital Communications Certificate covers the theoretical background and practice of wireless and digital communications. Topics include: digital modulation, wireless systems, detection, sequence estimation, channel equalization, array processing for wireless communications, 5G Wireless networks, radar systems, information theory, source and channel coding.

Certificate Requirements:

Five courses are required to earn the certificate. The two Core Courses are required, unless the student already has a comparable background. After fulfilling the core requirement, the balance of the five courses are to be taken from the list of Elective Courses. Related courses can be substituted for the Elective Courses only upon approval from the ECE Graduate Coordinator. Students electing this certificate are expected to have a background in signal and system theory comparable to ECE 3242.

Required Courses

Item #	Title	Credits
ECE 8072	Stat Signal Processing	3
ECE 8700	Comm Systems Engineering	3

Elective Courses

Item #	Title	Credits
ECE 8720	5G Wireless Networks	3
ECE 8408	Mob Computing & Wireless Net	3
ECE 8710	Radar Systems	3
ECE 8708	Wireless Communications	3
ECE 7231	Applied DSP	3

Computer Engineering

Degree Type Master of Science

Admission Requirements
Admission Criteria for Applicants with a BSCpE from an accredited US university:

- Minimum GPA of 3.0 out of 4.00
- Two recommendations

Admission Criteria for International Applicants with a BSCpE from a non-US university:

- Minimum GPA of 3.25 out of 4.00 or equivalent.
- Minimum TOEFL score of 90 or IELTS score of 7.0
- Two recommendations

Admission Criteria for Applicants with undergraduate degrees from a US university in Mechanical Engineering, Physics, Math, Electrical Engineering Technology:

- Minimum GPA of 3.25 out of 4.00
- Two recommendations
- Satisfy the required BSCpE courses or their equivalent (see below). The graduate equivalent of the following courses can be taken:
  - ECE 2172/3 – Digital Systems
  - ECE 3170/1 - Computer Architecture

- ECE 2160/1 - C++, Algorithms & Data Struct
- ECE 3476 - Computer Networks

If taken at the graduate level, a maximum of two of these courses can be transferred toward the MSCpE degree (Provided no other courses from other institutions have been previously transferred)

Applicants with BS degrees in other engineering disciplines may also be considered on individual bases.

Degree Requirements

Coursework	Thesis Option	Non-Thesis Option
Computer Engineering Required Courses	9 credits	9 credits
Computer Engineering Area Courses	9 credits	9 credits
Computer Engineering Electives	3 credits	12 credits
Independent Study	3 credits	NA*
Thesis	6 credits	NA
Total Credit Hours	**30 credits**	**30 credits**

Note: students must complete ECE 9030 before applying for the thesis option. Thesis applications also require a written research proposal and recommendation and approval from the student's research advisor and the department chairperson. Students who qualified for the thesis option are required to make an oral presentation prior to graduation.

* Graduate students electing the non-thesis option may substitute three credits of independent study for one elective course.

Required Courses

Item #	Title	Credits
ECE 7428	Computer Comm Networks	3
ECE 8448	Embedded Systems Architecture	3
ECE 8473	UNIX and C Programming	3

Area Courses: choose 3

Item #	Title	Credits
ECE 7428	Computer Comm Networks	3
ECE 8405	Computer Organ & Design	3
ECE 8408	Mob Computing & Wireless Net	3
ECE 8410	Trusted Computing	3
ECE 8440	Hardware Sys Des & Modeling	3
ECE 8450	Design of Secure Comput System	3
ECE 8455	Adv. Digital Des. Using FPGAs	3
ECE 8481	Post-Quantum Cryptographic ENR	3
ECE 8487	Advanced Machine Learning	3

Any course from the area courses above may also count as an elective. At least two of the electives must be ECE courses. Courses not listed here may count as electives with approval of the advisor.

Item #	Title	Credits
ECE 8476	Cryptography & Netwk. Security	3
ECE 8484	Cybersec. Threats and Defense	3
ECE 8485	Control Systems Security	3
ECE 8486	Ethical Hacking	3
ECE 8491	Blockchain Techno and Uses	3
ECE 8492	Secure Software Development	3
CSC 8210	Hlthcare Safety Secur Law&Eth	3
CSC 8301	Design and Ana of Algs	3
CSC 8310	Programming Languages	3
CSC 8453		3
CSC 8490	Database Systems	3
CSC 8510	Theory of Computability	3
CSC 8515	Machine Learning	3
CSC 8540	Software Engineering	3
CSC 8566	Internet of Things	3
MAT 7770	Number Theory	3
MAT 8435	Mathematical Modeling	3
MAT 8650	Abstract Algebra	3
MAT 8790	Selected Topics I	3
ECE 9030	Independent Study	3
ECE 9031	Research I	3
ECE 9032	Research II	3
ECE 9090	ECE Project	3

Class Schedule

Note: Tentative Computer Engineering Graduate Course Offerings. All scheduled course offerings are subject to change due to instructor availability and other factors. For course descriptions, refer to the Computer Engineering course descriptions.

Fall 2024

Item #	Title	Credits
ECE 8440	Hardware Sys Des & Modeling	3
ECE 8455	Adv. Digital Des. Using FPGAs	3
ECE 8481	Post-Quantum Cryptographic ENR	3
ECE 8487	Advanced Machine Learning	3

Spring 2025

Item #	Title	Credits
ECE 7428	Computer Comm Networks	3
ECE 8405	Computer Organ & Design	3
ECE 8448	Embedded Systems Architecture	3
ECE 8450	Design of Secure Comput System	3

Fall 2025

Item #	Title	Credits
ECE 8408	Mob Computing & Wireless Net	3
ECE 8440	Hardware Sys Des & Modeling	3
ECE 8455	Adv. Digital Des. Using FPGAs	3
ECE 8481	Post-Quantum Cryptographic ENR	3
ECE 8487	Advanced Machine Learning	3

Spring 2026

Item #	Title	Credits
ECE 7428	Computer Comm Networks	3
ECE 8405	Computer Organ & Design	3
ECE 8448	Embedded Systems Architecture	3
ECE 8450	Design of Secure Comput System	3
	Total Credits	30

Cybersecurity

Degree Type Master of Science

Whether your interest lies in systems, policy or operations—the program's three areas of concentration—Villanova's Master of Science in Cybersecurity will prepare you for success in this rapidly growing, ever-evolving field.

Admission Requirements
Admission Criteria:

Admission to the Master of Science in Cybersecurity degree program will be granted to qualified students who hold a Bachelor's degree in Engineering, Computer Science, Mathematics, or applied sciences from an accredited and/or reputable institution, with a GPA of 3.0 or better. Applicants must meet the general requirements for admission to the College of Engineering.

Applicants with a US Bachelor's degree in other fields of study, with a minimum GPA of 3.0 out of 4.0, and with relevant work experience and industry certifications, will also be considered. Undergraduate course prerequisite requirements include Villanova ECE 4470, Computer Networks, or equivalent. In some cases, students will be admitted on a provisional basis (non-matriculated) and will need to complete two (2) courses with at least a B or better in each course, before being considered for full admission (matriculated).

The GRE is required for full-time applicants for TA or RA positions: minumum score (quantitative reasoning plus verbal) 1200 (old scale) or 305 (new scale).

International Student Admission Requirements:

For individuals receiving their Bachelor's degree outside of the United States, the minimum GPA is 3.25 out of 4.00 or equivalent, and the TOEFL/IELTS is required: minimum TOEFL score of 90 or IELTS score of 7.0

Degree Requirements

Coursework	Thesis Option	Non-Thesis Option
Cybersecurity Required Courses	6 credits	6 credits
Cybersecurity Area Courses	12 credits	12 credits
Cybersecurity Electives	3 credits	12 credits
Independent Study	3 credits	NA*
Thesis	6 credits	NA
Total Credit Hours	**30 credits**	**30 credits**

Required Courses

Item #	Title	Credits
ECE 8476	Cryptography & Netwk. Security	3
ECE 8484	Cybersec. Threats and Defense	3

Area Courses: choose 4

Item #	Title	Credits
ECE 8410	Trusted Computing	3
ECE 8450	Design of Secure Comput System	3
ECE 8481	Post-Quantum Cryptographic ENR	3
ECE 8485	Control Systems Security	3
ECE 8486	Ethical Hacking	3
ECE 8488	Security Risk Assess. & Man.	3
ECE 8491	Blockchain Techno and Uses	3
ECE 8492	Secure Software Development	3
ECE 8494	Legal Aspects of Comp Security	3

Electives

Any course from the area courses above may also count as an elective. At least two of the electives must be ECE courses. Courses not listed here may count as electives with approval of the advisor.

Item #	Title	Credits
ECE 7428	Computer Comm Networks	3
ECE 8405	Computer Organ & Design	3
ECE 8408	Mob Computing & Wireless Net	3
ECE 8448	Embedded Systems Architecture	3
ECE 8473	UNIX and C Programming	3
ECE 8487	Advanced Machine Learning	3
ECE 9030	Independent Study	3
ECE 9031	Research I	3
ECE 9032	Research II	3
ECE 9090	ECE Project	3
CSC 8210	Hlthcare Safety Secur Law&Eth	3
CSC 8301	Design and Ana of Algs	3
CSC 8310	Programming Languages	3
CSC 8510	Theory of Computability	3
CSC 8453		3
CSC 8490	Database Systems	3
CSC 8515	Machine Learning	3
CSC 8540	Software Engineering	3
CSC 8566	Internet of Things	3
CSC 9010	Special Topics	3
MAT 7770	Number Theory	3
MAT 8650	Abstract Algebra	3
MAT 8790	Selected Topics I	3

Selected MBA courses are also available as electives. Registration requires approval of the academic advisor and school of business.

MBA Required Courses offered to Engineering students

Item #	Title	Credits
MBA 8250	Bus Opera & Supply Chain Mgmt	
MBA 8350	Analyzing and Leveraging Data	3
MBA 8550	Team Leadership & Grp Dynamics	1.5
MBA 8650	Strategic Marketing Mgmt.	3
MBA 8710	Info Tech as Strategic Lever	1.5
MBA 8720	Ethical Business Practices	1.5
MBA 8730	Mgmt. for Innov. & Creativity	1.5
MBA 8740	Global Political Economy	1.5

MBA Elective Courses for Engineering students

Item #	Title	Credits
MBA 8139	Contemporary Topics	3
MBA 8144		
MBA 8147	Analytics in Sports Business	1.5
MBA 8330	Contemporary Topics Economics	1.5
MBA 8522	Talent Management	1.5
MBA 8529-001		
MBA 8529-002		
MBA 8537	Intro to Data Mining	1.5
MBA 8546	Opp. Recognition & Pre Launch	1.5
MBA 8631	Exec Level Selling C-Suite	1.5
MBA 8632	Cons Psy Optimal Bus Solutions	1.5
MBA 8643	Mgmt & Mkt of Services-Part I	1.5
MBA 8644	Mgmt & Mkt of Services-Part II	1.5
MBA 8649	TOPICS: Marketing	1.5
MBA 8649	Topic: Marketing, Opp Analysis and International Bus Dev	
MBA 8800	Commercial Real Estate Invest.	3

Independent Study

Thesis

Class Schedule

Note: Tentative Cybersecurity Graduate Course Offerings. All scheduled course offerings are subject to change due to instructor availability and other factors. For course descriptions, refer to the Cybersecurity course descriptions.

Fall 2024

Item #	Title	Credits
ECE 8410	Trusted Computing	3
ECE 8476	Cryptography & Netwk. Security	3
ECE 8486	Ethical Hacking	3
ECE 8489	Malware Analysis and Defense	3

Spring 2025

Item #	Title	Credits
ECE 8450	Design of Secure Comput System	3
ECE 8484	Cybersec. Threats and Defense	3
ECE 8491	Blockchain Techno and Uses	3
ECE 8492	Secure Software Development	3
ECE 8496	Computer Forensics	3
	Total Credits	30

Electrical Engineering

Degree Type Master of Science

Advance your career in electrical engineering by updating your knowledge and developing new skills through the Master of Science in Electrical Engineering program at Villanova University. The MSEE offers five concentration areas, as well as an option for a custom degree plan.

- Bio-Signals, Systems and Informatics (BSI)
- Electronic Circuits and Systems (ECS)
- Electric Energy Systems (EES)
- Microwave, Antenna, and Photonic Systems (MAPS)
- Signal Processing and Communications (SPC)

Admission Requirements
Admission Criteria for Applicants with a BSEE from an accredited US university:

- Minimum GPA of 3.0 out of 4.00
- Two recommendations

Admission Criteria for International Applicants with a BSEE from a non-US university:

- Minimum GPA of 3.25 out of 4.00 or equivalent.
- Minimum TOEFL score of 90 or IELTS score of 7.0
- Two recommendations

Admission Criteria for Applicants with undergraduate degrees from a US university in Mechanical Engineering, Physics, Math, Electrical Engineering Technology:

- Minimum GPA of 3.25 out of 4.00
- Two recommendations
- Satisfy the required BSEE courses or their equivalent (see below). The graduate equivalent of the following courses can be taken:
  - ECE-3242, Fundamentals of Signal Processing: ECE-7231
  - ECE-2530, Analog Electronics I
  - ECE-3690, Engineering Electromagnetics : ECE-8675 or ECE-8670
  - ECE-4290, Energy System Models & Control: its EGR equivalent

If taken at the graduate level, a maximum of two of these courses can be transferred toward the MSEE degree (Provided no other courses from other institutions have been previously transferred)

Applicants with BS degrees in other engineering disciplines may also be considered on individual bases.

Prerequisites for MSEE

MAT 2500 – Calculus III: Parametric equations; polar, cylindrical, and spherical coordinates; vectors and the geometry of space; vector functions (derivatives, integrals, curvature, etc.); partial derivatives; optimization; multiple integration and its applications; vector calculus (line integrals, vector analysis). Continued use of a computer algebra system.

MAT 2705 - Differential Equations: First order and linear second order differential equations, matrices and linear equation systems, eigenvalues and eigenvectors, and linear systems of differential equations.

PHY 2402 - Physics II Electricity & Magnetism: Electrostatics, DC Circuits, magnetism, and AC circuits. Designed for students in the College of Engineering.

ECE 2030 – Electrical Circuit Fundamentals**:** Basic concepts, steady-state dc circuit analysis, network theorems, energy storage elements, complete response of first-order circuits, steady-state sinusoidal circuit analysis, AC systems and Laplace Transform. (also EE 2031, Electrical Circuit Fundamentals Lab**)**

ECE 2530 - Analog Electronics I**:** Basic electronic concepts. Waves and particles, semiconductor device physics, diodes and BJT circuits and amplifier circuits.

ECE 3690 - Engineering Electromagnetics: Maxwell's equations, plane waves, dissipative media, reflection, and transmission of waves at an interface, metallic and optical waveguides, transmission lines, linear and array antennas. Practicum includes computer projects, laboratory demonstrations and problem solving. Three lecture hours and a two-hour practicum per week.

ECE 3220 - Signal Processing: Signal representation, Fourier series, Fourier transform, discrete-time systems, convolution, discrete-time Fourier transform, Z-transform. Practicum includes MATLAB exercises on transform properties and their use in modulation and filtering. Three lecture hours and a two-hour practicum per week.

ECE-2290- Energy System Models & Control: Modeling and analysis of electrical, mechanical, and electromechanical systems; open-loop and feedback systems; frequency domain models; state equations; linearization, time response; steady-state error; block diagrams and signal flow graphs; stability criteria; root locust method.

Degree Requirements

- A minimum of 30 earned semester credits (10 courses) of graduate work
- At least 21 course credits and up to 9 credits of research
- Electrical engineering courses must be chosen from the MSEE course offering list, however the required elective course may come from the Department of Computer Engineering, Computer Science or other appropriate programs
- Students may elect to choose the thesis or non-thesis option. Before applying for the thesis option, students must complete ECE 9030 in preparation. The application also requires the submission of a written research proposal and recommendation and approval from the student's research advisor and the department chairperson. Students who qualify for the thesis option are required to make an oral presentation prior to graduation.
- Graduate students electing the non-thesis option may substitute three credits of independent study for an approved elective course.

Ten courses (30 credits) are required to complete a Master's in Electrical Engineering with a concentration in Bio-Signals, Systems and Informatics (BSI).

Required Core Courses:

Item #	Title	Credits
ECE 7251	Analysis of Biomedical Signals	3
ECE 8001	Engineering Math I	3

Area Courses (at least 4 from):

Item #	Title	Credits
BIO 7805	Biostatistics & Exper. Design	4
ECE 8072	Stat Signal Processing	3
ECE 8487	Advanced Machine Learning	3
ECE 8525	Sensors	3
ECE 8562	Introduction to Photonics	3
ECE 9900 Wearable Biosensing		
ECE 9900 3D Cell Cultures		
STAT 8401 Statistical Theory II		

Breadth Courses (at least 1 of the following):

Item #	Title	Credits
BIO 7960	Adv Topics: C/M/D Biology	3
CSC 8200 Health Informatics and EHealth Systems		
ECE 7231	Applied DSP	3
EGR 8301	Control Systems Engineering	3
EGR 8311	Machine Learning for Engineers	3
NUR 9014		
NUR 9505	Statistical Analysis I	3
PHI 8420	Healthcare Ethics	3
PSY 8100	Stat & Experimental Des	3
STAT 7404	Statistical Methods	3

Breadth Courses:

Additional courses may be selected with the approval of your advisor to complement those above and to support your professional interests.

Ten courses (30 credits) are required to complete a Master's in Electrical Engineering with a concentration in Electronic Circuits and Systems (ECS).

Core Courses:

Item #	Title	Credits
ECE 7500	Fund Solid State Electronics	3
ECE 7580	Intro to Power Electronics	3

And one of:

Item #	Title	Credits
ECE 8460	VLSI Design	3
ECE 8566	RFIC Design	3

Area Courses (choose two):

Item #	Title	Credits
ECE 7550	Linear Integrated Electronics	3
ECE 7750	Communication Electronics	3
ECE 8455	Adv. Digital Des. Using FPGAs	3
ECE 8525	Sensors	3
ECE 8580	Power Electronics	3

Additional Course: should be selected to complement ECS core and area courses such that your degree supports your professional interests.

Ten courses (30 credits) are required to complete a Master's in Electrical Engineering with a concentration in Electric Energy Systems (EES).

Core Courses:

Item #	Title	Credits
ECE 7805	Electric Machinery	3
ECE 7810	Power System Modeling	3
EGR 8301	Control Systems Engineering	3

Area Courses:

Item #	Title	Credits
ECE 7000	Renewable Energy Policy	3
ECE 7500	Fund Solid State Electronics	3
ECE 7580	Intro to Power Electronics	3
ECE 7800	Renewable Energy Systems	3
ECE 7830	Intro. to Electric Drives	3
EGR 7850	Electrochemical Power Sources	3
EGR 8302	Digital Control	3
ECE 8580	Power Electronics	3
ECE 8815	Smart Energy Systems	3
ECE 8820	Power System Dynamics	3
ECE 8830	Advanced Electric Drives	3

Courses also included in Alternate & Renewable Energy track in Sustainable Engineering are:

Item #	Title	Credits
ECE 7000	Renewable Energy Policy	3
ECE 7580	Intro to Power Electronics	3
ECE 7805	Electric Machinery	3
ECE 7810	Power System Modeling	3
ECE 8580	Power Electronics	3
ECE 8815	Smart Energy Systems	3
ECE 8820	Power System Dynamics	3
EGR 7850	Electrochemical Power Sources	3

Approved Electives (up to two courses):

Item #	Title	Credits
ECE 7428	Computer Comm Networks	3
ECE 7525	Elec Measure & Convers	3
EGR 7800	Solar Therm. Energy Conversion	3
ECE 8476	Cryptography & Netwk. Security	3

Ten courses (30 credits) are required to complete a Master's in Electrical Engineering with a concentration in Microwave, Antenna, and Photonic Systems (MAPS):

Core Courses:

Item #	Title	Credits
ECE 8001	Engineering Math I	3
ECE 8562	Introduction to Photonics	3
ECE 8670	Microwave Thry & Tech I	3
ECE 8671	Micro Thry and Tech II	3
ECE 8675	Antenna Theory I	3

Area courses:

Item #	Title	Credits
ECE 8566	RFIC Design	3
ECE 8568	Optoelectronic Devices & Cir	3
ECE 8676	Antenna Theory & Design II	3
ECE 8760	Optical Communications	3

Additional Course: should be selected to complement MAPS core and area courses such that your degree supports your professional interests.

Ten courses (30 credits) are required to complete a Master's in Electrical Engineering with a concentration in Signal Processing and Communications (SPC). The following core courses are required:

Core Courses:

Item #	Title	Credits
ECE 7231	Applied DSP	3
ECE 8072	Stat Signal Processing	3
ECE 8700	Comm Systems Engineering	3

Area courses include three of the following:

Item #	Title	Credits
ECE 8708	Wireless Communications	3
ECE 8710	Radar Systems	3
ECE 8720	5G Wireless Networks	3
ECE 7251	Analysis of Biomedical Signals	3

Math Courses (1)

Item #	Title	Credits
ECE 8001	Engineering Math I	3
MAT 7660		3

Up to 3 additional courses should be selected to complement those above and to support your professional interests.

Thesis Option Courses:

Item #	Title	Credits
ECE 9030	Independent Study	3
ECE 9031	Research I	3
ECE 9032	Research II	3

Class Schedule

Note: Tentative Electrical Engineering Department Graduate Course Offerings. All scheduled course offerings are subject to change due to instructor availability and other factors. For course descriptions, refer to the Electrical Engineering Department course descriptions.

Fall 2024

Item #	Title	Credits
ECE 7231	Applied DSP	3
ECE 7580	Intro to Power Electronics	3
ECE 7805	Electric Machinery	3
ECE 8001	Engineering Math I	3
ECE 8072	Stat Signal Processing	3
ECE 8301		
ECE 8487	Advanced Machine Learning	3
ECE 8562	Introduction to Photonics	3
ECE 8675	Antenna Theory I	3
ECE 9900	Special Topics in E E	3

Spring 2025

Item #	Title	Credits
ECE 7251	Analysis of Biomedical Signals	3
ECE 7800	Renewable Energy Systems	3
ECE 7810	Power System Modeling	3
ECE 7831	Design&Model of Electric Vehic	3
ECE 8566	RFIC Design	3
ECE 8676	Antenna Theory & Design II	3
ECE 8700	Comm Systems Engineering	3

Summer 2025

Item #	Title	Credits
ECE 7000	Renewable Energy Policy	3
ECE 8525	Sensors	3

Fall 2025

Item #	Title	Credits
ECE 7231	Applied DSP	3
ECE 7830	Intro. to Electric Drives	3
ECE 8001	Engineering Math I	3
ECE 8072	Stat Signal Processing	3
EGR 8301	Control Systems Engineering	3
ECE 8487	Advanced Machine Learning	3
ECE 8670	Microwave Thry & Tech I	3
ECE 8708	Wireless Communications	3
ECE 8760	Optical Communications	3
ECE 8815	Smart Energy Systems	3

Spring 2026

Item #	Title	Credits
ECE 7251	Analysis of Biomedical Signals	3
ECE 7800	Renewable Energy Systems	3
ECE 7810	Power System Modeling	3
ECE 7831	Design&Model of Electric Vehic	3
EGR 7850	Electrochemical Power Sources	3
ECE 8671	Micro Thry and Tech II	3
ECE 8700	Comm Systems Engineering	3
ECE 8710	Radar Systems	3
ECE 8720	5G Wireless Networks	3

Summer 2026

Item #	Title	Credits
ECE 7000	Renewable Energy Policy	3
ECE 7525	Elec Measure & Convers	3
	Total Credits	30

Engineering

Engineering (BS to PhD)

Degree Type Doctor of Philosophy

In 2003, the College of Engineering initiated a new graduate program leading to a Doctor of Philosophy (Ph.D.). The primary purpose is to provide scholars for industry and academe, emphasizing the attributes of excellence, innovation and integrity. The course of study is integral to the strategic plan of the College, congruent with the mission of the Villanova University, reflective of the future of the engineering profession, and consonant with the emerging trends in 21st century academe.

Objectives

The doctoral program is designed to prepare scholars, teachers, and leaders for academia and industry in contemporary and emerging engineering fields. Its primary component is independent, directed research leading towards a dissertation. The Ph.D. degree can be achieved with a concentration in any of the engineering programs offered in the College of Engineering. The program is designed to encourage intellectual depth within the area or discipline of study while also providing enough flexibility to allow for breadth across disciplinary lines when useful for multi-disciplinary research topics. The Villanova University Engineering Ph.D. program is one of the few programs in the country that will allow the degree to be pursued on a part-time basis by working professionals, with many of the relevant courses available through our state-of-the-art on-line Distance Education program.

Admission Requirements

Formal criteria for admission to the Ph.D. program include:

Previous Degree

Master's degree in engineering from an ABET accredited institution or an established foreign institution.

Applicants with only a bachelor's degree in engineering may also apply. If admitted, B.S. only students must complete an additional 24 credits of graduate coursework to complete the PhD program.

GPA

For students applying with either a bachelor's or master's degree in engineering, a cumulative GPA of 3.5 on a point scale of 4.0 is required in the most recent engineering degree obtained.

GRE

The College of Engineering does not require the submission of GRE scores, but we will consider your GRE scores as part of the application review if submitted.

TOEFL or IELTS

TOEFL - Score of at least 90 for international applicants is expected with mandatory ESL course.

IELTS - Score of at least 7.0 for international applicants is expected with mandatory ESL course.

The TOEFL / IELTS examination may be waived by the Associate Dean if there is sufficient proof of the candidate's ability to speak, comprehend, and write high-quality English. An example of this is if the candidate were successfully working for at least several years in an engineering position.

Conditional Admission

Applicants to the program who have deficiencies in the normal requirements may be admitted conditionally. The conditions for the acceptance and the plan and timeframe for a remedial course of action will be clearly specified. Upon completion of the course of action the student's application will be reviewed by the Ph.D. Committee and a final decision will be made on unconditional admission.

Degree Requirements

Detailed program requirements for students with MS degree

- The student must take a minimum of six courses (18 credits) including at least one graduate level mathematics course.
- The student will be required to register for 30 credits of research.
- The student will be required to take qualifying examinations. These examinations will be in two areas: mathematics and a discipline specific exam. A maximum of two attempts is permitted to pass this examination.
- In addition, he/she is required to defend a proposal of dissertation as well as a final dissertation defense.

Detailed program requirements for students with BS degree entering directly into the Engineering Doctoral Program

This path is highly selective and limited to only the most highly qualified candidates.

- The student must take a minimum of fourteen courses (42 credits) including at least one graduate level mathematics course.
- The student will be required to register for 30 credits of research.
- The student will be required to take qualifying examinations. These examinations will be in two areas: mathematics and a discipline specific exam. A maximum of two attempts is permitted to pass this examination.
- In addition, he/she is required to defend a proposal of dissertation as well as a final dissertation defense.

Detailed program requirements for part-time students

They have the same requirements as the full-time students.

Professional Development Program

Villanova's College of Engineering is unique in its newly launched professional development program for doctoral students, which reflects Villanova's commitment to high-quality teaching and close attention to the student, as well as development of the whole person as embodied by ***Veritas, Unitas, Caritas.***

The program consists of a required core course, **EGR 9240**, which will cover topics such as:

- Communication and interpersonal skills
- Diversity and inclusion
- Teamwork
- Project management
- Leadership
- Strategic planning
- Employee empowerment
- Entrepreneurially minded learning
- Ethics
- Safety and the environment
- Lifelong learning
- Unique culture of Villanova, which emphasizes service to, and care for, one's community

The required core course will be recorded on the student's transcript. However, those who satisfactorily complete this course, plus a required minimum number of "supplements" from either an academic or industry track will also receive a certificate. The pursuit of a certificate is optional. Because EGR 9240 and the Certificate courses EGR 9200, 9220, and 9260 are in-class discussion-based, a student will not be permitted to take any of these courses as an E-Learning student.

GE - PhD Courses for CAPP

BS to PhD Banner CODE: EPHB

72 (3 credit or 1.5 credits) Total Credits: 14 3 credits coursework and 30 credits of research:

* 1 credit PhD PD courses are not included in 48 credit requirement

Degree or Certificate Banner Code-DEGC Code	Department Banner Code	Field of Study Banner Code (Major)	Banner Program Code - IW (SOBCURR_PROGRAM)	Banner Dept
GPHD	EGR	EGR	GPHD	GPHD-EGR

14 Required 3 credit courses (42 credits):

Item #	Title	Credits
	CEE Courses	
	CHE Courses	
	ECE Courses	
EGEN 7116	Sustainable Innov & Entreprshp	3
	EGR Courses	
	ME Courses	
	SUSE Courses	
	PhD Other Colleges Courses	
	Required Minimum of 30 Credits Doctoral Research	
	Required for Full-Time Students (Employment Code)	
	Total Credits	72

Engineering (MS to PhD)

Degree Type Doctor of Philosophy

In 2003, the College of Engineering initiated a new graduate program leading to a Doctor of Philosophy (Ph.D.). The primary purpose is to provide scholars for industry and academe, emphasizing the attributes of excellence, innovation and integrity. The course of study is integral to the strategic plan of the College, congruent with the mission of the Villanova University, reflective of the future of the engineering profession, and consonant with the emerging trends in 21st century academe.

Objectives

The doctoral program is designed to prepare scholars, teachers, and leaders for academia and industry in contemporary and emerging engineering fields. Its primary component is independent, directed research leading towards a dissertation. The Ph.D. degree can be achieved with a concentration in any of the engineering programs offered in the College of Engineering. The program is designed to encourage intellectual depth within the area or discipline of study while also providing enough flexibility to allow for breadth across disciplinary lines when useful for multi-disciplinary research topics. The Villanova University Engineering Ph.D. program is one of the few programs in the country that will allow the degree to be pursued on a part-time basis by working professionals, with many of the relevant courses available through our state-of-the-art on-line Distance Education program.

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Previous Degree

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Conditional Admission

Applicants to the program who have deficiencies in the normal requirements may be admitted conditionally. The conditions for the acceptance and the plan and timeframe for a remedial course of action will be clearly specified. Upon completion of the course of action the student's application will be reviewed by the Ph.D. Committee and a final decision will be made on unconditional admission.

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This path is highly selective and limited to only the most highly qualified candidates.

- The student must take a minimum of fourteen courses (42 credits) including at least one graduate level mathematics course.
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- Project management
- Leadership
- Strategic planning
- Employee empowerment
- Entrepreneurially minded learning
- Ethics
- Safety and the environment
- Lifelong learning
- Unique culture of Villanova, which emphasizes service to, and care for, one's community

The required core course will be recorded on the student's transcript. However, those who satisfactorily complete this course, plus a required minimum number of "supplements" from either an academic or industry track will also receive a certificate. The pursuit of a certificate is optional. Because EGR 9240 and the Certificate courses EGR 9200, 9220, and 9260 are in-class discussion-based, a student will not be permitted to take any of these courses as an E-Learning student.

GE - PhD Courses for CAPP

MS to PhD Banner CODE: EPHM

48 (3 credit or 1.5 credits) Total Credits

* 1 credit PhD PD courses are not included in 48 credit requirement

Degree or Certificate Banner Code-DEGC Code	Department Banner Code	Field of Study Banner Code (Major)	Banner Program Code - IW (SOBCURR_PROGRAM)	Banner Dept
GPHD	EGR	EGR	GPHD	GPHD-EGR

Item #	Title	Credits
	CEE Courses	
	CHE Courses	
	ECE Courses	
EGEN 7116	Sustainable Innov & Entreprshp	3
	EGR Courses	
	ME Courses	
	SUSE Courses	
	PhD Other Colleges Courses	
	Required Minimum of 30 Credits Doctoral Research	
	Required for Full-Time Students (Employment Code)	
	Total Credits	48

Sustainable Engineering

Degree Type Master of Science

Villanova's Master of Science in Sustainable Engineering (MSSE) is a multi-disciplinary degree, ideal for those who are interested in gaining further expertise and knowledge with regard to the full environmental, social and economic aspects of sustainable engineering.

A unique degree useful for engineers and non-engineers alike, MSSE graduates can advance in areas such as corporate sustainability, project management green construction, and more.

Admission Requirements
Admission Criteria:

- The Master of Science in Sustainable Engineering may be pursued by the non-engineering degree holder, provided he/she can present evidence of proficiency in:
  - Mathematics: Calculus (equivalent to MAT 1500, 1505 and 2500; including differentiation, integration, vector calculus)
  - Basic Science: Two semesters of college Chemistry
  - Engineering Science: One semester of college Physics
- In the absence of such evidence, the applicant may be admitted provisionally, but will be required to complete undergraduate prerequisite courses that will depend on the applicant's background and intended track. These undergraduate courses will not count towards the degree. Upon completion, the candidate can then be granted regular admission status into the program.
- Please refer to the College of Engineering's Graduate Application Requirements for information which applies to all graduate engineering applicants.

Admission Criteria for International Applicants with a degree from a non-US university:

- Minimum TOEFL score of 90 or IELTS score of 7.0
- Minimum GPA of 3.25 out of 4.00 or equivalent
- Two recommendations

Degree Requirements

All students pursuing a master's degree in Sustainable Engineering are required to take the following for a total of 30 credits.

Courses Only Option:

- Three (3) core courses in Sustainable Engineering (3 credits per course, 9 credits total)
- Minimum Two (2), Maximum Four (4) elective core courses (3 credits per course, 6-12 credits total)
- Minimum Three (3) concentration courses (3 credits per course, minimum 9 credits total)
    - Or classes of your choosing with approved Plan of Study

Capstone Option:

- Three (3) core courses in Sustainable Engineering (3 credits per course, 9 credits total)
- Minimum Two (2), Maximum Three (3) elective core courses (3 credits per course, 6-9 credits total)
- Minimum Three (3) concentration courses (3 credits per course, minimum 9 credits total)
    - Or classes of your choosing with approved Plan of Study
- One (1) Capstone course, SUE 9030, (3 credits per course, 3 credits total)

Thesis Option:

- Three (3) core courses in Sustainable Engineering (3 credits per course, 9 credits total)
- Two (2) elective core courses (3 credits per course, 6 credits total)
- Three (3) concentration courses (3 credits per course, 9 credits total)
    - Or classes of your choosing with approved Plan of Study
- Two (2) thesis courses (3 credits per course, 6 credits total): SUSE 9024 Thesis I and SUSE 9025 Thesis II.
- The thesis option requires a presentation of work at a conference or at Villanova. Thesis requires research advisor and program director approval.

Core Courses

Item #	Title	Credits
SUSE 7110	Fundamentals-Sustainable Engr	3
SUSE 7111	Life Cycle/Impact Assessment	3
SUSE 7112	Econ/Social Equity Integrators	3

Core Electives

ID – International Development specialization option (requires ID focused thesis or capstone)

Item #	Title	Credits
SUSE 7113	Sustainable Materials & Design	3
SUSE 7115	Sustainable Engineering System	3
SUSE 7200	Biomimicry	3
SUSE 8111	ADV LCA & Intro to Prod Design	3
SUSE 8112	Supply Chain Sustainability	3
SUSE 8113	Sust. Buildings & Operations	3
SUSE 7120	Intro to Sus Eng for Intl Dev	3
SUSE 7121	Sus WASH & Enviro Egr for Dev	3
SUSE 7123	ICT and Energy for Development	3

TRACKS/CONCENTRATIONS

Alternative & Renewable Energy

Item #	Title	Credits
ECE 7800	Renewable Energy Systems	3
ECE 7000	Renewable Energy Policy	3
ECE 7580	Intro to Power Electronics	3
ECE 7810	Power System Modeling	3
ECE 8815	Smart Energy Systems	3
EGR 7850	Electrochemical Power Sources	3
SUSE 7123	ICT and Energy for Development	3

Sustainable Infrastructure

Item #	Title	Credits
SUSE 9015	Sustainable Infrastructure Sys	3
SUSE 8111	ADV LCA & Intro to Prod Design	3
CEE 8201	Urban Transportation Egr	3
GEV 7040	Intro to GIS	4
SUSE 8131	Climate Change & Sust Engr	3

Sustainable Materials

Item #	Title	Credits
SUSE 7113	Sustainable Materials & Design	3
SUSE 7200	Biomimicry	3
ME 7501	Reinforced Comp Materials	3
CHE 7570	Polymer Science & Engineering	3
SUSE 8111	ADV LCA & Intro to Prod Design	3

Water Resources Sustainability

Item #	Title	Credits
CEE 7111	Intro Hydraulics & Hydrology	3
CEE 7211	Water Res Planning & Mgmt	3
CEE 8501	Surface Water Hydrology	3
CEE 8503	Open Channel Hydraulics	3
CEE 8502	Watershed Modeling	3
CEE 8508	Urban Hyd & Storm Water Mgmt	3
SUSE 7121	Sus WASH & Enviro Egr for Dev	3
GEV 7040	Intro to GIS	4

Sustainable Systems

Item #	Title	Credits
SUSE 7115	Sustainable Engineering System	3
SUSE 7113	Sustainable Materials & Design	3
SUSE 7120	Intro to Sus Eng for Intl Dev	3
SUSE 7200	Biomimicry	3
SUSE 8111	ADV LCA & Intro to Prod Design	3
SUSE 8112	Supply Chain Sustainability	3
SUSE 8130	GHG Management Fundamentals	3
SUSE 9015	Sustainable Infrastructure Sys	3
ECE 7800	Renewable Energy Systems	3
GEV 7040	Intro to GIS	4

Class Schedule

Note: Tentative Sustainable Engineering Department Graduate Course Offerings. All scheduled course offerings are subject to change due to instructor availability and other factors. For course descriptions, refer to the Sustainable Engineering Department course descriptions.

Fall 2024 (and every Fall semester thereafter)

Item #	Title	Credits
SUSE 7110	Fundamentals-Sustainable Engr	3
SUSE 7112	Econ/Social Equity Integrators	3
SUSE 7113	Sustainable Materials & Design	3
SUSE 7120	Intro to Sus Eng for Intl Dev	3
SUSE 8111	ADV LCA & Intro to Prod Design	3
SUSE 8132	GHG Mitigation-Strategy&Tech	3

Spring 2025 (every Spring semester thereafter)

Item #	Title	Credits
SUSE 7111	Life Cycle/Impact Assessment	3
SUSE 7115	Sustainable Engineering System	3
SUSE 7200	Biomimicry	3
SUSE 8112	Supply Chain Sustainability	3
SUSE 8130	GHG Management Fundamentals	3

Spring 2025 (and every Spring odd year thereafter – i.e. Spring 2027)

Item #	Title	Credits
SUSE 7123	ICT and Energy for Development	3

Summer 2025 (and every Summer semester thereafter)

Item #	Title	Credits
SUSE 9015	Sustainable Infrastructure Sys	3
SUSE 8131	Climate Change & Sust Engr	3

Spring 2026 (and every Spring even year thereafter – i.e. Spring 2028)

Item #	Title	Credits
SUSE 7121	Sus WASH & Enviro Egr for Dev	3
	Total Credits	30

Interdisciplinary

Nonlinear Dynamics and Control

Degree Type Certificate

The College of Engineering offers a certificate program in Nonlinear Dynamics and Control, administered jointly by the Chemical Engineering, Electrical and Computer Engineering, and Mechanical

Engineering Departments. It includes a concentrated study of modern principles with both breadth and depth of coverage being emphasized. The research program at the Center for Nonlinear Dynamics & Control (CENDAC) serves to complement the course.

The certificate program is open to all individuals who possess a bachelor's degree in either Engineering or some related field. Applications for admission are assessed on the basis of undergraduate record and related work experience.

Requirements for the Certificate

The Nonlinear Dynamics and Control Certificate is awarded upon satisfactory completion of four courses:

Required:

Item #	Title	Credits
EGR 8301	Control Systems Engineering	3

The Nonlinear Dynamics and Control Certificate is awarded upon satisfactory completion of four courses:

Item #	Title	Credits
	Nonlinear Dynamics and Control Courses (Up to three courses may be chosen):	3
	Graduate Level Mathematics Course (One may be chosen):	3
	Graduate Level Control or Optimization Course (One may be chosen):	3
	Total Credits	12

Sustainable Engineering

Degree Type Certificate

This certificate will consist of 5 courses. A minimum of 2 courses must be selected from the core courses. The remaining 3 courses must be selected from one of the tracks for the MS in Sustainable Engineering degree. No transfer credit is allowed. A minimum cumulative GPA of 3.0 must be obtained from the courses used towards the certificate. Courses used for the certificate may not be used towards the MS in Sustainable Engineering degree nor may they have been used to meet requirements for a BS or BA degree without the permission of the Program Director; however, they may be used for other MS or PhD degrees depending on those specific degree program requirements.

Doctoral Program Certificate Options

In addition to **EGR 9240** (the required core course not under the Doctoral Program section on page 30), to earn the Academic Scholar certificate, two required supplements are needed.

1. A min. B grade in EGR 9200 (Teaching in Higher Education; a 1 credit course)
2. A min. B grade in EGR 9220 (Teaching in Higher Education Practicum)

In addition to **EGR 9240** (the required core course), to earn the Industry Scholar certificate, one required and one optional supplement is needed.

Required: A min. B grade in **EGR 9260** (PhD PD Industry Track Seminar; a 1 credit course)

Optional:

1. An industrial internship
2. Coordinating and chairing a session at an industrial conference
3. A min. B grade in a course from the following list:

Item #	Title	Credits
CHE 7005	Global Pharmaceutical Business	3
CHE 7511	Sustainable Industrial Chem	3
EGR 7011	Business Basics for Engineers	3
EGR 7012	Management for Engineers	3
EGR 7013	Business Model Feasibility	3
EGR 7014	Innovation & Opportunity	3
EGR 7112	Econ/Social Equity Integrators	3
EGR 8112	Supply Chain Sustainability	3
	Total Credits	15

Biomedical Engineering

Degree Type Master of Science

New for Fall 2024, the Master of Science in Biomedical Engineering program at Villanova University aims to prepare the next generation of innovators who will contribute to advancements in health care, medical devices and biotechnology.

The program integrates Mechanical Engineering (ME), Chemical and Biological Engineering (CBE), and Electrical and Computer Engineering (ECE) courses. Our interdisciplinary method will not only expand students' knowledge but also provide them with the abilities needed to address intricate engineering problems in the real world.

Admission Requirements
Admission Criteria for Applicants with a BS from an accredited US university:

- Minimum GPA of 3.0 out of 4.0
- Two letters of recommendation

Admission Criteria for International Applicants with a BS degree from a non-US university:

- Minimum GPA of 3.25 out of 4.0 or equivalent.
- Minimum TOEFL score of 90 or IELTS score of 7.0
- Two letters of recommendation

The applicant's undergraduate record and letters of recommendation must indicate the ability to undertake graduate studies.

Applicants should ideally hold an accredited bachelor's degree in biomedical, chemical, mechanical, electrical, or computer engineering or their equivalent.

Applicants with BS degrees in other engineering disciplines or in non-engineering disciplines such as biology, chemistry, physics or computer science may also be considered on an individual basis. However, they may need to take additional undergraduate courses before admission. Specific courses will be determined in consultation with the Graduate Chair and must be completed before official acceptance.

Degree Requirements

The Master of Science in Biomedical Engineering (MSBME) program requires:

- A minimum of 30 earned semester credits (10 courses and one zero-credit seminar course) of graduate work. Course requirements are divided into four categories: a math requirement, two fundamental courses, area courses and breadth courses.
- Students may elect to choose the thesis or non-thesis option. Before applying for the thesis option, students must complete ECE 9030 in preparation.
- Full-time undergraduate students in the ECE, ME and CBE departments with a minimum GPA of 3.00 have the option of applying for admission into the five-year combined BS/MS program with a BS degree in their department and an MS degree in Biomedical Engineering.
- Graduate students electing the non-thesis option may substitute three credits of independent study for an approved elective course.

Table 1 provides details on the course and credit distribution for the two options. Course requirements are broadly divided into four categories: a math requirement, two fundamentals' courses, area courses, and breadth courses. Course options in these areas are fleshed out in greater detail in table two.

Thesis Option	Non-thesis option with independent study	Non-thesis option without independent study
3 area courses	**3** area courses	**3** area courses
1 math course	**1** math course	**1** math course
2 fundamentals courses	**2** fundamentals courses	**2** fundamentals courses
2 breadth courses	**3** breadth courses	**4** breadth courses
2 research courses (thesis)	**1** research/independent study course	**1** seminar course (no credit)
1 seminar course (no credit)	**1** seminar course (no credit)	
Total: 10 courses + seminar	**Total: 10 courses + seminar**	**Total: 10 courses + seminar**

Area courses: Based on the discipline/research area of interest.
Math course: Discipline-specific basic engineering math course.
Fundamentals courses: To cover fundamental topics and concepts in BME.
Breadth courses: To complement core area courses within and across concentrations and colleges.
Research courses: Independent study (IS) and/or Thesis research (for thesis option).
Seminar course (zero-credit): Inter-departmental seminars from VU faculty and graduate students, other guest speakers and experts covering current research topics in the BME field.

Course options in each required Course type, BME Concentration:

Area Course (3)

Cell & Tissue Engineering

Item #	Title	Credits
CHE 8586	Biomaterials & Drug Delivery	3
CHE 8591	Gene & Cell Therapy	3
CHE 8663	Systems Biology	3
CHE 8592	Protein Engineering	3
ME 7700	Tran Phen in Bio Systems	3

Biomechanics & Biomaterials

Item #	Title	Credits
ME 7550	Biomechanics of Hard Tissues	3
ME 7560	Biomechanics of Soft Tissues	3
ME 7700	Tran Phen in Bio Systems	3
ME 7270	Polymer Engineering	3
ME 8103	Advanced Fluid Mechanics	3
CHE 8586	Biomaterials & Drug Delivery	3

Biomedical Signals, Sensors & Imaging

Item #	Title	Credits
ECE 7251	Analysis of Biomedical Signals	3
ECE 8525	Sensors	3
ECE 8487	Advanced Machine Learning	3
	ECE 8XXX - 3D Cell Cultures (Spring 24)	
	ECE 7XXX - Medical Imaging (Fall 25)	
ECE 9000		

Math Course (1)

All Concentrations

Item #	Title	Credits
ME 7000	Advanced Engineering Analysis	3
ECE 8001	Engineering Math I	3

Fundamentals Courses (2)

All Concentrations

Item #	Title	Credits
	EGR 7XXX - Medical Sciences for Eng. (new-S24)	
	EGR 7XXX-Foundations of Biomed. Eng. (new F24)	

Breadth Courses

(min:2, max:4)
2:Thesis option
3: Non-thesis w IS
4: Non-thesis w/o IS

All Concentrations

All other Concentration/Dept. Area Courses

Item #	Title	Credits
EGR 8301	Control Systems Engineering	3
EGR 7014	Innovation & Opportunity	3
EGR 8311	Machine Learning for Engineers	3
ME 7040	Intro to Fin Element Analysis	3
ME 7030	Num Methods for Eng Simulation	3
ECE 8473	UNIX and C Programming	3
CSC 8515	Machine Learning	3
PHI 8420	Healthcare Ethics	3
BIO 7960	Adv Topics: C/M/D Biology	3
NUR 9014		
ME 7240	Constructal Theory and Design	3
BIO 7805	Biostatistics & Exper. Design	4
STAT 7404	Statistical Methods	3
NUR 9505	Statistical Analysis I	3
PSY 8100	Stat & Experimental Des	3

Research Courses

(min: 0, max: 2)
0: Non-thesis w/o IS
1: Non-thesis w IS
2: Thesis option

All Concentrations & Depts

Item #	Title	Credits
	Independent Study (IS) and/or Thesis Research (for thesis option)	

Seminar Course (1)

(zero-credit)

All Concentrations & Depts

Item #	Title	Credits
	4-6 invited speakers a semester for both fall and spring, current research topics in BME	

Explore MSBME concentrations:

The MSBME offers three concentration areas, as well as an option for a custom degree plan:

- Biomechanics and Biomaterials
- Cell and Tissue Engineering
- Biomedical Signals, Sensors and Imaging

Nonlinear Dynamics and Control Certificate

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Requirements for the Certificate

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Required

Item #	Title	Credits
EGR 8301	Control Systems Engineering	3

Electives (Choose three):

Nonlinear Dynamics and Control Courses (Up to three courses may be chosen):

Item #	Title	Credits
EGR 8302	Digital Control	3
EGR 8304	Nonlinear Control	3
EGR 8305	System Identification	3
EGR 8306	Nonlinear Dynamics	3
EGR 8308	Feedforward Control	3
EGR 8309	Adv Topics in Dynam & Control	3

Graduate Level Mathematics Course (One may be chosen):

Item #	Title	Credits
CHE 8579	Adv Process Modeling/Analysis	3
ECE 8001	Engineering Math I	3
ECE 8007	Matrix Theory	3
ME 7000	Advanced Engineering Analysis	3

Graduate Level Control or Optimization Course (One may be chosen):

Item #	Title	Credits
ME 8204	Robotics:Analysis & Control	3

Special Related Topics Course (One may be chosen): ChE, ECE, or ME Departments

Sustainable Engineering Certificate

This certificate will consist of 5 courses. A minimum of 2 courses must be selected from the core courses. The remaining 3 courses must be selected from one of the tracks for the MS in Sustainable Engineering degree. No transfer credit is allowed. A minimum cumulative GPA of 3.0 must be obtained from the courses used towards the certificate. Courses used for the certificate may not be used towards the MS in Sustainable Engineering degree nor may they have been used to meet requirements for a BS or BA degree without the permission of the Program Director; however, they may be used for other MS or PhD degrees depending on those specific degree program requirements.

Doctoral Program Certificate Options

In addition to **EGR 9240** (the required core course not under the Doctoral Program section on page 30), to earn the Academic Scholar certificate, two required supplements are needed.

1. A min. B grade in EGR 9200 (Teaching in Higher Education; a 1 credit course)
2. A min. B grade in EGR 9220 (Teaching in Higher Education Practicum)

In addition to **EGR 9240** (the required core course), to earn the Industry Scholar certificate, one required and one optional supplement is needed.

Required: A min. B grade in **EGR 9260** (PhD PD Industry Track Seminar; a 1 credit course)

Optional:

1. An industrial internship
2. Coordinating and chairing a session at an industrial conference
3. A min. B grade in a course from the following list:

Item #	Title	Credits
CHE 7005	Global Pharmaceutical Business	3
CHE 7511	Sustainable Industrial Chem	3
EGR 7011	Business Basics for Engineers	3
EGR 7012	Management for Engineers	3
EGR 7013	Business Model Feasibility	3
EGR 7014	Innovation & Opportunity	3
EGR 7112	Econ/Social Equity Integrators	3
EGR 8112	Supply Chain Sustainability	3

Class Schedule

Notes: All scheduled course offerings are subject to change due to instructor availability and other factors.

Sample 2-Year Course Plans for different concentrations

Key: Check marks represent the semester the select/representative course can be taken. Dashes represent other semesters the same course is offered. Sample course plans incorporate the semesters the courses have been offered in prior years.

Cell & Tissue Engineering

			Year 1 (2024-25)			Year 2 (2024-25)		
Description	**Course**	**Type**	**Fall**	**Spr**	**Sum**	**Fall**	**Spr**	**Sum**
Med. Sci. for Eng	EGR 7XXX	Fundamental		√			-	
Found. Bio. Eng.	EGR 7XXX	Fundamental				√		
Adv. Eng. Analysis	ME 7000	Math	√			-		
Gene & Cell Therapy	CHE 8591	Area				√		
Protein Eng	CHE 8592	Area					√	
Biomat. & Drug Deliv.	CHE 8586	Area		√				
Adv. Fluid Mech.	ME 8103	Breadth		√				
Biostat. & Exp Des	BIO 7805	Breadth		-			√	
Research		Research				√		√
Seminar (non-credit)		Seminar	√	-		-	-	

Biomechanics & Biomaterials

			Year 1 (2024-25)			Year 2 (2024-25)		
Description	**Course**	**Type**	**Fall**	**Spr**	**Sum**	**Fall**	**Spr**	**Sum**
Med. Sci. for Eng	EGR 7XXX	Fundamental		√			-	
Found. Biomed. Eng.	EGR 7XXX	Fundamental				√		
Adv. Eng. Analysis	ME 7000	Math	√			-		
Biomec. Hard Tissue	ME 7550	Area		√				
Adv. Fluid Mech.	ME 8103	Area		√				
Trans Phen in Bio Sys	ME 7700	Area					√	
Analysis of Bio. Sig.	ECE 7251	Breadth				√		
Control Sys. Eng.	EGR 8301	Breadth	-			√		
Research		Research					√	√
Seminar (non-credit)		Seminar	√	-		-	-	

Biomedical Signals, Sensors & Imaging

			Year 1 (2024-25)			Year 2 (2024-25)		
Description	**Course**	**Type**	**Fall**	**Spr**	**Sum**	**Fall**	**Spr**	**Sum**
Med. Sci. for Eng	EGR 7XXX	Fundamental		√			-	
Found. Biomed. Eng.	EGR 7XXX	Fundamental				√		
Eng. Math	ECE 8001	Math	√			-		
Analysis of Bio. Sig.	ECE 7251	Area		√			-	
Wearable Sensing	ECE 9000	Area	√			-		

			Year 1 (2024-25)			Year 2 (2024-25)		
Adv. Machine Learn.	ECE 8487	Area				√		
Stat & Exp. Des	PSY 8100	Breadth		-			√	
Control Sys. Eng.	EGR 8301	Breadth	-			√		
Research		Research					√	√
Seminar (non-credit)		Seminar	√	-		-	-	

Total Credits 30

Mechanical Engineering

Electro-Mechanical Systems

Degree Type Certificate

A certificate in Electro-Mechanical Systems will be awarded upon successful completion of a total of five courses. One of these courses is required and the remaining four are electives to be chosen from the elective course list below. At least one elective must be an ME graduate class. Similarly, at least one elective must be an ECE graduate class.

Required Course

The Electro-Mechanical Systems Certificate consists of (1) required courses and four (4) elective courses from the lists below.

Item #	Title	Credits
EGR 8301	Control Systems Engineering	3

Elective Courses: (Choose four from the following list)

Item #	Title	Credits
ECE 7525	Elec Measure & Convers	3
ECE 8007	Matrix Theory	3
ECE 8342	Digital Control Systems	3
ECE 8224	Reliability Theory & Practice	3
ECE 8580	Power Electronics	3
ECE 9900	Special Topics in E E	3
ME 7000	Advanced Engineering Analysis	3
ME 7060	Multiphysics Sys Modelng & Sim	3
ME 7205	Advanced Dynamics	3
ME 7206	Dynamics of Rotating Machinery	3
ME 8204	Robotics:Analysis & Control	3
ME 8207	Vibration Analysis	3
ME 8010	Special Topics in ME	3

[1]ECE 9900, ME 8010: These courses will be accepted only if the selected topics are appropriate for the certificate, as determined by the graduate committee chair.

[2]While ME 7000 may be used toward these certificate programs, it cannot be counted toward two different ME certificates.

Total Credits 15

Mechanics/Materials

Degree Type Certificate

A certificate in Mechanics and Materials will be awarded upon successful completion of four courses selected from the list below. These four courses must include at least one course selected from each of the two disciplines: a) Mechanics and b) Materials. ME 7000 can be taken as one of the courses that count towards the certificate, but it will not count towards the required one course from either discipline.

These four courses must include at least one course selected from each of the two disciplines:

a. Mechanics and
b. Materials.

ME 7000 can be taken as one of the courses that count towards the certificate but it will not count towards the required one course from either discipline.

Materials Courses:

Item #	Title	Credits
ME 7250	Nano/Microscale Mater Behavior	3
ME 7260	Mechanic Behavior of Materials	3
ME 7270	Polymer Engineering	3
ME 7280	Additive Manufacturing	3
ME 7501	Reinforced Comp Materials	3
ME 7502	Fiber Composite Structures	3
ME 7550	Biomechanics of Hard Tissues	3
ME 7560	Biomechanics of Soft Tissues	3
ME 8010	Special Topics in ME	3

Mechanics Courses:

Item #	Title	Credits
ME 7002	Continuum Mechanics	3
ME 7040	Intro to Fin Element Analysis	3
ME 7260	Mechanic Behavior of Materials	3
ME 7501	Reinforced Comp Materials	3
ME 7502	Fiber Composite Structures	3
ME 7550	Biomechanics of Hard Tissues	3
ME 7560	Biomechanics of Soft Tissues	3
ME 7070	Aero Vehicle Struc Analy & Des	3
ME 8145	Thermoelasticity & Thermal Str	3
ME 8200	Elasticity & Stress Analysis	3
ME 8350	Applied Fracture Mechanics	3
	Total Credits	12

Modeling and Simulation

Degree Type Certificate

A certificate in Modeling and Simulation requires the successful completion of five courses. Two tracks are available: Dynamics & Systems (Track A) and Mechanics & Manufacturing (Track B). The following two courses are required for both tracks:

Two courses are required for both tracks. Students can then choose any three courses from the track options.

Two Required Courses

Item #	Title	Credits
ME 7030	Num Methods for Eng Simulation	3
ME 7040	Intro to Fin Element Analysis	3

Track A: Dynamics & Systems: (Choose any three)

Item #	Title	Credits
ME 7060	Multiphysics Sys Modelng & Sim	3
ME 7402	Comp-Aided Prod Planning	3
ME 7206	Dynamics of Rotating Machinery	3
ME 7800	Systems Engineering	3
ME 8010	Special Topics in ME	3
ME 8204	Robotics:Analysis & Control	3
ME 8207	Vibration Analysis	3
EGR 8305	System Identification	3
EGR 8310	Optimization for Engineers	3
EGR 8311	Machine Learning for Engineers	3
MAT 8435	Mathematical Modeling	3
MAT 8430	Operations Research	

Track B: Mechanics and Manufacturing: (Choose any three)

Item #	Title	Credits
ME 7002	Continuum Mechanics	3
ME 7402	Comp-Aided Prod Planning	3
ME 7501	Reinforced Comp Materials	3
ME 7550	Biomechanics of Hard Tissues	3
ME 7560	Biomechanics of Soft Tissues	3
ME 8010	Special Topics in ME	3
EGR 8310	Optimization for Engineers	3
EGR 8311	Machine Learning for Engineers	3
	Total Credits	15

Thermofluid Systems

Degree Type Certificate

A certificate in Thermofluid Systems will be awarded upon successful completion of any four of the following courses:

Item #	Title	Credits
ME 7000	Advanced Engineering Analysis	3
ME 7002	Continuum Mechanics	3
ME 7030	Num Methods for Eng Simulation	3
ME 7038	Intro-Computational Fluid Mech	3
ME 7103	Advanced Engrg Thermodynamics	3
ME 7130	HVAC Analysis and Design	3
ME 7600	Thermal Mgmnt of Electronics	3
ME 7700	Tran Phen in Bio Systems	3
ME 8103	Advanced Fluid Mechanics	3
ME 8120	Convection Heat Transfer	3
ME 8150	Multiphase Flow & Heat Trans.	3
ME 8250	Microscale Heat Transfer	3
EGR 7800	Solar Therm. Energy Conversion	3

[1]These courses will be accepted only if the selected topics are appropriate for the certificate, as determined by the graduate committee chair.

[2]While ME 7000 may be used toward these certificate programs, it cannot be counted toward two different ME certificates.

	Total Credits	12

Mechanical Engineering

Degree Type Master of Science

Villanova's MSME program is modern, relevant and comprehensive. In addition to the broad areas of thermalfluid sciences, mechanics and materials, and dynamics and controls, courses are also offered in emerging fields like bioengineering and nanotechnology.

Admission Requirements
Admission Criteria:

- The applicant's undergraduate record and letters of recommendation must indicate the ability to undertake graduate studies.
- A minimum GPA of 3.0 out of 4.0.
- Applicants should ideally hold an accredited bachelor's degree in mechanical engineering or its equivalent. Applicants not possessing an undergraduate degree in mechanical engineering may be required to take additional undergraduate courses prior to admission. Specific courses will be determined in consultation with the Graduate Chair and must be completed prior to official acceptance.
- Scores on the General Test of the Graduate Record Examinations (GRE) are recommended for graduates of institutions not accredited by ABET. A Quantitative GRE score of at least 155 is recommended.
- International applicants must give evidence of adequate proficiency in the English language by achieving a score of at least 80 (internet-based test) on the Test of English as a Foreign Language (TOEFL). IELTS scores may be substituted for the TOEFL.

Disclaimer: Please note that meeting the above criteria does not automatically guarantee admission to graduate mechanical engineering programs.

Degree Requirements

The Master of Science in Mechanical Engineering (MSME) program requires:

- 30 semester credit hours (10 courses), including at least 24 course credits and 6 credits of research for the thesis option.
- A math requirement, which can be met by either taking ME 7000 (Advanced Engineering Analysis) or ME 7030 (Numerical Methods for Engineering Simulation).
- A combined maximum of six credits may be either (1) taken outside the department with the approval of the graduate committee chair; or (2) may be transferred from other institutions with the approval of the graduate committee chair. A grade of "B" or better is necessary for transfer of credits.
- Only graduate and research assistants are required to write a thesis. It is optional for other students.
- Students must maintain at least a "B" average.

	Thesis Option	Non-Thesis Option
Required Math Elective	3 credits	3 credits
Elective courses	21 credits	27 credits
Thesis	6 credits	Not applicable
Total credit hours	30 credits	30 credits

30 Credits Thesis

Item #	Title	Credits
	Required Math Elective	3
	Elective Courses (21 credits)	21
	Thesis Credits	6

30 Credits non-Thesis

Item #	Title	Credits
	Required Math Elective	3
	Elective Courses (27 credits)	27

Class Schedule

Note: Tentative Mechanical Engineering Department Graduate Course Offerings. All scheduled course offerings are subject to change due to instructor availability and other factors. For course descriptions, refer to the Mechanical Engineering Department course descriptions.

Fall 2024 (and every fall even year thereafter i.e. Fall 2026)

Item #	Title	Credits
ME 7000	Advanced Engineering Analysis	3
ME 7140	Thermal Energy Storage	3
ME 7207	Simulation of Multibody System	3
ME 7270	Polymer Engineering	3
ME 7280	Additive Manufacturing	3
ME 7502	Fiber Composite Structures	3
ME 8010	Special Topics in ME	3
ME 8207	Vibration Analysis	3
EGR 8301	Control Systems Engineering	3

Spring 2025 (and every spring odd year thereafter i.e. Spring 2027)

Item #	Title	Credits
ME 7030	Num Methods for Eng Simulation	3
ME 7040	Intro to Fin Element Analysis	3
ME 7070	Aero Vehicle Struc Analy & Des	3
ME 7700	Tran Phen in Bio Systems	3
ME 8010	Special Topics in ME	3
ME 8020	Financial Engineering II	3
ME 8038	Adv Computational FluidDynamic	3
ME 8120	Convection Heat Transfer	3
EGR 8306	Nonlinear Dynamics	3
EGR 8310	Optimization for Engineers	3

Fall 2025 (and every fall odd year thereafter i.e. Fall 2027)

Item #	Title	Credits
ME 7000	Advanced Engineering Analysis	3
ME 7103	Advanced Engrg Thermodynamics	3
ME 7260	Mechanic Behavior of Materials	3
ME 7560	Biomechanics of Soft Tissues	3
ME 7800	Systems Engineering	3
ME 8010	Special Topics in ME	3
ME 8100	Fund of Cond & Rad Heat Trans	3
ME 8150	Multiphase Flow & Heat Trans.	3
ME 8200	Elasticity & Stress Analysis	3
EGR 8301	Control Systems Engineering	3
EGR 8311	Machine Learning for Engineers	3

Spring 2026 (and every spring even year thereafter i.e. Spring 2028)

Item #	Title	Credits
ME 7060	Multiphysics Sys Modelng & Sim	3
ME 7240	Constructal Theory and Design	3
ME 7501	Reinforced Comp Materials	3
ME 7550	Biomechanics of Hard Tissues	3
ME 8010	Special Topics in ME	3
ME 8103	Advanced Fluid Mechanics	3
ME 8204	Robotics:Analysis & Control	3
EGR 8311	Machine Learning for Engineers	3
	Total Credits	30

PD CERT

Academic Scholar

Degree Type Certificate

Degree or Certificate Banner Code-DEGC Code	Department Banner Code	Field of Study Banner Code (Major)	Banner Program Code - IW (SOBCURR_PROGRAM)	Banner Dept
EACASC	EGR	CERT	EACASC	EGR

* 1 credit PhD PD courses are not included in 48 credit requriement

Required:

Item #	Title	Credits
EGR 9240	PhD Prof Devel Seminar	1
EGR 9200	Teaching Engr'ng in Higher Edu	1
EGR 9220	Teaching Engr'ng Practicum	1

Required for full-time students

Item #	Title	Credits
EGR 9200	Teaching Engr'ng in Higher Edu	1
EGR 9220	Teaching Engr'ng Practicum	1
EGR 9240	PhD Prof Devel Seminar	1
EGR 9260	PhD PD Industry Track Seminar	1
	Total Credits	7

Industry Scholar

Degree Type Certificate

Degree or Certificate Banner Code-DEGC Code	Department Banner Code	Field of Study Banner Code (Major)	Banner Program Code - IW (SOBCURR_PROGRAM)	Banner Dept
EINDSC	EGR	CERT	EINDSC	EGR

* 1 credit PhD PD courses are not included in 48 credit requriement

Required:

Item #	Title	Credits
EGR 9240	PhD Prof Devel Seminar	1
EGR 9260	PhD PD Industry Track Seminar	1

One of the following courses:

(these courses are already on the main sheet of PhD acceptable courses)

Item #	Title	Credits
CHE 7005	Global Pharmaceutical Business	3
CHE 7511	Sustainable Industrial Chem	3
EGR 7011	Business Basics for Engineers	3
EGR 7012	Management for Engineers	3
EGR 7013	Business Model Feasibility	3
EGR 7014	Innovation & Opportunity	3
EGR 7112	Econ/Social Equity Integrators	3
EGR 8112	Supply Chain Sustainability	3
EGR 9150	Prof Development/CPT	

Required for full-time students

Item #	Title	Credits
EGR 9200	Teaching Engr'ng in Higher Edu	1
EGR 9220	Teaching Engr'ng Practicum	1
EGR 9240	PhD Prof Devel Seminar	1
EGR 9260	PhD PD Industry Track Seminar	1
	Total Credits	9

Courses

BIO

BIO 7805: Biostatistics & Exper. Design

Conceptualization of experimental design, hypothesis testing, execution of statistical analyses, expression of statistical results, and effective graphical presentation of quantitative data. Includes a written exercise emulating peer-reviewed journal publication.
Credits 4.0

BIO 7960: Adv Topics: C/M/D Biology

More intensive coverage of current topics in cellular, molecular, and developmental biology. Topics will be announced on a semester by semester basis. Specific information available in the departmental office.
Credits 3.0

CEE

CEE 7010: Lake, Stream & Wetland Ecology

Basic ecological principles. Food chains, trophic structure, biogeochemical cycles, and ecosystem dynamics. Water quality problems including nutrient enrichment, toxicity, and nonpoint source pollution. Watershed evaluation and management concepts, and TMDL applications.
Credits 3.0

Last Offered
Summer 2023, Summer 2021, Summer 2019, Summer 2018

CEE 7011: Hazardous Waste Manage

Regulatory considerations, land disposal problems, groundwater contamination, health and safety, site clean-up, and treatment methods; RCRA, TSCA and other regulatory compliance aspects; health and safety requirements; land disposal options and design considerations; groundwater clean-up methodologies; treatment technologies and conceptual designs; remedial investigations and feasibility studies of hazardous waste sites; and case histories.
Credits 3.0

Last Offered
Spring 2024, Spring 2022, Spring 2020, Spring 2018

CEE 7018: Water Quality Modeling

Addresses water quality modeling and its applications through case studies; application of QUAL2K and WASP models which are widely used in environmental engineering.
Credits 3.0

Last Offered
Summer 2020

CEE 7111: Intro Hydraulics & Hydrology

Extension of fluid mechanics. Basic principles, mathematical concepts and solution methods, experimental data, and engineering judgment. Pressurized-flow systems, free surface flow, stream channel behavior and control, hydrologic data interpretation, hydrograph analysis and synthesis, Prerequisite: Undergraduate fluid mechanics (or its equivalent), proficiency in computers.
Credits 3.0

Last Offered
Summer 2024, Summer 2023, Summer 2022, Summer 2021

CEE 7211: Water Res Planning & Mgmt

Theoretical and practical approaches to water resource planning, analysis, design, economics and management: ground water and surface water supply, wetlands protection, water quality, water demand projections and reservoir operation. Prerequisite: CEE 7111 or its undergraduate equivalent.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022, Fall 2021

CEE 7300: Design of Railway&Airport Infr

Design principles for infrastructure found in railway and airport facilities. Railway facilities built for passenger and freight service, track geometry and alignment design, drainage, and intermodal operations. Design of airport infrastructure and field systems, including runway, taxiway, and aprons. Prerequisite: Engineering Statiscs.
Credits 3.0

Last Offered
Spring 2018, Spring 2016, Summer 2012

CEE 7303: Pavement Design & Dynamic Resp

Response of pavements subjected to both static and dynamic loads; design of rigid and flexible pavements; inspection and rehabilitation of pavement structures; design airport and port facility pavements. Prerequisite: CEE 8439 (with permission of instructor in the absence of this prerequisite).
Credits 3.0

Last Offered
Fall 2018, Summer 2016, Spring 2014, Spring 2012

CEE 7402: Forensic Engineering

Forensic evaluation and analysis of structural failures. Case studies of bridge, building, dam and construction catastrophes. Investigation of various failure mechanisms.
Credits 3.0

Last Offered
Summer 2023, Summer 2021, Summer 2019, Summer 2017

CEE 7404: Masonry Design

Design and behavior of masonry structural components with emphasis on design codes; ASD and SD design approaches; material properties; unreinforced and reinforced masonry; bearing walls, flexural walls, shear walls, beams, columns, pilasters; construction specifications; movements in masonry structures.
Credits 3.0

Last Offered
Summer 2022, Summer 2020, Summer 2018, Summer 2016

CEE 7405: Wood Design

Design and behavior of wood structural components with emphasis on design codes; ASD and LRFD design approaches; material properties; beams, tension members, compression members, combined loading; connections; structural panels; shear walls and diaphragms; engineered wood products.
Credits 3.0

Last Offered
Fall 2024, Spring 2024, Spring 2023, Spring 2022

CEE 7412: Modern Structural Analysis

Development of structural stiffness matrices for trusses, beams and frames; nonlinear analysis of frames; numerical solutions of plates; finite elements for plane stress and strain; solid elements; utilization of commercial computer software.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022, Fall 2021

CEE 7502: Fundamentals Env Eng Processes

Fundamental physical, chemical and biological principles and processes for water and wastewater treatment; chemical kinetics, reactor engineering, mass transfer and sedimentation. Prerequisites: CEE 3107 Mechanics III: Fluid Behavior or its equivalent and two semesters of undergraduate chemistry.
Credits 3.0

Last Offered
Summer 2024, Summer 2023, Summer 2022, Summer 2021

CEE 7511: Microbiology Enviro EGR

Introduction to microbiology and biochemistry; bacteria, fungi, algae, protozoa, and viruses; structure, function, synthesis, and degradation of lipids, proteins, nucleic acids, and carbohydrates; nutritional requirements for microbial growth; waterborne disease; indicator organisms; microbial ecology; and microbiology of the nitrifiers, methanogens, and sulfur bacteria. Prerequisite: One year of undergraduate chemistry.
Credits 3.0

Last Offered
Fall 2024, Fall 2022, Fall 2020, Fall 2018

CEE 7513: Fate-Trans. Contaminants

Physical, chemical, and biological processes governing the fate and transport of hazardous contaminants in natural and engineered systems: sorption, volatilization, biodegradation, hydrolysis, advection, and diffusion.
Credits 3.0

Last Offered
Spring 2023, Spring 2021, Spring 2019, Spring 2017

CEE 7514: Sustainable Manufacturing

Preventive environmental management approaches versus end of pipe treatment; cleaner production development and implementation; cleaner production tools such as environmental impact assessment, life cycle analysis, environmental technology assessment, chemical assessment, environmental compliance audit, waste audit, energy audit, risk audit, and good house keeping. Sustainable development and environmental ethics as integral components of pollution prevention approach.
Credits 3.0

Last Offered
Fall 2015, Fall 2013, Spring 2008, Spring 2006

CEE 7520: Environmental Compliance Sys.

This course will cover environmental, health and safety, and hazardous materials handling laws and the resulting regulations with which industry must comply. Tools and techniques for designing and conducting defensible compliance audits and due diligence programs will be provided. Prerequisite: Undergraduate Chemistry.
Credits 3.0

Last Offered
Fall 2024, Fall 2020, Fall 2018, Fall 2014

CEE 7701: Aquatic Chem Environ EGR

Chemical kinetics; equilibrium analyses of water solutions incorporating solubility, ionization, acid-base, redox, and complexation considerations; use of graphical procedures to analyze complex mixtures; and, applications including pC-pH diagrams of the carbonate system, chemistry of iron and aluminum coagulants, alkalinity and acidity of natural waters, and metal complexation by organic ligands. Prerequisite: One year of undergraduate chemistry.
Credits 3.0

Last Offered
Fall 2023, Fall 2021, Fall 2019, Fall 2017

CEE 7829: Princ Sust Devel for Ind & Soc

Investigation of problems with the present system of development and production, and evaluation of required steps to achieve sustainability will be conducted. Sustainability approaches such as green engineering and design, renewable energy systems, sustainable transportation, green building and low impact development techniques will be explored.
Credits 3.0

Last Offered
Spring 2024, Spring 2022, Spring 2020, Spring 2018

CEE 8102: Foundation Engineering

Deep foundations, bulkheads, soil-structure interaction and advanced topics in soil behavior and stability. Prerequisite: Undergraduate Soil Mechanics
Credits 3.0

Last Offered
Summer 2024, Summer 2022, Summer 2020, Summer 2018

CEE 8103: Geosynthetics

Design of civil engineering structures, such as retaining walls and landfills, using geosynthetics for reinforcement, drainage, filtration, separation, and containment. Prerequisite: Undergraduate Soil Mechanics
Credits 3.0

Last Offered
Fall 2023, Fall 2021, Fall 2019, Fall 2017

CEE 8104: Geoenvironmental Engineering

Application of geotechnical engineering to the disposal of wastes, remediation of polluted environments, and sustainable construction.
Credits 3.0

Last Offered
Fall 2024, Fall 2022, Fall 2020, Fall 2018

CEE 8105: Advanced Geotechnical Engr.

Practical design of below-grade support and special foundation work in urban and difficult sites.
Credits 3.0

Last Offered
Summer 2021, Summer 2019, Summer 2017, Spring 2015

CEE 8106: Embankments and Slopes

Design of slopes and embankments, including slope stability, seepage, and design applications.
Credits 3.0

Last Offered
Spring 2024, Spring 2022, Spring 2020, Spring 2018

CEE 8107: Geoenvironmental Processes

Processes governing flow and transport in soil and rock, measurement of transport properties, and design and evaluation of Geoenvironmental application. First Offering: Spring 2017 (will be offered odd spring).
Credits 3.0

CEE 8108: Geotechnical Earthquake Eng

Plate tectonics and earthquakes faulting; strong ground motions; development of design ground motions; dynamic soil properties; evaluation and mitigation of soil liquefaction; seismic earth pressures; seismic slope stability; soil-structure interaction.
Credits 3.0

Last Offered
Spring 2023, Spring 2021, Spring 2019

CEE 8111: Analysis & Design of Dams

Dam history; site investigation and loading; embankment, gravity, and arch dam design; hydraulic control structures and spillway design considerations; construction of dams; failure modes and risk analysis; dam performance monitoring.
Credits 3.0

Last Offered
Summer 2023, Summer 2021, Summer 2019

CEE 8201: Urban Transportation Egr

Transportation problems as related to urban areas; transit and other mode characteristics and planning; transportation network analyses through generation; distribution and assignment.
Credits 3.0

Last Offered
Spring 2023, Fall 2019, Fall 2017, Fall 2015

CEE 8202: Transportation Plan & OP

Transportation planning and operation based on recently developed capacity analyses of transportation facilities and networks.
Credits 3.0

Last Offered
Spring 2020, Spring 2018, Spring 2016, Spring 2014

CEE 8203: Traffic Engineering

Road user and vehicle characteristics, stream flow characteristics, freeway operations, speed studies, traffic control and management, and its technologies and applications.
Credits 3.0

Last Offered
Spring 2022, Spring 2019, Spring 2017, Spring 2015

CEE 8205: Highway Safety

Overview of highway safety including factors that contribute to highway crashes, techniques to improve the safety of the roads, geometric design elements, and accident reconstruction techniques.
Credits 3.0

Last Offered
Fall 2018, Fall 2016, Fall 2014, Spring 2013

CEE 8206: Construction Project Mngmnt

Project organization, scheduling techniques; changes, delays and claims management; systematic design review (standards and specifications); cost control technique of value engineering; quality control/quality assurance and warranty techniques; innovative contracting: design-build variations and public-private partnerships; case studies and computer-based scheduling. Prerequisite: BSCE or consent of instructor.
Credits 3.0

Last Offered
Summer 2024, Summer 2022, Summer 2020, Summer 2018

CEE 8207: Des of Sustainable Transp Sys

Environmental consequences and transportation systems; context sensitive solutions; national measures of sustainability in transportation; infrastructure asset management. Prerequisite: CEE 2211 or equivalent introduction undergraduate course in transportation engineering (or consent of instructor).
Credits 3.0

Last Offered
Summer 2023, Summer 2021, Summer 2019, Summer 2017

CEE 8208: Sustainable Pavement Systems

Pavement preservation, accelerated construction techniques, intelligent compaction, recycled and waste products in asphalt/concrete mixtures, energy translation from pavements, and the use of innovative materials in highway construction. Prerequisites: CEE 8439 (with permission of instructor in the absence of this prerequisite).
Credits 3.0

Last Offered
Fall 2019, Fall 2017, Spring 2015

CEE 8209: Transportation Economics

In this course, we will dive into the economic forces driving transportation systems and explore pricing strategies, policy impacts, and sustainability challenges, gaining insights to navigate the complex world of transportation in a rapidly changing global landscape
Credits 3.0

Last Offered
Spring 2024

CEE 8303: Urban Planning

Structure and history of urbanization in the United States. The current problems of cities and suburbs, and how they have evolved, will be the subjects of student projects. Will Philadelphia survive? Proposed solutions involving community activism, urban renewal, fiscal reform and new towns will be examined and evaluated. The design professional's role in the planning team is defined.
Credits 3.0

Last Offered
Spring 2021, Spring 2019, Spring 2017, Fall 2014

CEE 8305: Civil Engr Data Analytics

Emphasizes the practical implementation of data analytics using Python and R. Uses real world civil engineering datasets in transportation and building energy consumption to cover data visualization, data cleaning, feature extraction, and statistical modeling, and introduces machine learning and clustering.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022

CEE 8402: Repair & Retrofit of Civil Str

Repair and retrofit of structures and structural members; repair of concrete, steel wood, and masonry structures due to deterioration and strength deficiencies; introduction to the use of fiber reinforced polymer (FRP) materials for repair.
Credits 3.0

Last Offered
Summer 2020

CEE 8420: Composites for Infrastructure

Constituent materials and manufacturing processes for composites; limit-state design philosophy; anisotropic laminate theory for composite plates, beams, and shells; applications in reinforced concrete, structural and geotechnical engineering.
Credits 3.0

Last Offered
Spring 2019, Spring 2017, Spring 2015, Spring 2011

CEE 8434: Structural Dynamics

Dynamic response of damped and undamped structural systems. Free vibration; forced vibration for harmonic and general loading. Single and multiple degree-of-freedom systems. Modal superposition method; matrix structural analysis approach to dynamic problems.
Credits 3.0

Last Offered
Spring 2024, Spring 2023, Spring 2022, Spring 2021

CEE 8435: Reinforced Concrete

Design and behavior of beams, columns and two-way slabs; shear and torsion; shear walls; strut and tie models.
Credits 3.0

Last Offered
Spring 2024, Spring 2023, Spring 2022, Spring 2021

CEE 8436: Prestressed Concrete

Prestressed and partial prestressed concrete; flexure, shear, serviceability; composite beams; continuity, primary and secondary moments; load balancing. Prerequisite: Permission of instructor.
Credits 3.0

Last Offered
Fall 2022, Fall 2020, Spring 2018, Spring 2016

CEE 8437: Structural Steel

Behavior of steel beams, columns, and frames; elastic and plastic analysis; composite design; load and resistance factor.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022, Fall 2021

CEE 8438: Structural Connections

Behavior of structural connections involving high strength bolts and welds; semi-rigid connections; LRFD and ASD.
Credits 3.0

Last Offered
Summer 2024, Summer 2022, Summer 2020, Summer 2018

CEE 8439: CE Materials

Fundamentals of material science with applications to structural and transportation materials. Durability, fracture, fatigue, corrosion, non-destructive tests and properties of masonry, concrete, asphalt, and wood will be taught with discussion of laboratory testing, specifications, and quality assurance (QA) data analysis. Prerequisites: Undergraduate mechanics of materials course.
Credits 3.0

Last Offered
Summer 2024, Summer 2021, Fall 2019, Fall 2017

CEE 8440: Adv. Cementitious Materials

Advanced concepts related to concrete and other cement-based materials; multi-scale characterization (from macro to nano) of structure and behavior of cement-based systems, role of concrete in sustainable design, concrete durability; modifications through admixtures, special concretes, alternative binders.
Credits 3.0

Last Offered
Fall 2018, Fall 2016, Fall 2014, Fall 2012

CEE 8442: Advanced Structural Mechanics

Continuously supported rods and beams; stability analysis and the buckling of columns and frames; applied fracture mechanics.
Credits 3.0

Last Offered
Spring 2020, Spring 2018, Spring 2016, Spring 2014

CEE 8443: Advanced Structural Analysis

Advanced structural theory and analysis. Beams, frames, and beam-columns; multistory structures; non-prismatic sections; curved members; thin plates and shells.
Credits 3.0

CEE 8449: Applied Finite Elements CEE

Discrete and Continuous System Models; Linear and Nonlinear Analyses in Solid and Structural Mechanics; Beams, Frames, and Plates; Time-Dependent Problems; Commercial Software Applications.
Credits 3.0

Last Offered
Spring 2023

CEE 8460: Tall Building Design

Behavior of high-rise building structures and design of their foundations, lateral systems and gravity systems. Wind and seismic loading, wind tunnel considerations. Introduction to finite element modeling software (ETABS).
Credits 3.0

Last Offered
Summer 2023, Summer 2021, Summer 2019
Prerequisite Courses
CEE 8434

CEE 8461: Design of Bridge Superstructur

Addresses AASHTO LRFD Bridge specifications as it applies to superstructure design of steel, concrete, and timber bridges; introduction to inspection, repair, and load rating for superstructure elements.
Credits 3.0

Last Offered
Fall 2024, Fall 2022, Fall 2020

CEE 8462: Design of Bridge Substructures

Addresses AASHTO LRFD Bridge specifications as it applies to substructure design of steel, concrete, and timber bridges; mechanically stabilized abutments, open abutments, column and solid wall piers; structural design of spread footing and pile supported foundations; introduction to inspection, repair, and load rating for substructure elements.
Credits 3.0

Last Offered
Fall 2023, Fall 2021

CEE 8467

CEE 8501: Surface Water Hydrology

Basic factors for hydraulic design and storage requirements; frequency and duration studies; runoff hydrographs; design storms and flood determinations; hydrologic and hydraulic routing; peak flow formulas; reservoir regulation; effects of land use and treatment; mathematical models including HEC-HMS. Prerequisite: CEE 7111 (or its equivalent).
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022, Fall 2021

CEE 8502: Watershed Modeling

Continuation of CEE 8501 (Surface Water Hydrology). Use and application of hydrologic quality and quantity watershed models. Topics include GIS, Scale, accuracy and numerical and statistical methods.
Credits 3.0

Last Offered
Spring 2023, Spring 2021, Spring 2019, Spring 2017
CEE 8501 :C

CEE 8503: Open Channel Hydraulics

Free surface flow in canals, chutes, bends, gradual and abrupt transitions, stilling basins and energy dissipators, constrictions, bridge waterways, spillways; channel delivery; water-surface profiles in artificial and natural channels; unsteady flow, wave propagation and surges; design criteria and case histories; mathematical models including HEC-RAS. Prerequisite: CEE 7111 (or its equivalent).
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022, Fall 2021

CEE 8504: Geoenvironmental Engineering

CEE 8507: Environmental Fluids

The principal concepts of fluid mechanics applied to environmental systems, such as rivers, lakes, estuaries and the atmosphere.
Credits 3.0

Last Offered
Spring 2020, Spring 2018, Spring 2016, Spring 2014
Prerequisite Courses
CEE 8503

CEE 8508: Urban Hyd & Storm Water Mgmt

Current engineering approaches to reduce adverse environmental effects of urbanization. Water quality and runoff quantity. Storm water management and best management practices. Prerequisite: CEE 7111 (or its equivalent).
Credits 3.0

Last Offered
Spring 2024, Spring 2022, Spring 2020, Spring 2018

CEE 8510: Groundwater Hydrology

The occurrence and movement of water in the subsurface portion of the hydrologic cycle. Darcy's Law and flow equations for surficial aquifers, confined aquaifers, and the unsaturated zone. Pump tests for the determination of conductivity and storage. Seawater intrusion, sustainable yields, land subsidence, streamflow depletions and groundwater contamination.
Credits 3.0

CEE 8511: River Dynamics

Changes in channels and floodplains through time based on the governing theories of fluvial geomorphology, river hydraulics, and sediment entrainment, transport, and deposition. Analysis of various aspects of channels numberically and using different software platforms.
Credits 3.0

Last Offered
Spring 2023, Spring 2021, Spring 2019
Prerequisite Courses
CEE 8503

CEE 8512: River Mechanics & Engineering

Includes fluvial geomorphology, streambank stabilization, dam removal, in-stream habitat enhancement, sediment transport analysis, scour at bridges and culverts, design of scour countermeasures, design of naturally and structurally stable channel systems and design of energy dissipaters.
Credits 3.0

Last Offered
Summer 2024, Summer 2022, Summer 2020, Summer 2018
Prerequisite Courses
CEE 8503

CEE 8551: Special Topics in Water Resour

Explores contemporary topics within water resources engineering with a unique theme identified for each course offering. The chosen topic theme changes with each offering to emphasize pressing issues within the industry. Technical details of topic theme are placed in the context of case studies.
Credits 3.0

Last Offered
Summer 2024, Summer 2023, Summer 2022, Summer 2021

CEE 8601: Special Topics Engr

Individual supervised study. Topic and scope must be submitted in writing to topic advisor for approval prior to registration. Requirements must be completed by the end of its semester of registration.
Credits 3.0

Last Offered
Spring 2024, Summer 2023, Spring 2022, Fall 2020

CEE 8602: CEE Special Topics - Grad

Individual supervised study. Topic and scope must be submitted in writing to topic advisor for approval prior to registration. Requirements must be completed by the end of its semester of registration.
Credits 1.0

Last Offered
Summer 2020, Fall 2019, Summer 2019, Summer 2018

CEE 8603: CEE Graduate Practicum

Provides work experience for a graduate student who has been offered an opportunity to work in the civil engineering field in industry. Required for curricular practical training.
Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

CEE 8707: Phys/Chem Treatment Proc

Analysis and design of physical/chemical processes for treatment of contaminated air and water. Topics include adsorption, stripping, scrubbing, chemical oxidation, disinfection, coagulation and flocculation, filtration, water softening and ion exchange. Prerequisite: CEE 7502 and CEE 7701 (or their equivalents).
Credits 3.0

Last Offered
Spring 2024, Spring 2022, Spring 2020, Spring 2018

CEE 8708: Bio Treatment Processes

Biological treatment processes including aerobic, anoxic, and anaerobic processes; suspended growth and fixed film microbial communities; biological nutrient removal processes. Prerequisite: CEE 7511 or its equivalent.
Credits 3.0

Last Offered
Spring 2023, Spring 2021, Spring 2019, Spring 2017
Prerequisite Courses
CEE 7511

CEE 9030: CE Resrch/Investigation

Topic and scope must be submitted in writing to topic advisor for approval prior to registration. The results of the course findings may provide the basis for the thesis option. The final written document at the completion of the semester will be submitted for approval as a thesis proposal or a term paper for grade. The thesis proposal must be agreed upon by both the student and the topic advisor and approved by the chairperson. Requirements must be completed by the end of its semester of registration and prior to CEE 9031 registration. Prerequisite: Consent of chairperson.
Credits 3.0

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

CEE 9031: Thesis I

Credits 3.0

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

CEE 9032: Thesis II

Credits 3.0

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

CEE 9080: Thesis Continuation

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

CHE

CHE 7002: Quantitative Safety Tech

Quantitative safety analysis, applied to chemical processing: fire and explosion hazards, electrostatic hazards, source and dispersion models, relief requirements, quantitative risk assessment, accident case studies.
Credits 3.0

Last Offered
Summer 2024, Summer 2021, Summer 2018, Summer 2010

CHE 7005: Global Pharmaceutical Business

Covers new technologies that drive new bioproducts and bioprocesses in the pharmaceutical industry. Includes regulatory harmonization, global access to medicines, elements of global supply chain management and risk based quality and marketing approaches that differ across products and countries.
Credits 3.0

Last Offered
Summer 2024, Summer 2021, Spring 2018, Spring 2016

CHE 7511: Sustainable Industrial Chem

Project based learning experience; three key areas; past discoveries that shaped the industry and its footprint; today's technology and the sustainability issues it faces; future directions based on green chemistry, and bioproduced feedstocks. Industry expert guest lecturers. Industrial site visits.
Credits 3.0

CHE 7561: Air Pollution Control

The causes, effects and control of air pollution, emphasizing fundamental mechanisms: chemistry of pollutant generation, meterorology and atmospheric dispersion, sampling and analysis, data interpretation, theory underlying control systems.
Credits 3.0

Last Offered
Summer 2023, Summer 2020, Summer 2017, Summer 2014

CHE 7570: Polymer Science & Engineering

Principles of polymer science: nature and structure of organic high-polymers, polymerization reactions, physical and chemical properties, mechanical testing, viscoelasticity, flow and processing applications.
Credits 3.0

Last Offered
Summer 2022, Summer 2019, Summer 2016, Spring 2015

CHE 7580: CHE Economics

Techniques for economic evaluation of projects and processes; time value of money, return on investment, cost estimation of processes, alternative project evaluations, economic balances and optimization.
Credits 3.0

Last Offered
Fall 2024, Fall 2022, Fall 2020, Fall 2018

CHE 7587: Biopharm Facility Design

Design of facilities for the pharmaceutical and bioprocess industries. Equipment selection, economics, team work, and presentations.
Credits 3.0

Last Offered
Spring 2023, Summer 2020, Fall 2017, Fall 2015

CHE 7591: Industrial Waste Management

Analysis of industrial waste disposal: sources of industrial wastes, disposal using physical, chemical and biological processes, overview of governmental regulations to prevent pollution.
Credits 3.0

CHE 7595: Special Topics in CHE

Topics of current interest in chemical engineering, (to be announced in advance of offering).
Credits 3.0

Last Offered
Spring 2024, Summer 2023, Spring 2021, Summer 2020

CHE 7600: Energy Storage Systems

Provide introduction to existing and emerging energy storage methods and their criticality to utilizing renewable sources for the production of electricity and potable water in different geographies and economic regions of the world. Course Requirement: Basic background at undergraduate level in physical sciences.
Credits 3.0

CHE 7651: Survey of Biomass Conversion

Survey of biomass resources and utilization for the production of bio-based products, including energy, chemicals, and transportation fuels. Life cycle analysis and technoeconomic analysis for addressing the sustainability/environmental aspects and the economic feasibility of biomass production and utilization. Senior Engineers or Grad Science with Instructor's Permission.
Credits 3.0

Last Offered
Fall 2018, Fall 2016

CHE 7693: Core Biochemistry

CHE 8531: Zeolite

Properties and classes of nanomaterials, solid state physics semiconductors, characterization techniques, catalysis for energy transformations, fuel cells, batteries, solar cells, biofuels, hydrocarbons and hydrogen.
Credits 3.0

Last Offered
Fall 2023, Fall 2021, Fall 2019, Spring 2015

CHE 8550: Chem Eng Reactors

Overview of homogeneous and heterogeneous chemical kinetics, thermodynamic effects on rate laws and reactor behavior, reactor design for simple and complex reactions, mass and energy balances over reactors, transient and non-ideal reactor behavior.
Credits 3.0

Last Offered
Fall 2022, Fall 2020, Fall 2018, Fall 2016

CHE 8551: Chem Kinetics and Catalysis

In-depth look at homogeneous and especially heterogeneous kinetics and catalysis, collision and transition state theories, analysis of reaction sequences, rate laws from experimental data, and heat and mass transport effects on catalyst and reactor performance.
Credits 3.0

Last Offered
Spring 2024, Spring 2022, Spring 2020, Spring 2018

CHE 8558: Process Design I

The design of chemical processes: synthesizing a process, organizing material and energy balances for solution, iterative convergence techniques, cost estimation and economic analysis, process improvemment, energy conservation, interaction of process units, process control, designing for safety.
Credits 3.0

Last Offered
Fall 2023, Fall 2021, Fall 2019, Fall 2017

CHE 8563: Transport Phenomena

Unified study of momentum, heat, and mass transport with emphasis on theory and applications of fluid dynamics and mass transfer. Underlying physical laws, mathematical representation of transport laws, transport analogies.
Credits 3.0

Last Offered
Fall 2024, Spring 2023, Spring 2021, Spring 2019

CHE 8564: Fluid Dynamics

Theory and applications of fluid dynamics: continuity equation, equation of motion, ideal fluid flow, laminar viscous flow, boundary layer flow, turbulent flow.
Credits 3.0

CHE 8565: Heat Transfer

Mechanisms, theory and applications of heat transfer by conduction, convection and radiation.
Credits 3.0

Last Offered
Fall 2024, Fall 2022, Fall 2020, Fall 2018

CHE 8571: Separation Processes I

Distillation processes, from the equilibrium-stage point of view: separation factors, phase equilibrium relationships, analysis of steady state processes such as flash vaporization, binary, multicomponent and azeotropic distillations, batch distillation.
Credits 3.0

Last Offered
Spring 2023, Spring 2021, Spring 2019, Spring 2017

CHE 8572: Separation Processes II

Separation processes other than distillation, from the equilibrium-stage point of view: gas absorption, extraction, leaching, adsorption, filtration and sedimentation, ultracentrifugation, evaporation.
Credits 3.0

Last Offered
Spring 2024, Spring 2022, Spring 2020, Spring 2018

CHE 8575: Thermodynamics

Advanced concepts of thermodynamics: equations of state, physical and chemical equilibrium, estimation of thermodynamic properties.
Credits 3.0

Last Offered
Fall 2023, Fall 2021, Fall 2019, Fall 2017

CHE 8579: Adv Process Modeling/Analysis

Mathematical techniques for analyzing chemical engineering problems: development of mathematical models of physical and chemical problems, time dependent and position dependent models, solution of model equations by numerical techniques, computer applications
Credits 3.0

CHE 8586: Biomaterials & Drug Delivery

Materials for use in medicine and in/on the body, material bulk and surface properties, biological responses to materials, applications, manufacturing processes, cost, sterilization, packaging and regulatory issues. Drug delivery mechanisms, issues, and modeling.
Credits 3.0

Last Offered
Spring 2024, Spring 2022, Spring 2020, Spring 2018

CHE 8588: Biochemical Engineering I

Basics of biochemistry, microbiology, cell biology and molecular biology, as applied to bioproduct formation; enzyme kinetics, immobilized enzymes, diffusion limitations, immobilized enzyme reactors; cell growth kinetics, batch and continuous fermentor operation, bioreactor operation; sterilization, oxygen transfer and scaleup.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022, Fall 2021

CHE 8589: Biochemical Engineering II

Fedbatch, continuous, immobilized-cell and other advanced bioreactors; bioreactor monitoring and control; design and operation of downstream processes, including cell disruption, filtration, extraction, chromatography; facility design; validation and regulatory issues.
Credits 3.0

Last Offered
Spring 2024, Spring 2023, Spring 2022, Spring 2021

CHE 8591: Gene & Cell Therapy

An introduction to molecular genetics, genomic editing techniques, and a survey of recent successful gene and cell therapies in the clinic.
Credits 3.0

Last Offered
Fall 2024, Fall 2022, Fall 2020, Summer 2008

CHE 8592: Protein Engineering

Advanced concepts of protein structure, stability, and activity applied to the modification and improvement of proteins and enzymes; along with computer simulations of protein structure and activity.
Credits 3.0

Last Offered
Spring 2023, Spring 2021, Spring 2019, Spring 2017

CHE 8651: Biomass Conversion

Technical approaches for converting biomass to energy, fuels, and useful chemicals. New advances, current challenges, industrial applications, important research areas discussed.
Credits 3.0

CHE 8663: Systems Biology

MATLAB-based modeling and analysis approaches for drug target identification: introduction to systems biology, biological reaction networks, model construction and parameter estimation, sensitivity analysis, metabolic modeling, pathway network analysis, pharmacokinetic modeling, biological data analysis, and systems biology approaches for personalized medicine.
Credits 3.0

Last Offered
Fall 2023, Fall 2021, Fall 2019, Fall 2017

CHE 8951

CHE 9020: CHE Independent Study

This course may be taken twice by graduate students.
Credits 3.0

Last Offered
Fall 2024, Spring 2024, Fall 2023, Fall 2022

CHE 9024: CHE Thesis I

Credits 3.0

Last Offered
Fall 2024, Spring 2024, Fall 2023, Summer 2023

CHE 9025: CHE Thesis II

Credits 3.0

Last Offered
Fall 2024, Spring 2024, Fall 2023, Spring 2023

CHE 9080: Thesis Continuation

Last Offered
Fall 2024, Spring 2024, Fall 2023, Spring 2023

CHE 9085: Independent Study Continuation

Last Offered
Summer 2019, Summer 2018, Spring 2018, Fall 2017

CHM

CHM 7693: Core Biochemistry

Protein structure; protein function and structure-function relationships in proteins; regulatory mechanisms in proteins, including ligand effectors, covalent modification, and proteolysis; structural and functional genomics and proteomics.
Credits 3.0

CSC

CSC 8210: Hlthcare Safety Secur Law&Eth

US and relevant international health and data security and privacy laws/regulations, HIPAA and HITECH compliance for EHR software and medical devices, federal and state patient privacy and health data access rights, electronic transmission of health data, health insurance, FDA rules and regulations, unauthorized access, vulnerabilities, unsecured wireless access, inadequate encryption, authentication failures, and other access control vulnerabilities, security risk assessment, privacy and security gaps in health information exchanges, federal and state privacy breach notification laws and related civil and criminal penalities, and successful security compliance audit and management strategies.
Credits 3.0

CSC 8301: Design and Ana of Algs

Fundamental strategies for algorithm design; mathematical and empirical techniques for analysis of nonrecursive and recursive algorithms, with applications such as sorting, searching, string processing and graphs; NP-complete problems and approximation algorithms.
Credits 3.0

CSC 8310: Programming Languages

Organization, characteristics, constructs, and design principles of programming languages; syntax, semantics, and pragmatics; language implememtation issues; different programming paradigms such as imperative, functional, object-oriented, and logic programming.
Credits 3.0

CSC 8453

Credits 3.0

CSC 8490: Database Systems

Modern database systems, including relational and NoSQL systems. Emphasize practical knowledge while covering the essential theory design; query lanquages; security; transactions. Focus on both theory and practice.
Credits 3.0

CSC 8510: Theory of Computability

Automata theory: deterministic and non-deterministic finite automata, pushdown automata, regular languages, context-free grammars, pumping lemma. Computability and recursion theory: Turing machines and their variations, decidability and recursive enumerability, mapping reducibility and Turing reducibility, undecidability of the halting problem, logical theories and Godel's incompleteness theorem. Complexity theory: time complexity, space complexity, major open problems on computational complexity. Corequisite: CSC 8301 or degree program in mathematics.
Credits 3.0

CSC 8515: Machine Learning

Study of algorithms and systems that can learn without being explicitly programmed. Topics include: clustering, classification, prediction, supervised learning, unsupervised learning, decision trees, support vector machines, random forests, regression, dimensionality reduction, neural networks, deep learning, and probabilistic graphical models.
Credits 3.0

CSC 8515: Machine Learning

Credits 3.0

CSC 8540: Software Engineering

An introduction to software engineering covering development life cycle models, requirements analysis and specification design concepts and methods, testing, maintenance, CASE tools and management concerns. Additional topics may include reuse metrics, experimentation, reengineering, development environments, and standards. The student may be required to write a research paper and/or give an in-class presentation.
Credits 3.0

CSC 8566: Internet of Things

The advancement of embedded processes and sensor networks that have made the IOT feasible. Topics include: Introduction, Domains of application, IOT VS M2M, IOT Management, Protocols, Design Methodologies, Hands on Design using Raspberry Pi and Python, Reviewing servicers and clouds, and data analytics.
Credits 3.0

CSC 9010: Special Topics

Advanced elective study of topics of current interest and importance in the computer field. This may be retaken for a different topic.
Credits 3.0

ECE

ECE 7000: Renewable Energy Policy

An introduction to renewable energy policy from inception to current state of the industry. Deals with the evolution of policy from monopolistic to competitive marketplace. Study will include the various factors affecting this process.
Credits 3.0

Last Offered
Summer 2024, Summer 2023, Summer 2022, Summer 2021

ECE 7231: Applied DSP

The course introduces advanced topics in digital signal processing with an emphasis on applications. Topics include sampling, aliasing, data quantization, discrete time signals and systems, z-transform, discrete Fourier transform, Fast Fourier Transform, design of frequency selective digital filters, optimum filtering, all with real world applications to communications, radar, biomedical engineering and imaging fields.
Credits 3.0

Last Offered
Fall 2024, Spring 2023, Fall 2021
ECE 3225 or ECE 3245

ECE 7251: Analysis of Biomedical Signals

Application of signal processing methods to analysis of biomedical signals. Introduction to human physiological signals, including cardiovascular, neurological, hemodynamic and muscular. Consideration of signal processing functions, including biomedical signal acquisition, frequency selective and optimal filtering, modeling and spectrum estimation, stationary and nonstationary signal processing. Pre-requisites: ECE 3225/3245 or ECE 5251 or ECE 7231 or equivalent.
Credits 3.0

Last Offered
Fall 2022, Spring 2014, Spring 2013, Spring 2011
ECE 3225 or ECE 3245 or ECE 5251 or ECE 7231

ECE 7321

ECE 7428: Computer Comm Networks

Brief Review of ISO/OSI, TCP/IP reference models; TCP details: state machine, timers, optimizations, performance implications, congestion control, socket programming; queuing disciplines, QoS; IEEE 802.11, Bluetooth; Voice Over IP; Layer 7 switching: peer-peer and content distribution networks. Prerequisite: ECE 4470, or equivalent.
Credits 3.0

Last Offered
Summer 2024, Fall 2023, Summer 2022, Summer 2021

ECE 7500: Fund Solid State Electronics

Solid state electronics concepts including semiconductor device physics, microelectronic fabrication, and SPICE modeling. Topics include quantum well structures, semiconductor physics, pn junctions, bipolar and field effect transistors, photolithography, oxidation, diffusion, and computer simulation of semiconductor devices.
Credits 3.0

Last Offered
Summer 2019, Summer 2017, Summer 2016, Summer 2015

ECE 7505: Elec Properties of Matrl

Includes electrical conduction; optical, magnetic & superconductivity. Also includes energy bands in crystals, electron wave functions, electrical conduction in crystalline & non-crystalline materials, optical transitions in semiconductors, classical & quantum theory of magnetism. Open to graduate students & qualified undergraduates.
Credits 3.0

ECE 7525: Elec Measure & Convers

Practical methods for the conversion and measurement of physical quantities by the use of transducers and electronic circuits are discussed. The underlying technology of the typical electronic measurement system is studied. The role of analog interfaces, modifiers, A/D conversion, busses and digital interfaces in designing instrumentation is discussed.
Credits 3.0

Last Offered
Summer 2024, Summer 2022, Summer 2020, Fall 2011

ECE 7550: Linear Integrated Electronics

Integrated Circuit Model, application of integrated circuits to the design of amplifiers, active filters, oscillators, modulators, regulators and analog systems.
Credits 3.0

ECE 7580: Intro to Power Electronics

Idealized power switching diodes and transistors; DC-DC converters; AC-DC rectifiers; DC-AC inverters; Magnetic circuits and elements (including inductors and transformers); soft-switching of power devices. Practical design of switch-mode DC power supplies, DC and AC motor drives.
Credits 3.0

Last Offered
Fall 2024, Fall 2022, Fall 2020, Fall 2018

ECE 7590: Microelectromechanical Sys

Principles, applications, and engineering of micro- electromechanical systems. Various MEMS designs and fabrication technologies are studied that are currently employed in a wide range of devices for actuation, sensing, micro-fluid manipulations, and RF and optical applications. Projects using MEMS device layout and simulation tools. Laboratory exercises with simple MEMS actuating devices.
Credits 3.0

ECE 7710: Real-Time Dig Sig Proc

Real-time computation of digital signal processing, adaptive filtering, spectrum estimation; implementation on a real-time digital signal processing chip; chip architecture, assembly language, and arithmetic; consideration of real-time processing such as aliasing, data quantization, computational limitations, signal level limiting, scaling, and I/O handling.
Credits 3.0

ECE 7711: Hardware DSP

Hardware implementation of real-time DSP. Parallel processing and architecture size/speed tradeoffs; Field Programmable Gate Arrays (FPGAs) and the use of the VHDL design language; development tools and libraries; FPGA implementation of filters and filter banks multirate processors, digital communication system components, implementation of advanced signal processing functions
Credits 3.0

ECE 7750: Communication Electronics

Building blocks of radio communication systems; modulators, mixers, narrow & broadband small signal amplifiers, oscillators & power amplifiers. Interstage matching networks in detail, practical design techniques. Present day communication systems used as examples.
Credits 3.0

ECE 7800: Renewable Energy Systems

The design of renewable energy systems. Topics include: Solar Thermal Energy, Photovoltaics, Bioenergy, Hydroelectricity, Tidal Power, Wind Power and Geothermal Energy.
Credits 3.0

Last Offered
Spring 2024, Spring 2023, Spring 2022, Spring 2021

ECE 7805: Electric Machinery

Principles of operation, performance calculations, and industrial considerations of transformers and induction, synchronous, and dc machines.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2021, Fall 2019

ECE 7810: Power System Modeling

Static behavior of the electric power system. The topics include balanced, three-phase systems, steady-state operation of transmission lines, transformer modeling, per-unit normalization, power flow analysis, symmetrical components, and balanced faulty analyses.
Credits 3.0

Last Offered
Spring 2021, Spring 2020, Spring 2019, Spring 2018

ECE 7830: Intro. to Electric Drives

Introduction to space vectors, scalar speed and torque control of induction motors, space vector representation of ac motors, dynamic dq modeling of ac motors, introduction to vector control of ac drives. Pre-req. ECE 7805 or permission of instructor.
Credits 3.0

Last Offered
Fall 2021, Fall 2017, Fall 2015, Spring 2013

ECE 7831: Design&Model of Electric Vehic

Graduate standing or consent of instructor.
Credits 3.0

Last Offered
Spring 2024, Spring 2022

ECE 8001: Engineering Math I

Applied mathematics course tailored to the needs of EE graduate students. Topics: i) Complex variable theory, ii) Sturm-Liouville problem, eigen-function expansion and special functions, iii) Matrix theory, eigen value and diagonalization, iv) Fourier analysis, multi-dimensional Fourier series and transforms, and v) Partial differential equations. Various examples from engineering and physics will be incorporated as appropriate.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022, Fall 2021

ECE 8007: Matrix Theory

Linear transformations and linear optimization as applied to vector spaces. Topics include solution of linear algebraic equations, linear transforms and their matrices, system decomposition (diagonalization), nondiagonalization operators and Jordan form, inner products, orthogonal projection, and pseudoinverse.
Credits 3.0

Last Offered
Spring 2020, Fall 2017, Fall 2016, Fall 2015

ECE 8072: Stat Signal Processing

Discrete and continuous random variables, conditional and joint distributions, random vector and stochastic processes, correlation and spectra of stationary processes under linear transformations, smoothing and prediction in mean square estimation. Prerequisite: Background in statistics and probability.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2021, Fall 2020

ECE 8224: Reliability Theory & Practice

Concepts and techniques of reliability evaluation at both the component and systems levels. The material will be useful to engineers in any discipline who are involved in system design or system performance/safety evaluation. Topics: reliability function, hazard rates, MTTF; component reliability, reliability network modeling; decomposition, cut set/tie set, event space, and fault-free approaches to reliability evaluation; systems with repair, Markov process models, availability, frequency and duration concepts, MTBF; approximations to systems reliability; introduction to software reliability. Prerequisites: Background in probability theory or permission of instructor.
Credits 3.0

ECE 8234: Image Processing

Fundamentals of digital image processing covering both analytical and practical foundations of working with 2-D images. Topics: digital image acquisition and definitions, image transforms, enhancement, restoration, and segmentation; electronic imaging and color; image encoding, compression, and graphic file formats; morphological processing. Computer projects implement classroom techniques and modern software tools are discussed.
Credits 3.0

ECE 8247: Multimedia Systems

Issues, algorithms and standards for the representation storage, and transmission of multimedia signals, including: low bit rate coding (e.g. JPEG, JEPEG2000) for still images, and MPEG-1, 2, 4 and 7 for digital video compression; audio compression via MP3 and H.261 video conferencing standard; multimedia content protection through digital watermarking, authentication by data hiding, encryption, content-based search and retrieval, multimedia communications over DSL and other broadband networks. Commercial and consumer multimedia products and systems.
Credits 3.0

ECE 8320: Control Systems Engineering

Analysis and design of controllers for dynamic systems in both frequency domain and time domain. Topics extend over both classical and state space approaches; Bode, Nyquist, and Root locus designs; extensive usage of MATLAB and practical applications. Prerequisite: Undergraduate Background in System & Control
Credits 3.0

ECE 8340: Real-time Control & Robotics

Basics needed by engineers in the design of automation and motion control. Topics: actuators, sensors, robot fundamentals, path control, and the Forth language together with its application to real-time motion control. Laboratory work is part of the course and leads to a complete robot-based job project.
Credits 3.0

ECE 8342: Digital Control Systems

Digital controllers for discrete-time systems. Topics include: Z transform, recursive equations; observers and Kalman filtering, pole placement, regulators and trackers. Special emphasis on usage of MATLAB for practical design applications. Prerequisites Undergraduate background in systems and control.
Credits 3.0

ECE 8405: Computer Organ & Design

Computer components, subsystems, and their interaction. Instruction sets, central processing units, microprogramming, intersystem communications, interrupts, DMA, memory hierarchy, and operating system demands on hardware. Prerequisite: Undergraduate background in digital systems (equivalent to ECE 2042).
Credits 3.0

Last Offered
Spring 2023, Spring 2022, Spring 2021, Spring 2020

ECE 8408: Mob Computing & Wireless Net

Topics include: concepts in nomadic computing and mobility; challenges in design and deployment of wireless and ad hoc networks; MAC issues, routing protocols and mobility management for ad hoc networks and networks of the future. Prerequisites: ECE 4470 or equivalent.
Credits 3.0

Last Offered
Summer 2023, Spring 2022, Spring 2020, Spring 2018

ECE 8410: Trusted Computing

Hardware security topics including embedded systems security hardware Trojans, security in implantable medical devices, security in RFID/NFC, protection from side channel attacks, tamper resistance and crypto processor design, trusted FPGA design/JTAG, hardware-based cryptanalysis.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2021, Fall 2020

ECE 8410: Trusted Computing

Credits 3.0

ECE 8415: Cyber-Physical Systems

Introduction to modeling, designing, and analyzing cyber-physical systems (CPS), which tightly integrate computation, control, and communication. Topics: continuous and discrete dynamics, modeling of physical processes, state machines, sensors and actuators, models of computation, CPS architectures and software design, networked and distributed embedded systems, analysis and verification, security and privacy.
Credits 3.0

ECE 8420: High-Performance Computing

Introduction to software and hardware of modern high-performance computing platforms, including multi-core and many-core processors. Topics include: models of parallel computing and machine organizations, parallelization strategies and algorithms, task scheduling, parallel software design, GPU computing, interconnection networks, cache coherence, performance analysis, power-efficient design techiques.
Credits 3.0

ECE 8425: Microproc & Microcomp

Advanced study of hardware and software concepts necessary for the design of 32-bit micropressor-based systems. Topics: (for a widely-used 32-bit microprocessor) addressing modes, instruction set, input/output, and interrupts with examples taken from the areas of computer engineering, signal processing and communication. The course includes a student analysis/design project and laboratory work involving a 32-bit processor. Prerequisite: Undergraduate background in microprocessors (equivalent to ECE 3490).
Credits 3.0

ECE 8440: Hardware Sys Des & Modeling

Hardware system design and modeling including synchronous design techniques, modeling of systems and subsystems at various levels of detail, and the use of hardware descriptive languages. Presentation of a schematic capture tool, VHDL modeling and simulation, and SPICE simulation.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2019, Fall 2017

ECE 8448: Embedded Systems Architecture

A hands-on course on software and architecture aspects of embedded systems. Topics include: embedded processor architecture, software architecture and development, communicating with I/O devices, firmware and operating systems, buses and embedded networks, memory technology and design, and low power design.
Credits 3.0

Last Offered
Spring 2024, Spring 2023, Spring 2022, Spring 2021

ECE 8450: Design of Secure Comput System

This course examines common low-level software vulnerabilities that take advantage of current system architectures. Mitigation strategies at the software level and the system level will be discussed and analyzed
Credits 3.0

Last Offered
Spring 2023

ECE 8455: Adv. Digital Des. Using FPGAs

Introduces students to advanced digital design and implementation using FPGAs (Field-Programmable Gate Arrays). Topics include VHDL & Verilog, FPGA architectures, programming technologies, design methodologies, simulation and synthesis, place and route, and timing analysis, which board and EDA tools are used to help students gain hands-on experience. Prerequisite: Digital/logic design and VHDL basics.
Credits 3.0

Last Offered
Fall 2024, Fall 2022, Fall 2021, Fall 2020

ECE 8460: VLSI Design

Design introduction to concepts of CMOS VISI design. Design and layout concepts, properties of digitial circuits, scaling, and simulation. Emphasis is on deep submicron silicon system design and layout with circuit analysis. CAD tools are introduced and used throughout the course. A project is required. Prerequisite: ECE 7500 with permission of instructor.
Credits 3.0

ECE 8473: UNIX and C Programming

Programming using the UNIX operating system, shells, utilities, and C. Emphasis on standards including the ISO/IEC C standard and the POSIX/IEEE Open Group Single Unix Specification.
Credits 3.0

Last Offered
Fall 2022, Fall 2021, Fall 2020, Spring 2019

ECE 8474: Secure Systems Engineering

Multidisciplinary approach to security including economics, psychology and ethics, addressing security threats in engineering fields such as network security, wireless attacks on micro-controllers, electronic and cyber warfare, e-voting, and side-channel attacks. Study of current research literature and an extensive student project.
Credits 3.0

ECE 8476: Cryptography & Netwk. Security

Theory and practice of computer communications security, including cryptography, authentication, and secure electronic mail. Topics include secret and public key cryptography; message digests; password-based, address- based, and cryptographic authentication; privacy and authentication in email; PEM, PGP, and S/MIME. Use of various algorithms.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Summer 2022, Fall 2021

ECE 8480: Intro. to Cloud Computing

Introduction of Cloud Computing by covering fault tolerance and load balancing at the network, web server, enterprise bean server and data base server. Concludes by introducing non-relational solutions including Lucene and Map/Reduce. Working knowledge of JAVA, SQL.
Credits 3.0

ECE 8481: Post-Quantum Cryptographic ENR

Basic foundation of the post-quantum crypotographic engineering and recent advances in the field; introduces design and implementation techniques for the arithmetic unit and overall post-quantum cryptography on both hardware and software platforms, and side-channel attack skills.
Credits 3.0

Last Offered
Fall 2024, Fall 2023

ECE 8484: Cybersec. Threats and Defense

Malware and cyber threats: computer network defense; software for Data Protection and Privacy, Security Information and Event Management (SIEM), Governance, Risk and Compliance (GRC); trusted computer systems and secure applications; identy and access management including biometrics; next generation security concepts.
Credits 3.0

Last Offered
Spring 2024, Spring 2023, Spring 2022, Spring 2021

ECE 8485: Control Systems Security

Security risks of critical infrastructure systems such as electrical, pipelines, water, and transportation. Design and setup of Supervisory Control and Data Acquisition (SCADA) systems, Distributed Control Systems (DCS), and Programmable Logic Controller (PLC) systems. Security challenges and defense-in-depth methodology. Hands-on lab experiments.
Credits 3.0

Last Offered
Fall 2023, Fall 2021, Fall 2020, Summer 2019

ECE 8486: Ethical Hacking

Quantifying security in an unambiguous way using the Trusted System Evaluation Criteria. "Hacking" a system, developing and implementing countermeasures and threat removal, techniques for Access control, confidentiality, etc. Secure the network, web, enterprise and database, the Cloud and the Semantic Web.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022, Fall 2021

ECE 8487: Advanced Machine Learning

Advanced Machine Learning covers three main areas: basic algorithmic foundations such as linear regression and neural networks, applications of machine learning in image classification and natural language processing, and hardware acceleration of machine learning using GPUs and customized silicon (e.g., TPU).
Credits 3.0

Last Offered
Fall 2024, Fall 2023

ECE 8488: Security Risk Assess. & Man.

Fundamentals of vulnerability and risk assessment to mitigate and manage security risks. Analytical methodologies for information security risk assessment, test and evaluation. Practical experience with case studies and defense-in-depth concepts.
Credits 3.0

Last Offered
Summer 2023, Summer 2021, Summer 2019, Summer 2017

ECE 8489: Malware Analysis and Defense

Malicious software detection and defenses including tripwire, Bit9, and other techniques such as signature and hash algorithms. Viruses, worms and Trojan horses, logic bombs, malicious web server scripts and software. Anatomy of well-known viruses and worms. Mobile code issues. Methodologies used by the anti-virus/spyware vendors and freeware.
Credits 3.0

Last Offered
Fall 2024, Spring 2020, Spring 2019, Spring 2018

ECE 8490: Th. and Prac. of Comput. Appl.

Fundamentals of key topics in computing with an emphasis on applications. Operating systems, compilers, data structures, algorithms, and basics of systems/software engineering. Accelerated review of C programming. Applications of systems/software engineering focusing on object-oriented analysis and mobile application development.
Credits 3.0

ECE 8491: Blockchain Techno and Uses

Provides a technical analysis of distributed ledger technology (DLT) and application areas. Learn the process of mining and signing blocks using Proof of Work and Proof of Stake. Analyze problems best suited for public and and permissioned blockchains for distributed applications.
Credits 3.0

Last Offered
Spring 2024, Spring 2022, Spring 2021, Spring 2020

ECE 8492: Secure Software Development

Security requirements and design principles for secure software development. Security issues in current applications, database systems and web systems. Identifying vulnerabilities, their impact, and solutions to securing them.
Credits 3.0

Last Offered
Spring 2024, Spring 2023, Spring 2022, Spring 2021
Prerequisite Courses
ECE 8484

ECE 8494: Legal Aspects of Comp Security

Legal rights and liabilities associated with computer security, information privacy; Rights enforceable by private parties; Liabilities associated by private parties and governments; Legal aspects of records management; Un-authorized computer use; Computer Fraud and Abuse Act; Trade Secrets; Economic Espionage Act; Civil Law Claims; Privacy; Export Control; Constitutional Rights; USA-PATRIOT Act; HIPAA, Gramm-Leach-Bliley; Digital Rights Management.
Credits 3.0

Last Offered
Summer 2024, Summer 2022, Summer 2020, Summer 2018

ECE 8495: Cybersec Behavioral Analytics

Fundamentals of behavior analytics using statistical predictive models, system dynamics modeling and decision analysis to determine how cyber attackers choose their attack vectors, why victims fail to secure their systems and how network traffic reveals when attacks my be occurring. Provide a set of valuable tools to address underlying human behavior in the rapidly evolving cybersecurity field.
Credits 3.0

Last Offered
Summer 2021, Summer 2020, Summer 2019

ECE 8496: Computer Forensics

Introduction to the application of forensic science principles and practices for collecting, preserving, examining, analyzing and presenting digital evidence. The capture/intercept of digital evidence, the analysis of audit trails, the recording of running processes, and the reporting of such information. Selected topics from the legal, engineering and information-technology domains. Lecture, tool explorations and hands-on experience along with written projects.
Credits 3.0

Last Offered
Spring 2021, Spring 2020, Spring 2019, Spring 2018
ECE 8476 and ECE 8484

ECE 8498: CyberPhysical System Security

Cyber-Physical Systems include home automation and protection, connected vehicles, connected medical devices, drones, smart buildings and cities, and industrial control systems. Secure engineering of cyber- physical systems leading to a safer and more secure connected environment that also respects personal privacy. Improvement of security after deployment. Strategies for risk mitigation and emerging standards such as the NIST Draft Framework.
Credits 3.0

Last Offered
Fall 2022, Spring 2021, Spring 2019, Spring 2018
Prerequisite Courses
ECE 8485

ECE 8525: Sensors

Recent developments in the field of smart sensor systems are reviewed. A systematic approach towards the design of smart sensor systems is presented. Smart sensor systems involving the measurement of physical quantities such as temperature, pressure, strain, acceleration, magnetic fields, etc. through the use of electrical, optical, and other transduction methods is discussed. The lectures include case studies.
Credits 3.0

Last Offered
Summer 2023, Summer 2021, Summer 2015, Spring 2013

ECE 8560: Mixed Signal IC Design

Mixed analog and digital CMOS integrated circuit design devices: MOS devices, design, layout and simulation of digital and analog circuits including elementary logic and sequential machines, amplifiers, operational amplifiers, and analog signal processing and data conversion circuits. Projects using integrated circuit layout and simulation tools.
Credits 3.0

ECE 8562: Introduction to Photonics

Introduction to photonic systems. Course begins with an overview of ray, wave, and gaussian beam optics. Examples of several optical components, relavent to photonic systems, are discussed utilizing methods developed for these three optical domains. Laser concepts and technologies are next reviewed with applications in Fourier optics. Specific examples include image processing, optical correlation, and holography. Also examined are several technologies covering electro-optical, optical switches, and holographic inter- connections with applications in optical computing systems. Prerequisites: Undergraduate Electromagnetic Theory, Differential Equations
Credits 3.0

Last Offered
Fall 2022, Fall 2020, Fall 2018, Fall 2014

ECE 8566: RFIC Design

Fundamental principles for design of integrated circuits for use at radio frequency using CMOS technology. Topics: introduction to communications circuits and parameters, issues in RFIC design: noise, linearity, filters, review of technology; fabrication process, MOSFET transistors, design, simulation and use of passive elements in the MOS process, impedance matching, amplifier design; and low noise and general gain circuits, mixers, oscillators, power amplifiers.
Credits 3.0

Last Offered
Fall 2022, Fall 2020, Fall 2016, Fall 2014

ECE 8568: Optoelectronic Devices & Cir

Principles of operation, terminal chacteristics and circuit implementation of various optoelectronic devices. Devices: light emitting diodes, semiconductor lasers, infrared photodetectors, optoisolators, charge coupled devices, solar cells, and optoelectronic switching. SPICE modeling of devices and circuits containing these devices will be emphasized.
Credits 3.0

ECE 8580: Power Electronics

Application of semiconductor power devices (e.g., power FET's SCR's, TRIAC's) with emphasis on high-reliability applications. Device characteristics; linear and switch-mode power supplies; voltage regulators; power amplifiers; high-current switching applications.
Credits 3.0

Last Offered
Spring 2023, Spring 2021, Spring 2019, Spring 2017
ECE 7580 :C

ECE 8601: Engr Emag I (Intermediate)

Beginning graduate course in electromagnetics. Material covered is a prerequisite for advanced course in applied electromagnetism. Topics: Maxwell's equations, boundary conditions, wave propagation, reflection and transmission, waveguides and transmission lines and cavity resonators.
Credits 3.0

ECE 8602: Egr Electromagnetics II (Adv)

Continuation of Engineering Electromagnetics I. Topics: scattering theory, moment methods, geometircal theory of diffraction and Green's functions as applied to electromagnetic problems.
Credits 3.0

ECE 8670: Microwave Thry & Tech I

Modern analysis and design techniques for use with microwave and millimeter-wave frequency range. Topics a review of Maxwell's equation; transmission lines and waveguides; planar guiding structures including stripline, microstrip, slotline and coplanar waveguides; scattering parameters and microwave network theory with applications to transmission line and waveguide junctions and obstacles; Impedance matching and tuning; examples of microwave passive devices including power dividers, couplers and hybrids. Prerequisite: Undergraduate Electromagentic Theory
Credits 3.0

Last Offered
Fall 2023, Fall 2021, Fall 2019, Fall 2017
ECE 3690 :D-

ECE 8671: Micro Thry and Tech II

Continuation of study of microwave passive devices and network theory covered in ECE 8670. Analysis and design of two and three terminal microwave solid-state devices and ciricuits such as mixers, frequency multipliers, oscillators, control circuits and amplifiers are covered. Included is the study of microwave filters, systems and ferromagnetic devices.
Credits 3.0

Last Offered
Spring 2024, Spring 2022, Spring 2020, Spring 2018
ECE 8670 :C

ECE 8675: Antenna Theory I

Fundamental principles of antenna theory and application to analysis and design of various antennas. Topics: antenna fundamentals including radiation from an ideal dipole, pattern, gain, polarization, antenna temperature, radar range equation and link budget calculations; analyses of wire and loop antennas; antenna arrays, analysis and synthesis; impedance concept and mutual coupling; broadband and frequency independent antennas; antenna radiation above ground, modes of propagation and multipath; numerical modeling of wire antennas using method of moments. System application of various antennas in radar, satellite and mobile communications. Prerequisite: Undergraduate Electromagnetic Theory
Credits 3.0

Last Offered
Fall 2024, Fall 2022, Fall 2020, Fall 2018

ECE 8676: Antenna Theory & Design II

Continuation of Antenna Theory I. Topics: Method of Moments, Geometrical Theory of diffraction, aperture and horn antennas, microstrip and low profile antennas, reflector antennas, lens antennas, dielectric and leaky-wave antennas, application of high Tc superconductors to antenna systems. Review of mathematical and numerical techniques required for understanding advanced topics, modern trends in modeling and application of various antenna systems.
Credits 3.0

Last Offered
Spring 2021, Spring 2019, Spring 2013, Spring 2011
ECE 8675 :C

ECE 8700: Comm Systems Engineering

Basic topics in digital communications, including: modulation schemes, maximum likelihood symbol detection and sequence estimation, Viterbi algorithm, carrier and symbol synchronization, bandlimited channels, intersymbol interference modeling, channel equalization, MIMO systems, multiuser communications.
Credits 3.0

Last Offered
Spring 2024, Spring 2023, Spring 2021, Spring 2020
ECE 3720 and ECE 3770

ECE 8705: Detection and Estimation

Fundamental problems in detection and estimation; statistical decision theory, techniques in hypothesis testing, and their performance analysis; parameter estimation for both deterministic and random parameters; exploring important applications of detection and estimation theory in radar, digital, and wireless communications.
Credits 3.0

Last Offered
Fall 2018, Spring 2016, Spring 2014, Spring 2013
Prerequisite Courses
ECE 8072

ECE 8708: Wireless Communications

Principles of cellular and wireless communication system, including frequency reuse, hand-off, interference and capacity; modulation techniques; propagation; channel modeling and equalization; diversity; multiple access techniques including FDMA, TDMA and CDMA; wireless standards (AMPS, IS-54, IS-95); digital cordless standards.
Credits 3.0

Last Offered
Fall 2023, Spring 2022, Fall 2020, Spring 2019

ECE 8710: Radar Systems

Radar systems are introduced in a framework of electronic systems integration which represents a unification of engineering theory and practice. A comprehensive set of radar principles are presented which form a foundation for the radar range equator. Systems applications are presented which illustrate the potentials and limitations of radar.
Credits 3.0

Last Offered
Fall 2022, Spring 2021, Fall 2017, Fall 2015
ECE 8072 :C

ECE 8720: 5G Wireless Networks

This course covers several topics on fifth generation (5G) of wireless systems with a specific focus on the physical layer and air interface technologies. 5G systems are being developed by industry for deployment starting in 2020. In comparison to 4G systems, 5G systems are to support for 10 times higher the peak data rate, 10 times lower latency, and 10 times higher number of connected devices. We then look at the opportunities and challenges introduced by using mmWave frequency bands, massive MIMO, cloud-RAN, and full-duplex communications. Pre-requisites: Undergrad Signal Processing and Communication.
Credits 3.0

Last Offered
Spring 2024, Spring 2023, Spring 2020
ECE 3225 and ECE 3770

ECE 8760: Optical Communications

Introduction to fiber and free space optical communication systems from a discrete and system perspective. Topics include : fiber optics waveguides, pulse dispersion and bandwidth computations, PIN and APD detectors. LED and LD optical sources, optical receiver designs, bit error rate estimation, and transmission link analysis. Also examined` are system requirements for space-based laser communication systems which include communication bandwidth as well as acquisition and pointing considerations. Prerequisites: Undergraduate electromagnetic theory, differential equiations.
Credits 3.0

Last Offered
Fall 2023, Fall 2019, Fall 2017, Fall 2015

ECE 8771: Info Theory and Coding Dig Com

Information theory, within the context of digital communications applications, as a means of bounding digital communication system performance. Topics in channel coding including block and convolutional channel coding, Trellis coded modulation, turbo coding and turbo trellis coded modulation.
Credits 3.0

ECE 8815: Smart Energy Systems

The modern electric power infrastructure; manifestations of the smart-grid; two-way, smart revenue metering for system operating efficiencies, maximal utilization of renewable resources, improved power quality, and automated management of service disruptions; and evolving technologies offering security, reliability, and environmental sustainability of the electric infrastructure.
Credits 3.0

Last Offered
Fall 2023, Fall 2019, Fall 2017, Spring 2011
Prerequisite Courses
ECE 7810

ECE 8820: Power System Dynamics

The focus of the course is the dynamic behavior of the electric power system. The topics include transient performance of ac machines, load-frequency and voltage control systems, economic operation, transient behavior of transmission lines, and transient stability. Prerequisites: ECE 7805 and ECE 7810 or approval from instructor.
Credits 3.0

ECE 8830: Advanced Electric Drives

Focus on the design and computer simulation of electric motors and variable speed drives. Topics to be covered include the design of synchronous, induction and permanent magnet motors; Park's transformation and D-Q modeling; CSI, VSI, 6-step, and PWM drive topologies. Modeling of various control strategies (including vector control) and stability of control loops will be covered. Design examples for high power (>1MW) applications will be provided.
Credits 3.0

ECE 9000

ECE 9030: Independent Study

An investigation of a current research topic under the direction of a faculty member. A written report is required. Needs Chairperson's Permission to register for course.
Credits 3.0

Last Offered
Summer 2024, Spring 2024, Fall 2023, Summer 2023

ECE 9031: Research I

Supervised research in pursuit of thesis. Needs Chairperson's Permission to register for this course.
Credits 3.0

Last Offered
Summer 2024, Spring 2024, Fall 2023, Summer 2023

ECE 9032: Research II

Continuation of ECE 9031.
Credits 3.0

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

ECE 9080: Thesis Continuation

The continuation of the Master Thesis Course, ECE 9031.
Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

ECE 9085: Independent Study Continuation

The continuation of the Independent Study Course, ECE 9030.
Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

ECE 9090: ECE Project

Independent student investigation of electrical engineering or computer engineering problem under the supervision of a faculty advisor; a written comprehensive report embodying the results of the project is required. Prerequisite: Consent of Chairperson
Credits 3.0

Last Offered
Fall 2024, Spring 2024, Fall 2023, Spring 2023

ECE 9900: Special Topics in E E

Advanced elective study of topics of current interest and importance in electrical engineering.
Credits 3.0

Last Offered
Summer 2018, Spring 2018, Fall 2017, Summer 2017

ECE 9905: Sup Study Elec & Comp Egr

Individually supervised study on special topics in electrical and computer engineering. Prerequisite: Permission of department chairperson and faculty advisor.
Credits 3.0

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

ECE 9910: Spec Top Systems Egr I

Topics: linear systems; control theory; stochastic control, rigid body of dynamics, vibrating systems, basic probability and statistics. Given at King of Prussia, PA.
Credits 3.0

Last Offered
Spring 2021, Spring 2020, Summer 2018, Spring 2018

ECE 9920: Spec Top Systems Egr II

Topics: fluid mechanics, boundary layer theory, electromagnetic theory, switching theory, remote sensing information theory, random processes and statistical decision theory. Given at King of Prussia, PA.
Credits 3.0

Last Offered
Spring 2021, Spring 2020, Summer 2018, Spring 2018

ECE 9940: ECE Graduate Practicum

Provides work experience for a graduate student who has been offered an opportunity to work in the electrical or computer engineering field in industry. Required for curricular practical training.
Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

ECE 9941: Grad. Practicum Continuation

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023
Prerequisite Courses
ECE 9940

EGEN

EGEN 7001: Emerging Tech & Innov 21st Cen

This course provides students with an exploration of emerging technologies and their applications in various industries. Students will gain an understanding of how disruptive technological advancements are transforming industries and driving innovation, creating insight and application to bench discovery.
Credits 3.0

EGEN 7116: Sustainable Innov & Entreprshp

How to develop sustainable products, service innovations and businesses. Topics include customer engagement, lean product development, elements of sustainable business models and development of a strong value proposition.
Credits 3.0

Last Offered
Fall 2019

EGR

EGR 7011: Business Basics for Engineers

Business fundamentals providing working knowledge in key business disciplines: economics, globalization, business ethics, money and banking, securities, investing, accounting, marketing and business etiquette/protocol.
Credits 3.0

Last Offered
Spring 2024, Spring 2023, Fall 2021, Fall 2020

EGR 7012: Management for Engineers

Application of principles and tools of contemporary management focusing on the process of getting the job done effectively and efficiently: planning, organization, staffing, leadership, control and communication.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022, Spring 2021

EGR 7013: Business Model Feasibility

Analyze the technical and business viability of opportunities; identify and gather resources needed to launch a successful venture whether in a start up or a large established organization; develop practical business models. Lectures will be combined with multiple active learning exercises.
Credits 3.0

EGR 7014: Innovation & Opportunity

Find and recognize entrepreneurial opportunities; add value to the opportunities, and develop creative solutions that will help move from abstract ideas to practical innovations. Lectures will be combined with multiple active learning exercises.
Credits 3.0

EGR 7015: Infrastructure Asset Mgmt

Understand how infrastructure asset management supports the responsible stewardship of infrastructure assets, the achievement of greater value from the assets and how sound asset management principles and technologies are applied to manage financial, operational and sustainability goals.
Credits 3.0

EGR 7016: Engineering Leadership

Essential components of engineering leadership including: communication, innovative thinking, strategic decision making, ethical leadership, and team building and collaboration.
Credits 3.0

Last Offered
Spring 2024

EGR 7100: Materials Characterization

Principles of analytical methods for characterization of materials for structure & composition; crystallography, optical microscopy, scanning electron microscopy, transmission electron microscopy, x-ray diffraction, & atomic force microscopy. Hands-on laboratory experiments in scanning electron microscopy, x-ray diffraction, Atomic Force Microscopy. Restricted to Engineering/Science graduate students & seniors with 3.0 GPA or higher.
Credits 3.0

EGR 7110: Fundamentals-Sustainable Engr

Introduction to the current state of science & public policy directions; development of a comprehensive framework for evaluating the challenges and opportunities resulting from Global Climate Change and Sustainability; application of technical/economic tools for solving high-potential opportunities.
Credits 3.0

Last Offered
Fall 2021, Fall 2020, Fall 2019, Fall 2018

EGR 7111: Life Cycle/Impact Assessment

Methodology for assessing and modifying the impacts of product development, new project construction, operations upgrade and infrastructure improvement within a sustainable development framework consistent with US and global requirements.
Credits 3.0

Last Offered
Spring 2022, Spring 2021, Spring 2020, Spring 2019

EGR 7112: Econ/Social Equity Integrators

Developing a careful balance among the environmental, economic and social equity issues of a proposed product, service or infrastructure project; focus on specific tools and case studies; creating a holistic solution.
Credits 3.0

Last Offered
Fall 2021, Fall 2020, Fall 2019, Fall 2018
CHE 7110 or EGR 7110 or CHE 7111 or EGR 7111

EGR 7113: Sustainable Materials & Design

Comprehensive, systems-focused basis for selecting materials in new uses or as more sustainable alternatives; more eco-efficient alternatives, including technologies to reduce material intensity, renewably sourced materials, recyclable materials and material solutions inspired by nature (biomimetic). Non-engineering majors will require permission by the instructor.
Credits 3.0

Last Offered
Fall 2021, Fall 2020, Fall 2019, Fall 2018

EGR 7115: Sustainable Engineering System

An overview of systems engineering theory and techniques in Sustainable Engineering with a central focus on sustainability related applications.
Credits 3.0

Last Offered
Spring 2022, Spring 2021, Spring 2020, Spring 2019
Prerequisite Courses
EGR 7110

EGR 7117: Trans Tech for Sust Solutions

Transformative technology will be examined to contrast and compare potential new solutions to sustainability issues. Appropriate technology as well as learnings from nature will then be applied to develop improved solutions in a project-based learning environment.
Credits 3.0

EGR 7120: Intro to Sus Eng for Intl Dev

Introduction to engineering in a developing community context; frameworks for applying engineering and technology to achieve sustainable development goals; geo-political, historical, institutional, economic, cultural, and ethical perspectives. NOTE: Intro course for the Sustainable Development track and should be the first course taken for this 4 course track program.
Credits 3.0

Last Offered
Fall 2021, Fall 2020, Fall 2019, Fall 2018

EGR 7121: Sus WASH & Enviro Egr for Dev

Applied fundamentals in water, sanitation and environmental health for global development. Includes engineering design tools for water and sanitation infrastructure and leadership tools for sustainable solutions to global WASH challenges. Note: course part of International Development Track in Sustainable Engineering. Must be enrolled in one of the following levels: Graduate Engineering, or have prior consent of instructor.
Credits 3.0

Last Offered
Spring 2022, Spring 2020, Spring 2019, Spring 2017

EGR 7122: Product Dev for Low Rsrc Set

Design thinking and empathetic design considerations; appropriate technologies; sustainable business model development; case studies of sustainable products developed for low resource settings. Note: course part of International Development Track in Sustainable Engineering Must be enrolled in one of the following levels: Graduate Engineering, or have prior consent of instructor. Prerequisites: EGR 7114 Intro to Sus Egr for Intl Dev or prior consent of instructor.
Credits 3.0

EGR 7123: ICT and Energy for Development

Open source software and mobile tools and platforms for development; low cost renewable energy technologies for energy access; applications in health care, water and sanitation, education, agriculture, financial inclusion and monitoring and evaluation.
Credits 3.0

Last Offered
Spring 2023, Spring 2021, Spring 2019

EGR 7200: Biomimicry

Using observations from nature to provide sustainable solutions to our everyday needs. Key outcomes include whole system understanding of current solutions (benefits/issues), nature's capabilities, and new solutions by applying nature's capabilities to today's needs. Restricted to Engineering students or permission of instructor.
Credits 3.0

Last Offered
Spring 2022, Spring 2021, Spring 2020, Spring 2019

EGR 7501

EGR 7510: Building Green with LEED

EGR 7515: Building Information Modeling

Generating and managing building data used for increasing productivity in building design, construction, and operation during complete life cycle of the structure.
Credits 3.0

EGR 7800: Solar Therm. Energy Conversion

Fundamentals of solar radiation, heat and fluid transport in active and passive solar collectors, solar ponds, solar cooling, and photovoltaic energy conversion. Analysis and design of active and passive solar systems. Needs undergrad material equivalent of ME 3100 and ME 3600.
Credits 3.0

EGR 7850: Electrochemical Power Sources

Principles of the design & application of electrochemical power sources, including batteries, super capacitors, fuel cells, & hydrogen electrolysis. Applications include automotive, industrial, medical, telecommunications, & utilities. Prereq=CHM 1151 or equivalent.
Credits 3.0

Last Offered
Spring 2024, Spring 2022, Spring 2020, Spring 2018

EGR 8001: Systems Engineering I

Introduction to the system science and the decision science with focus on theoretical foundations and mathematical modeling. Topics: system design models, system architecture, probability theory, linear programming, non-linear programming, Bayesian analysis, Modeling and Simulation, optimization techniques, risk analysis, sensitivity analysis, and regression analysis.
Credits 3.0

EGR 8111: ADV LCA & Intro to Prod Design

This course is designed as an in-depth exploration of LCA issues and applications. Students will complete a baseline LCA semester team project then use sustainable product design techniques to reduce overall impacts of the product or material.
Credits 3.0

Last Offered
Fall 2021, Fall 2020, Fall 2019, Fall 2018
Prerequisite Courses
EGR 7111

EGR 8112: Supply Chain Sustainability

Sustainability practices from upstream sourcing from suppliers to manufacturing through delivery to customers and disposal and how these impact a company's triple bottom line. Topics include product/process design, green procurement, network management, life cycle assessment, performance measurement, risk management, among others.
Credits 3.0

Last Offered
Spring 2022, Spring 2020, Spring 2019, Spring 2018
Prerequisite Courses
EGR 7110

EGR 8113: Sust. Buildings & Operations

Focuses on implementing sustainability and reducing impacts of buildings. Students will evaluate green building standards for New Construction and Existing Buildings and learn the principals of making buildings more sustainable. Restricted to College of Engineering students. Otherwise permission of instructor.
Credits 3.0

Last Offered
Spring 2022, Spring 2021, Spring 2020, Spring 2019

EGR 8301: Control Systems Engineering

Review of dynamic process modeling, linearization, transfer function and state-space models. Stability and dynamics of open-loop and closed-loop systems. Feedback control system design and analysis in the frequency and time domain. Topics include: Bode, Nyquist, and Root locus design; multivariable control; feedforward control. Prerequisite: Undergraduate background in systems and control.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022, Fall 2021

EGR 8302: Digital Control

Introduction to digital control analysis & design techniques applied to discrete-time & sampled continuous-time systems. Sampling, difference equations, the Z-transform & modified Z-transform, discrete transfer function & state-space models, discrete-time regulator & observer design, stability of discrete-time systems, discrete linear quadratic regulator & linear quadratic Gaussian formulation. Prerequisite: EGR 8301 or equivalent with permission of the instructor.
Credits 3.0

Last Offered
Fall 2020, Fall 2018, Fall 2016, Fall 2014
Prerequisite Courses
EGR 8301

EGR 8304: Nonlinear Control

Advanced treatment of nonlinear dynamical systems and control theory using modern techniques with applications. Topics include: Lyapunov stability theory, partial stability finite-time stability and control design, control Lyapunov functions, nonlinear optimal control, sliding mode control, and adaptive control.
Credits 3.0

Last Offered
Spring 2021, Spring 2019, Spring 2016, Spring 2009

EGR 8305: System Identification

Introduction to system identification techniques for linear systems. Topics include: non-parametric time- and frequency-domain methods, parametric model structures, noise models, parametrc estimation methods, recursive estimation, bias and data pre-filtering, validation methods.
Credits 3.0

EGR 8306: Nonlinear Dynamics

Introduction to nonlinear dynamic analysis using analytical, graphical & numerical techniques. Linear system theory, the nonlinear pendulum, stability concepts, bifurcation theory, self-excited oscillations, overview of asymptotic methods, Floquet theory, Poincare maps, & chaos.
Credits 3.0

Last Offered
Spring 2023, Spring 2021, Spring 2019, Spring 2017

EGR 8308: Feedforward Control

Introduction to feedforward control techniques with an emphasis on model-based methods. Design of feedforward inputs for linear systems, nonlinear systems, nonminimum phase systems, and systems with actuator redundancy; integration of feedforward and feedback; iterative control; dealing with plant uncertainty.
Credits 3.0

EGR 8309: Adv Topics in Dynam & Control

Advanced treatment of various aspects of nonlinear dynamics and control. Prerequisite: Depends on the topic covered each semester. Contact instructor for specific details.
Credits 3.0

EGR 8310: Optimization for Engineers

Linear programs, non-linear programs, and integer programs. Gradient and steepest descent methods and Newton's method for constrained and unconstrained problems. Interior point methods including cutting planes and branch bound methods. Combinatoric optimization. Heuristic methods. Engineering applications of optimization. Prerequisite: ME 7000 (concurrency allowed) or instructor's permission.
Credits 3.0

Last Offered
Spring 2023, Spring 2021, Spring 2019, Spring 2017
ME 7000 :Y

EGR 8311: Machine Learning for Engineers

Introductions to machine learning. Overview of optimization. Least mean square algorithm and regression analysis. Artificial neural networks, radial basis function, kernel learning and support vector machines. Decision trees. Genetic algorithms. Swarm intelligence. Bayesian techiniques. Hidden Markov Models. Hopfield network and Neurodynamics. Prerequisite: ME 7000 (concurrency allowed) or Instructor's permisson.
Credits 3.0

Last Offered
Fall 2023, Spring 2022, Fall 2019, Spring 2018
ME 7000 :Y

EGR 8312: Spectral Methods in Diff Equat

Chebyshev spectral collocation based trustworthy numerical solutions of linear and nonlinear differential equations with time varying coefficients encountered in various engineerng disciplines, applications to parameter estimation and control. Pre-requisites: ME 7000 or Instructor's approval
Credits 3.0

EGR 8315

EGR 9000: Doctoral Independent Study

For students who are studying specific advanced interdisciplinary subject areas. Prior to the beginning of the term, the student must prepare a proposal describing the area to be studied. This proposal must be signed by the faculty supervisor and submitted to the Chairman of the Interdisciplinary Program Committee for approval.
Credits 3.0

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

EGR 9010: ESL for Graduate Egr Students

Cover topics directly related to TOEFL sub scores. Listening and speaking will range from syllable structure and stress patterns to the intonation and rhythm of American English. Other topics will be added according to the individual needs of the students.
Credits 0.0

EGR 9011: Science Research Writing

Non-credit writing course for non-native speakers of English. Topics include structure, organization, grammar and vocabulary. Lectures/textbook will provide information necessary for students to utilize in writing engineering papers. No grades assigned; attendance is necessary.
Credits 0.0

EGR 9015: Sustainable Infrastructure Sys

This course equips students with a mindset and evaluative tools to analyze and design a new generation of sustainable infrastructure, which is a complex, dynamic service system with multiple sectors, development stages, and impact potentials on the natural world.
Credits 3.0

Last Offered
Spring 2022, Spring 2021, Spring 2019, Spring 2018

EGR 9020: Sust Eng Independent Study

Credits 3.0

Last Offered
Summer 2022, Spring 2022, Fall 2021, Summer 2021

EGR 9024: Sust Eng Thesis I

Credits 3.0

Last Offered
Summer 2022, Spring 2022, Fall 2021, Summer 2021

EGR 9025: Sust Eng Thesis II

Credits 3.0

Last Offered
Summer 2022, Spring 2022, Fall 2021, Summer 2021

EGR 9080: Sust Eng Thesis Continuation

Last Offered
Summer 2022, Spring 2022, Fall 2021, Summer 2021

EGR 9085: Sust Eng Ind Study Contin

Last Offered
Summer 2022, Spring 2022, Fall 2021, Summer 2021

EGR 9090: Sust Engr Summer Research

Continuation of Sustainable Engineering degree-required research during the Summer
Last Offered
Summer 2022

EGR 9095: Sust Engr - Graduate Practicum

Provides work experience for a graduate student who has been offered an opportunity to work in the field of Sustainable Engineering. Required for curricular practical training. Permisson of Graduate Advisor.
Last Offered
Spring 2022

EGR 9100: Doctoral Research

For accepted Ph.D. candidates conducting research as part of the Doctorate of Engineering degree requirements. The chair of the student's guidance committee is responsible for evaluating the performance of the student.
Credits 3.0

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

EGR 9110: Doctoral Research Continuation

Continuation of Doctoral Research course, EGR 9100. Must have completed minimum required credits (30) of EGR 9100.
Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023
Prerequisite Courses
EGR 9100

EGR 9120: PhD Student Summer Research

Continuation of degree-required research during the summer.
Last Offered
Summer 2024, Summer 2023, Summer 2022, Summer 2021

EGR 9150: Prof Development/CPT

Provide industry experience for purpose of career exploration and academic application. Permission of Research Advisor required.
Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

EGR 9151: Prof Devel/CPT Continuation

Continuation of Professional Development/CPT. Permission of Research Advisor required.
Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023
Prerequisite Courses
EGR 9150

EGR 9200: Teaching Engr'ng in Higher Edu

This course, for Ph.D. students only, introduces contemporary theories of education at the collegiate level, and demonstrates many effective methods of engineering instruction. Students will develop teaching skills that will promote active learning in the college classroom.
Credits 1.0

Last Offered
Fall 2024, Fall 2023, Fall 2022, Fall 2020

EGR 9220: Teaching Engr'ng Practicum

This hands-on immersion style course provides an opportunity for students to practice the methods learned in EGR 9200 in a supervised environment. Students will work directly with a faculty mentor in their classroom environment observing and practicipating in effective engineering teaching methods. Students will also have a course classroom environment in which they will prepare for the academic job search process.
Credits 1.0

Last Offered
Spring 2024, Spring 2023, Spring 2021, Spring 2020
Prerequisite Courses
EGR 9200

EGR 9240: PhD Prof Devel Seminar

Required course for the PhD program in Engineering. Includes: communication; teamwork; interpersonal skills; time people, & project management; leadership vision & styles; strategic planning; employee empowerment; leadership in patents; entrepreneurially minded learning; safety and the environment; lifelong learning.
Credits 1.0

Last Offered
Spring 2024, Spring 2023, Spring 2022, Spring 2021

EGR 9260: PhD PD Industry Track Seminar

Required course for PhD student PD program Industry Track in Engineering. Includes: how innovation happens, is managed, and protected; how products and offerings are introduced and commercialized; the importance of safety, quality, and ethics; and the engineer's role in achieving business excellence and superior customer value. Restricted to PhD Student in Engineering
Credits 1.0

Last Offered
Fall 2024, Fall 2023, Fall 2022, Fall 2021

GEV

GEV 7040: Intro to GIS

Principles, techniques, and applications of Geographic Information Systems (GIS).
Credits 4.0

MAT

MAT 7660

Credits 3.0

MAT 7770: Number Theory

Divisibility; Euclidean algorithm; prime numbers; Fundamental Theorem of Arithmetic; congruences; arithmetic functions; Diophantine equations, additional topics, which may vary by semester, include cryptography, law of quadratic reciprocity, continued fractions.
Credits 3.0

MAT 8430: Operations Research

MAT 8435: Mathematical Modeling

Model construction, Markov chains, game theory, networks and flows, growth processes and models for epidemics and queues with an emphasis on model construction.
Credits 3.0

MAT 8650: Abstract Algebra

Groups, homomorphisms, factor groups, rings, fields, finite fields, selected applications.
Credits 3.0

MAT 8790: Selected Topics I

Particular topics of study determined on a year to year basis to suit the desire and prepartion of students.
Credits 3.0

STAT 7404: Statistical Methods

Data summarization and display, distributions; binomial, Poisson, normal, t, chi-square and F, estimation, hypothesis testing, linear regression, correlation, statistical software packages.
Credits 3.0

MBA

MBA 8139: Contemporary Topics

Credits 3.0

MBA 8144

MBA 8147: Analytics in Sports Business

Discusses theory and application of how professional sports franchises gain competitive advantage through the integration of data analysis into their decision-making processes.
Credits 1.5

MBA 8250: Bus Opera & Supply Chain Mgmt

Concepts of operations management, operations technology, and the responsibilities of operation managers in the management of production systems, including problems and techniques of systems design, operation and control.
Credits 1.5

MBA 8250: Bus Opera & Supply Chain Mgmt

MBA 8330: Contemporary Topics Economics

Contemporary economic issues.
Credits 1.5

MBA 8350: Analyzing and Leveraging Data

The course begins with a review of descriptive statistics, confidence intervals, and hypothesis testing. These tools will be extended into regression analysis geared towards analyzing large data sets in order to make informed business decisions.
Credits 3.0

MBA 8522: Talent Management

Role of talent management in corporate strategy and success. Staffing, compensation, work design, performance measurement, individual and career development, safety, health, and separation. Focus on TM as critical success factor in organizations. Restricted to MBA Students and JDMBA Students.
Credits 1.5

MBA 8529-001

MBA 8529-002

MBA 8537: Intro to Data Mining

Process of selecting, exploring, and modeling large amounts of data to uncover previously unknown patterns and gain insights. Several data mining techniques will be applied to large data sets from different business areas to support business decision making.
Credits 1.5

MBA 8546: Opp. Recognition & Pre Launch

Includes idea generation, opportunity development, planning and preparation. Also pre launch marketing, intellectual property, risk-reward analysis and first dollar start up funding. Introduces items to build in from the beginning such as lean, sustainability, and ethics standards.
Credits 1.5

MBA 8550: Team Leadership & Grp Dynamics

Course focuses on the behavioral dimension of managerial action and decision making with emphasis on group dynamics and interpersonal relationships. It includes an exploration of personal style, team leadership competencies, motivation, influencing others, communication, diversity, high performance teams, and learning in a global environment.
Credits 1.5

MBA 8631: Exec Level Selling C-Suite

Selling higher in organizations, often referred to as C-suite selling or up-tiering relationships, requires a unique mindset and a defined set of skills in order to gain a place at the executive table. Course focuses on where and how to start building a knowledge base, and with simulation and case studies will challenge the student to move from traditional, entry and mid-level selling to proficiency with clients at all senior levels within an organization.
Credits 1.5

MBA 8632: Cons Psy Optimal Bus Solutions

Students will become "subject matter experts" on topics that impacts their professional lives. The format will be research-based and result in a detailed "full-immersion" presentation and consultancy exercise that demonstrates marketing and consumer behavior concepts combined with an analysis of a personal, corporate or agency strategic issue of interest to the students. Students will be exposed to in-class consultancy situations from corporate and governmental leaders and will analyze a business problem, provide a framework for analysis and qualified recommendations for action.
Credits 1.5

MBA 8643: Mgmt & Mkt of Services-Part I

Analysis of unique challenges of marketing services compared to products; introduction to the expanded marketing mix (7 P's) and the Gaps Model of Service Quality; apply knowledge through case analysis.
Credits 1.5

MBA 8644: Mgmt & Mkt of Services-Part II

Builds on material from Services I, further exploring the Gaps Model of Service Quality. Major topics include communications and roles of employees and customers in service delivery. Case analysis will make the material relevant and topical.
Credits 1.5

MBA 8649: TOPICS: Marketing

Credits 1.5

MBA 8649: Topic: Marketing, Opp Analysis and International Bus Dev

MBA 8650: Strategic Marketing Mgmt.

Course focuses on the development, implementation and control of strategic marketing management decisions in complex environments designed to accomplish an organization's objectives. Theory and practice are utilized to develop integrated corporate strategies and detailed programs.
Credits 3.0

MBA 8710: Info Tech as Strategic Lever

Advances in IT provide an opportunity for business to leverage technology to rethink organizational strategy, structure, and process. Course provides an understanding of technology, organizational environment, and its effect on society.
Credits 1.5

MBA 8720: Ethical Business Practices

Ethical responsibilities of managers and corporations. Plausible frameworks for dealing with ethical dilemmas. Common patterns of success and failure in managing ethical conflicts. Critical evaluation of managerial and corporate ethics.
Credits 1.5

MBA 8730: Mgmt. for Innov. & Creativity

Study innovation processes at organizational system level. Develops students & apos; awareness and confidence to innovate. Value of creativity tools and techniques for individual and group innovation. Students develop their own preferred creativity processes and apply to individual and group challenges.
Credits 1.5

MBA 8740: Global Political Economy

International trade and production, global division of labor, environmental change, political economy governance, exchange rate implications, and consequences of globalization and production. International relations and organizations governing countries' trade relations.
Credits 1.5

MBA 8800: Commercial Real Estate Invest.

An overview of commercial real estate investment. Emphasis is on life cycle from acquisition through disposition using analytical and practical tools. Topics include market analysis, valuation, deal structuring, commercial leases, financing, investment management, marketing and careers in real estate.
Credits 3.0

ME

ME 7000: Advanced Engineering Analysis

Solutions of ordinary differential equations, series solutions, special functions, boundary-value problems, partial differential equations, vector calculus, calculus of variations, and engineering applications. Undergraduate students must obtain permission of the department chair.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022, Fall 2021

ME 7002: Continuum Mechanics

Tensor algebra and calculus; Lagrangian and Eulerian Kinematics of Deformation; Cauchy and Piola-Kirchhoff stresses; general principles including conservation of mass, conservation of linear and angular momentum and energy; constitutive theory, ideal fluids, Newtonian and non-Newtonian fluids, finite elasticity, and linear elasticity.
Credits 3.0

Last Offered
Spring 2024, Spring 2018, Fall 2015, Fall 2013

ME 7020: Financial Engineering 1

Introductions to Financial Engineering and big data programing skills. Integrating and applying methods from engineering, financial theory, computer science, statistics and applied mathematics. Topics: Corporate Finance, Financial Statements, Discounted Cash Flow, NPV, Stocks, Bonds, REITs, CAPM, Business Cases, R and basic programing strategies.
Credits 3.0

Last Offered
Summer 2024, Summer 2023, Summer 2022, Summer 2021

ME 7030: Num Methods for Eng Simulation

Numerical methods for root finding, curve fitting, integration, differential equation solving, coupled systems of equations, and optimization; algorithm choice for stability and computational efficiency.
Credits 3.0

Last Offered
Spring 2023, Spring 2022, Fall 2020, Fall 2019

ME 7038: Intro-Computational Fluid Mech

Discretization, boundary conditions, solution methods, heat transfer, flow with known pressure field, calculation of pressure field, applications program, special topics. Undergraduate students must obtain permission of the department chair.
Credits 3.0

Last Offered
Summer 2023, Summer 2021, Summer 2020, Summer 2019

ME 7040: Intro to Fin Element Analysis

Introduction to the finite element method with a focus on stress analysis. Boundary value problems; weighted residuals; variational methods; finite element formulation and solution; hands-on experience using programs for solution of problems.
Credits 3.0

Last Offered
Spring 2023, Spring 2021, Spring 2019, Spring 2017

ME 7060: Multiphysics Sys Modelng & Sim

Modeling of dynamic systems that feature interactions between mechanical, electrical, magnetic, fluid, or other physical domains; unified analysis based on network theory and energy balance principles; derivation and solution of linear and nonlinear state equations; computer simulation of system response.
Credits 3.0

Last Offered
Spring 2020, Spring 2018, Spring 2016

ME 7070: Aero Vehicle Struc Analy & Des

Aerospace vehicle configurations, free body diagrams and load paths, metal and composite materials, closed form analysis methods for statically indeterminant (redundant) structures, compression structures analysis methods, shear panel analysis methods, joints and fittings, design for fatigue and damage tolerance.
Credits 3.0

Last Offered
Spring 2023
Prerequisite Courses
ME 7000

ME 7103: Advanced Engrg Thermodynamics

An advanced treatment of engineering thermodynamics involving reversible and irreversible macroscopic processes with emphasis on fundamentals and applications of the first and second laws, and the thermodynamics of equilibrium states of substances. Seniors must have a minimum GPA of 3.0
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2021, Fall 2019

ME 7110: Alternative Fuels Production

Understanding the thermodynamics of production and utilization methods of biologically and chemically based alternative fuels. Topics include ethanol, methanol, butanol, biomass, biodiesel, biogas, hydrogen, Fischer-Tropsch fuels, shale oil, and sands.
Credits 3.0

ME 7120: Thermodyn Altern Energy Prod

Application of thermodynamic principles to biomass, alternative fuels, wind, hydro, tidal, solar thermal, solar photovoltaic, nuclear, and geothermal energy sources.
Credits 3.0

ME 7130: HVAC Analysis and Design

This course covers analysis and design issues associated with heating, ventilating, and air conditioning (HVAC) systems. The topics covered include fundamentals, building heating and cooling loads, equipment, design and control, special applications, and the state-of-the-art.
Credits 3.0

Last Offered
Spring 2024, Summer 2021

ME 7140: Thermal Energy Storage

Basic principles of solar energy and Thermal Energy Storage (TES), sensible TES, latent TES, thermochemical TES, cold TES, TES and enviornmental impact, TES and energy savings, Energy and Exergy analysis of TES, case studies.
Credits 3.0

Last Offered
Fall 2022, Fall 2020

ME 7150: Sustainable Energy

Fundamentals of solar, wind, nuclear, and hydro/geothermal energy generation; energy storage; economics and financing of sustainable energy.
Credits 3.0

Last Offered
Fall 2024

ME 7205: Advanced Dynamics

Particle dynamics, system of particles, impulse and momentum, energy concepts, Lagrange's equations, kinematics of rigid body motion, dynamics of a rigid body. Approval of instructor. Prerequisite may be waived with permission of the chair. Undergraduate students must obtain permission of the department chair.
Credits 3.0

ME 7206: Dynamics of Rotating Machinery

Coordinate systems and kinematics of rotor motion, critical speeds and unbalance excitation, effect of asymmetry in rotor and stator, gyroscopic effect, stability and energy concepts, hydrodynamic bearings, finite element modeling, nonlinear phenomena in machinery. Undergraduate students must obtain permission of the department chair.
Credits 3.0

Last Offered
Fall 2021, Spring 2016, Spring 2014, Fall 2011

ME 7207: Simulation of Multibody System

Complex Mechanical Systems Motion simulation: Modeling, analysis, and control system for multibody mechanical systems including robots, automobiles, and various forms of mechanisms.
Credits 3.0

Last Offered
Fall 2024, Fall 2022

ME 7208: Space Flight Mechanics

Study of two-body and restricted three-body problems including orbital motion, orbit determination, and Langrange points, topics related to space craft dynamics and control including torque-free motion, attitude control, control moment gyros, thruster management
Credits 3.0

ME 7240: Constructal Theory and Design

Basic principles of fluid mechanics, heat transfer and thermodynamics; internal spacings for natural and forced convection; tree networks for fluid flow; multiscale configuations for heat transfer; multi-objective configuations; vascularized materials: mechanical and flow structures; electrokinetic transfer.
Credits 3.0

Last Offered
Spring 2024, Spring 2022

ME 7250: Nano/Microscale Mater Behavior

Atomic arrangements in crystalline solids, imperfections in crystalline solids, the relationship between nano-/micro-structure and materials properties, the synthesis and behavior of nanomaterials, and the characterization at the nano-/micro-scales; demonstration labs on materials behavior at the nano-/micro-scale using X-ray diffraction, atomic force microscope, bubble raft, and nanoindenter.
Credits 3.0

Last Offered
Fall 2021, Fall 2018, Spring 2016, Spring 2014

ME 7260: Mechanic Behavior of Materials

Mechanisms of linear and nonlinear elasticity, plasticity, viscoelastic-plasticity, creep, fatigue and fracture of materials. Atomistic and molecular fundamentals of mechanical behavior of crystalline and amorphous metallic materials, ceramics, and polymeric materials.
Credits 3.0

Last Offered
Fall 2023, Fall 2020, Fall 2017

ME 7270: Polymer Engineering

Advanced polymer processing-structure-property relationship. Polymer chain structures, polymer crystaline structures, glass transition, viscoelasticity, mechanical properties, electrical properties, polymer extrusion, and polymer injection as well as polymer composite processing.
Credits 3.0

Last Offered
Fall 2024, Fall 2022, Fall 2020

ME 7280: Additive Manufacturing

Additive manufacturing processes and workflow. Relevant standards. Bioprinting. Design for additive manufacturing. Software tools. Materials issues. Practical fused filament fabrication techniques. Stress and strain calculations.
Credits 3.0

Last Offered
Spring 2024, Fall 2022

ME 7400: Intro to Computer Integ Mfg

Production line analysis, line balancing, group technology, MRP, numerical control, robotics, automated inspection and material handling.
Credits 3.0

ME 7401: Num Control & Robotic Applns

Principles, types and features of NC systems; NC programming; CNC and DNC; principles and configurations of industrial robots; robot programming; end-effectors and sensors for robots; manufacturing applications of robots; justification of NC and robot systems.
Credits 3.0

ME 7402: Comp-Aided Prod Planning

Static and dynamic production planning models, operations scheduling, inventory control, forecasting, queuing theory. Undergraduate students must obtain permission of the department chair.
Credits 3.0

ME 7501: Reinforced Comp Materials

Particulate, filamentary, short-fiber, and laminated composites; elastic, and thermal structure/property relationships; stress analysis and design of material systems; static and fatigue failure; destructive and NDE test techniques. Undergraduate students must obtain permission of the department chair.
Credits 3.0

Last Offered
Spring 2024, Spring 2022, Spring 2020, Spring 2019
Prerequisite Courses
ME 7000

ME 7502: Fiber Composite Structures

Orthotropic stress-strain relations, hygrothermal effects, laminate analysis, manufacturing residual stresses, stress analysis, finite element analysis, composite structure failure, designing, joining, and repair. Prerequisites: Matrix algebra and undergraduate solid mechanics. Undergraduate students must obtain permission of the department chair.
Credits 3.0

Last Offered
Fall 2024, Fall 2022, Fall 2020, Fall 2018
Prerequisite Courses
ME 7000

ME 7550: Biomechanics of Hard Tissues

Mechanical properties and structure-property relationships of bone; analytical and computational models of mechanical behavior of bone including fracture mechanics, damage, and failure theories; composite models of bone; applications of bone mechanics. Restricted to ME Senior with 3.0 GPA or higher.
Credits 3.0

Last Offered
Spring 2022, Spring 2020, Spring 2018, Spring 2016

ME 7560: Biomechanics of Soft Tissues

Mechanical properties and structure/function relationships of biological soft tissues, including: connective tissues, muscle brain tissue, vasculature, and the heart. Numerical and computational modeling of mechanics of these tissues under physiological and non-physiological loading conditions. Analysis of novel engineered tissues.
Credits 3.0

Last Offered
Fall 2023, Fall 2018, Fall 2016

ME 7600: Thermal Mgmnt of Electronics

Fundamentals of thermal design issues associated with electronic equipment; including free and forced convection, liquid immersion, heat pipes, thermoelectrics, reliability, cold plates and numerical solution methods.
Credits 3.0

Last Offered
Spring 2022, Fall 2018, Fall 2016, Fall 2014

ME 7700: Tran Phen in Bio Systems

This course provides an introduction to the modeling and interpretation of transport in living tissue and cells. Topics include momentum, heat and mass transfer in arteries, water and solute exchange in the microcirculation, mass transfer across cell membrane, renal physiology and gas exchange in the lung. Prerequisite: Undergraduate fluid mechanics or transport courses, or instructor's consent.
Credits 3.0

Last Offered
Spring 2023, Spring 2021, Spring 2019, Fall 2017

ME 7800: Systems Engineering

Determining technical requirements for engineering systems; Planning technical product design and requirements; Analyzing functionality, interoperability, and sustainability; Integrating disparate engineering components; Testing and evaluation of engineering systems to evaluate conformance with requirements; Organizational structure for execution of complex engineering programs.
Credits 3.0

Last Offered
Fall 2023, Fall 2021, Fall 2019, Spring 2017

ME 8000: Adv. Engineering Analysis II

Tensor calculus with applications to dynamics and elasticity, Calculus of Variations, Complex analysis, Conformal mapping, Perturbation theory, Asymptotic expansions.
Credits 3.0

ME 8010: Special Topics in ME

Advanced and current topics in Mechanical Engineering.
Credits 3.0

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

ME 8020: Financial Engineering II

Introductions to advance investment products (derivatives) and strategies. Develop more advanced big data programming skills in R for developing and validating technical tools in finance. Topics: Derivatives, Arbitrage, Programing strategies for investment strategies/big data applications, Value at risk, Mean semi-variance, and Stochastic Dominance.
Credits 3.0

Last Offered
Spring 2023, Spring 2021
ME 7020 :B and ME 7000

ME 8038: Adv Computational FluidDynamic

Foundations of computational fluid mechanics and heat transfer; classification and solutions of model equations; application of numerical methods to the governing equations of fluid mechanics and heat transfer.
Credits 3.0

Last Offered
Spring 2023

ME 8040: Adv Fin Element Analysis

Nonlinear applications of the finite element method. Emphasis on formulation, solution algorithms, and convergence. Hands-on experience using programs for solution of problems.
Credits 3.0

ME 8100: Fund of Cond & Rad Heat Trans

Fundamental theory of steady and unsteady conduction with applications. Fundamental theory of diffuse radiation heat transfer with applications.
Credits 3.0

Last Offered
Fall 2023, Fall 2019, Fall 2017, Spring 2016

ME 8103: Advanced Fluid Mechanics

Fundamentals of fluid mechanics, conservation of mass, momentum, and energy; incompressible inviscid and viscous flows; Navier-Stokes equations, laminar and turbulent boundary layers, high speed flows.
Credits 3.0

Last Offered
Fall 2024, Spring 2022, Spring 2020, Spring 2018

ME 8104: Statistical Thermodynamics

A techanical introduction to selected topics within the broad subject of statistical thermodynamics, including the molecular interpretation of thermodynamic equilibrium, development of the partition function, introduction to quantum mechanics and molecular partition functions. The formulation of statistical thermodynamics and applications to ideal gases, solids, liquid, and related transport properties.
Credits 3.0

ME 8120: Convection Heat Transfer

Fundamentals of convection; conservation of mass, momentum and energy in integral and differential forms; laminar and turbulent, forced, and natural convection in internal and external flows; introduction to mass transfer. Prerequisite or Corequisite ME 7000.
Credits 3.0

Last Offered
Spring 2023, Spring 2021, Spring 2020, Spring 2017
Prerequisite Courses
ME 7000

ME 8145: Thermoelasticity & Thermal Str

Heat transfer mechanisms in structures: conduction, convection and radiation. Fundamentals of thermoelasticity for isotropic and anisotropic materials. Thermal stresses in one-dimensional members and plane thermoelastic problems. Thermal stresses in plate, spherical and cylindrical structures. Thermally induced instability and thermally induced vibrations in engineering structures.
Credits 3.0

ME 7000 :Y

ME 8150: Multiphase Flow & Heat Trans.

Elements of boiling heat transfer; pool boiling; bubble dynamics; convective boiling; boiling of mixtures; micro-channels boiling; condensation heat transfer.
Credits 3.0

Last Offered
Fall 2023, Spring 2019, Fall 2016, Fall 2014

ME 8200: Elasticity & Stress Analysis

Stress analysis fundamentals and solution methods. Strain, stress, elastic constitutive relations, equilibrium, compatibility, boundary value problems, uniqueness, two-dimensional and axisymmetric problems, flexure, torsion; energy methods, applications to structures, pressure vessels, rotating machinery. Approval of instructor.
Credits 3.0

Last Offered
Fall 2021, Spring 2019, Fall 2016, Fall 2014
ME 7000 :Y :C

ME 8204: Robotics:Analysis & Control

Forward and inverse kinematics of non-redundant and redundant robotic arms; kinematics and dynamics of wheeled robots; path planning and control of mobile robots; alternative locomotion mechanisms. Approval of instructor.
Credits 3.0

Last Offered
Spring 2022, Spring 2020, Spring 2018, Spring 2015

ME 8207: Vibration Analysis

Linearization and stability, multi-degree-of-freedom systems, eigenvalue problem, forced response, continuous systems, discretization techniques, finite element method for vibration analysis.
Credits 3.0

Last Offered
Fall 2024, Fall 2022, Fall 2020, Fall 2016

ME 8250: Microscale Heat Transfer

Kinetic theory of ideal gases; introduction to statistical thermodynamics; phonon, electron, and photon transport in solids.
Credits 3.0

ME 8350: Applied Fracture Mechanics

Analysis of stress field near a crack tip, concepts of stress intensity and strain energy release rate, fracture modes, brittle and ductile fractures, fracture toughness test, fracture mechanics design, fatigue and fatigue crack growth. Approval of instructor.
Credits 3.0

Last Offered
Summer 2022, Summer 2021, Fall 2014, Fall 2012

ME 8450: Nano/Microscale Mechanics

Mechanics of imperfections in crystals (point defects and dislocations), diffusion theory, time dependent plasticity (creep and viscoelasticplasticity), size-dependence of mechanical behavior, as well as mechanics of thin films/coatings, and mechanics of nanomaterials (nucleation and growth). Demonstration labs on mechanical behavior at the nano-/micro-scale using atomic force microscope and nanoindenter.
Credits 3.0

ME 9000: Independent Study

Individual supervised study on special topics in Mechanical Engineering. May include some research related to the topics. Approval of chair and faculty advisor.
Credits 3.0

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

ME 9031: Thesis Research I

Supervised participation in thesis research, registration to be approved by department chairperson and thesis advisor.
Credits 3.0

Last Offered
Fall 2024, Spring 2024, Fall 2023, Spring 2023

ME 9032: Thesis Research II

Second course of supervised participation in thesis research, registration to be approved by department chair and thesis advisor.
Credits 3.0

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

ME 9080: Thesis Continuation

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

ME 9085: Independent Study Continuation

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

ME 9086: ME Graduate Practicum

Provides work experience for a graduate student who has been offered an opportunity to work in the mechanical engineering field in industry. Required for curricular practical training.
Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

ME 9087: ME Grad Pract Continuation

Continuation of Mechanical Engineering Graduate Practicum. Required for extension of Curricular Practical Training (CPT).
Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

ME 9100: ME Graduate Seminar

The graduate seminar aims to immerse ME PhD students in cutting-edge research by attending ME department seminars given by distinguished speakers. The course will foster critical thinking, analytical skills, and the ability to learn from ongoing progress in the field.
Last Offered
Fall 2024

NUR

NUR 9014

NUR 9505: Statistical Analysis I

Principles of inferential statistical analysis including descriptive statistics, correlation coefficients, t-test, chi-squared, F sampling distribution, and effect size.
Credits 3.0

PHI

PHI 8420: Healthcare Ethics

A comparison and contrast of various theoretical approaches to healthcare ethics. Issues include healthcare rationing, human beginnings, death with dignity, refusing medical interventions, and professional-patient/client interactions.
Credits 3.0

PSY

PSY 8100: Stat & Experimental Des

Basic principles in experimental design; foundations and applications of analysis of variance, covariance, and multiple regression.
Credits 3.0

SUSE

SUSE 7110: Fundamentals-Sustainable Engr

Introduction to the current state of science & public policy directions; development of a comprehensive framework for evaluating the challenges and opportunities resulting from Global Climate Change and Sustainability; application of technical/economic tools for solving high-potential opportunities.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022

SUSE 7111: Life Cycle/Impact Assessment

Methodology for assessing and modifying the impacts of product development, new project construction, operations upgrade and infrastructure improvement within a sustainable development framework consistent with US and global requirements.
Credits 3.0

Last Offered
Spring 2024, Spring 2023

SUSE 7112: Econ/Social Equity Integrators

Developing a careful balance among the environmental, economic and social equity issues of a proposed product, service or infrastructure project; focus on specific tools and case studies; creating a holistic solution.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022
EGR 7110 or SUSE 7110 or EGR 7111 or SUSE 7111

SUSE 7113: Sustainable Materials & Design

Comprehensive, systems-focused basis for selecting materials in new uses or as more sustainable alternatives; more eco-efficient alternatives, including technologies to reduce material intensity, renewably sourced materials, recyclable materials and material solutions inspired by nature (biomimetic). Non-engineering majors will require permission by the instructor.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022

SUSE 7115: Sustainable Engineering System

An overview of systems engineering theory and techniques in Sustainable Engineering with a central focus on sustainability related applications.
Credits 3.0

Last Offered
Spring 2024, Spring 2023
EGR 7110 or SUSE 7110

SUSE 7117: Trans Tech for Sust Solutions

Transformative technology will be examined to contrast and compare potential new solutions to sustainability issues. Appropriate technology as well as learnings from nature will then be applied to develop improved solutions in a project-based learning environment.
Credits 3.0

SUSE 7120: Intro to Sus Eng for Intl Dev

Introduction to engineering in a developing community context; frameworks for applying engineering and technology to achieve sustainable development goals; geo-political, historical, institutional, economic, cultural, and ethical perspectives. NOTE: Intro course for the Sustainable Development track and should be the first course taken for this 4 course track program.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022

SUSE 7121: Sus WASH & Enviro Egr for Dev

Applied fundamentals in water, sanitation and environmental health for global development. Includes engineering design tools for water and sanitation infrastructure and leadership tools for sustainable solutions to global WASH challenges. Note: course part of International Development Track in Sustainable Engineering. Pre-requisite: EGR/SUSE 7120 or prior consent of instructor. Must be enrolled in one of the following levels: Graduate Engineering, or have prior consent of instructor.
Credits 3.0

Last Offered
Spring 2023
EGR 7120 or SUSE 7120

SUSE 7122: Product Dev for Low Rsrc Set

Design thinking and empathetic design considerations; appropriate technologies; sustainable business model development; case studies of sustainable products developed for low resource settings. Note: course part of International Development Track in Sustainable Engineering Pre-requisite: EGR/SUSE 7120 or prior consent of instructor. Must be enrolled in one of the following levels: Graduate Engineering, or have prior consent of instructor.
Credits 3.0

EGR 7120 or SUSE 7120

SUSE 7123: ICT and Energy for Development

Open source software and mobile tools and platforms for development; low cost renewable energy technologies for energy access; applications in health care, water and sanitation, education, agriculture, financial inclusion and monitoring and evaluation.
Credits 3.0

SUSE 7200: Biomimicry

Using observations from nature to provide sustainable solutions to our everyday needs. Key outcomes include whole system understanding of current solutions (benefits/issues), nature's capabilities, and new solutions by applying nature's capabilities to today's needs. Restricted to Engineering students or permission of instructor.
Credits 3.0

Last Offered
Spring 2024, Spring 2023

SUSE 8111: ADV LCA & Intro to Prod Design

This course is designed as an in-depth exploration of LCA issues and applications. Students will complete a baseline LCA semester team project then use sustainable product design techniques to reduce overall impacts of the product or material.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022
EGR 7111 or SUSE 7111

SUSE 8112: Supply Chain Sustainability

Sustainability practices from upstream sourcing from suppliers to manufacturing through delivery to customers and disposal and how these impact a company's triple bottom line. Topics include product/process design, green procurement, network management, life cycle assessment, performance measurement, risk management, among others.
Credits 3.0

Last Offered
Spring 2024, Spring 2023
EGR 7110 or SUSE 7110

SUSE 8113: Sust. Buildings & Operations

Focuses on implementing sustainability and reducing impacts of buildings. Students will evaluate green building standards for New Construction and Existing Buildings and learn the principals of making buildings more sustainable. Restricted to College of Engineering students. Otherwise permission of instructor.
Credits 3.0

SUSE 8130: GHG Management Fundamentals

Fundamental knowledge and skills for the design and implementations of a greenhouse gas (GHG) management program for a corporation or other large organization in accordance with global standards. Topics include GHG inventories, science-based reduction targets, reporting and disclosure, and market and policy mechanisms.
Credits 3.0

Last Offered
Spring 2024, Spring 2023

SUSE 8131: Climate Change & Sust Engr

Interpretation and assessment of climate change science and its application to Sustainable Engineering solutions. Topics include climate science, climate modeling and reporting, climate tools and data analysis, adaption and mitigation climate technologies, risk assessment and sustainable whole systems thinking.
Credits 3.0

Last Offered
Summer 2024, Summer 2023

SUSE 8132: GHG Mitigation-Strategy&Tech

Development/implementation of GHG mitigation strategies within companies and across value chains including emissions reduction and carbon removal opportunities. Transformative technology and policy/market innovations in sectors including energy, transportation, industry, buildings, agriculture, and land management toward a net-zero emissions economy.
Credits 3.0

Last Offered
Fall 2024, Fall 2023, Fall 2022

SUSE 9015: Sustainable Infrastructure Sys

This course equips students with a mindset and evaluative tools to analyze and design a new generation of sustainable infrastructure, which is a complex, dynamic service system with multiple sectors, development stages, and impact potentials on the natural world.
Credits 3.0

Last Offered
Summer 2024, Summer 2023

SUSE 9020: Sust Eng Independent Study

Credits 3.0

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

SUSE 9024: Sust Eng Thesis I

Credits 3.0

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

SUSE 9025: Sust Eng Thesis II

Credits 3.0

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

SUSE 9030: Capstone

Independent project applying program learned sustainable engineering principles to real world business and process sustainability challenges. Combination of applying technical sustainable engineering skills, whole systems thinking and project management. Faculty advised with white paper and final presentation as course deliverables.
Credits 3.0

Last Offered
Summer 2024, Spring 2024
SUSE 7110 and SUSE 7111 and SUSE 7112

SUSE 9040: RISE Practicum

The Resilient Innovation through Sustainable Engineering (RISE) Practicum enables graduate students outside of Sustainable Engineering (SE) to participate in addressing real world industry sustainability challenges alongside SE faculty, students and companies. Must have faculty permission to enroll.
Credits 1.0

SUSE 9080: Sust Eng Thesis Continuation

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

SUSE 9085: Sust Eng Ind Study Contin

Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

SUSE 9090: Sust Engr Summer Research

Continuation of Sustainable Engineering degree-required research during the Summer
Last Offered
Summer 2024, Summer 2023

SUSE 9095: Sust Engr - Graduate Practicum

Provides work experience for a graduate student who has been offered an opportunity to work in the field of Sustainable Engineering. Required for curricular practical training. Permisson of Graduate Advisor.
Last Offered
Fall 2024, Summer 2024, Spring 2024, Fall 2023

SUSE 9100: SUSE Seminar

The Sustainable Engineering Seminar series allows students/guests to present on research, conferences, or topics they find interesting. The aim is to build community and share knowledge/ideas

Last Offered

Fall 2024