ELECTRICAL ENGINEERING, BACHELOR OF SCIENCE (B.S.)

The profession of electrical engineering touches all aspects of our lives in that electrical engineers design and fabricate devices and systems critical in applications such as computing, communications, health care, manufacturing and automation, power generation and utilization, transportation, and entertainment. An element very important to these and many other applications is the microelectronic device or system.

In the sub-area of microelectronics, electrical engineers design and fabricate electronic materials such as semiconductors, conductors and superconductors used in the manufacture of electronic devices. As a natural progression, electrical engineers design and fabricate electronic devices such as transistors, which control or modulate the flow of energy; sensors of light, mechanical force, chemicals, etc.; electromagnetic radiation sources such as lasers, light emitting diodes and microwave power sources. Following this progression, we find electrical engineers designing and fabricating integrated circuits such as microprocessors and memory elements; flat-panel displays, etc., which are found in applications ranging from supercomputers to watches, clocks and toys. Further in this progression we find electrical engineers designing and fabricating today's and tomorrow's computers.

Computer systems and application-specific integrated circuits are the elements that enable the existence of today's communication systems, such as the Internet, satellite systems, telemedicine, wired and wireless (cellular) telephones, along with standard and high definition television. Additionally, along with sensors, microwave power sources and actuators, they permit our present and future automated manufacturing lines, air and traffic control systems, and automotive safety and traffic control through collision avoidance radar systems, antilocking brake systems, air bag actuators, automatic traffic routing and the "smart highway" of the future.

Electrical engineers play an ever increasing role in the design and building of major facets of today's and tomorrow's health care systems and medical research through the application of microelectronic instrumentation and diagnostic tools such as MRI and CAT scan systems. The field of electrical engineering truly permeates every facet of our lives and thus provides excellent employment opportunities to the general practitioner or specialist in more than 35 different subspecialties.

Student learning outcomes

Upon completing this program, students will know and know how to do the following:

1. Identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors
3. Communicate effectively with a range of audiences
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. Acquire and apply new knowledge as needed, using appropriate learning strategies

Special requirements

Program D grade policy: Students must receive a minimum grade of C in all engineering, computer science, physics, mathematics and all technical electives to graduate.

Degree requirements for Electrical Engineering, Bachelor of Science (B.S.)

Course	Title	Hours
General education (https://bulletin.vcu.edu/undergraduate/undergraduate-study/general-education-curriculum/)		
Select 30 credits of general education courses in consultation with an adviser.		30
Major requirements		
• Major core requirements		
EGRE 101	Introduction to Engineering	3
EGRE 201	Fundamentals of Electrical and Computer Engineering	3
EGRE 206	Electric Circuits	4
EGRE 207	Electric Circuits II	4
EGRE 245	Engineering Programming	4
EGRE 246	Advanced Engineering Programming	3
EGRE 254	Digital Logic Design	4
EGRE 303	Electronic Devices	3
EGRE 306	Introduction to Microelectronics	4
EGRE 309	Introduction to Electromagnetic Fields	3
EGRE 310	Electromagnetic Fields and Waves	3
EGRE 335	Signals and Systems	4
EGRE 336	Introduction to Communication Systems	3
EGRE 337	Statistical Information Processing	3
EGRE 364	Microcomputer Systems	4
EGRE 399	Fundamentals of Design and Analysis	3
ENGR 395	Professional Development	1
• Additional major requirements		
Select one of the following sequences:		4
EGRE 404 & EGRE 405	Senior Design Studio I (Laboratory/Project Time) and Senior Design Studio II (Laboratory/Project Time)	
EGRE 406 & EGRE 407	Senior Design Studio I - VIP (Laboratory/Project Time) and Senior Design Studio II - VIP (Laboratory/Project Time)	
Technical electives (see list and requirements below)		14
Math/science elective (see list below)		3
Ancillary requirements		
CHEM 101	General Chemistry I	3

ECON 205	The Economics of Product Development and Markets (satisfies BOK for social/behavioral sciences and/or AOI for global perspectives)	3
MATH 200	Calculus with Analytic Geometry I (satisfies general education quantitative foundations)	4
MATH 201	Calculus with Analytic Geometry II	4
MATH 301	Differential Equations	3
MATH 307	Multivariate Calculus	4
MATH 310	Linear Algebra	3
PHIL 201	Introduction to Ethics (satisfies general education BOK for humanities/fine arts and AOI for diversities in the human experience)	3
PHYS 207	University Physics I (may also satisfy general education BOK for natural sciences and AOI for scientific and logical reasoning)	5
Open electives		
Select any course.		3
Total Hours		**127**

The minimum number of credit hours required for this degree is 127.

Capstone project (four credits)

The program culminates in the capstone project. In order to prepare for the appropriate focus area of the capstone project, students, with the help of their academic adviser, should plan a course of study beginning in the fall semester of their junior year.

Technical electives (14 credits)

The technical electives in the junior and senior year must be chosen from the approved lists. The following criteria must be met:

- At least eight credit hours must be from approved electrical engineering electives (with or without lab).
- Courses not from the approved lists must be approved by the adviser and department chair.
- Courses must be technical courses at the 300-level or above.
- No more than three credit hours may come from independent study courses.
- If a student wants to apply ENGR 497 toward their technical electives, a minimum of four credit hours must be earned.
- A maximum of eight credits of ENGR 410, ENGR 497 and independent study courses may be used toward technical electives.

NOTE: Some of the listed courses may have prerequisites that do not count as technical electives.

Course	Title	Hours
Approved electrical engineering electives with lab		
EGRE 307	Integrated Circuits	4
EGRE 334	Introduction to Microfabrication	4
EGRE 365	Digital Systems	4
EGRE 426	Computer Organization and Design	3
EGRE 428	Introduction to Integrated Systems Design	2
EGRE 429	Advanced Digital Systems Design and Analysis	3
EGRE 435	Microscale and Nanoscale Fabrication	4
EGRE 454	Automatic Controls	4
EGRE 535	Digital Signal Processing	3
Approved electrical engineering electives without lab		
EGMN 315	Process and Systems Dynamics	3
EGMN 427	Robotics	3
EGRE 347	Applied Embedded Programming	3
EGRE 371	Power and Energy System Fundamentals	3
EGRE 436	Advanced Microscale and Nanoscale Fabrication	3
EGRE 444	Communication Systems	3
EGRE 455	Control Systems Design	3
EGRE 471	Power System Analysis	3
EGRE 510	Introduction to Internet of Things	3
EGRE 512	Intelligent Autonomous Systems	3
EGRE 513	Fundamentals of Modern Systems Engineering	3
EGRE 521	Advanced Semiconductor Devices	3
EGRE 525	Fundamentals of Photonics Engineering	3
EGRE 526/CMSC 506	Computer Networks and Communications	3
EGRE 531	Multicore and Multithreaded Programming	3
EGRE 532	GPU Computing	3
EGRE 536	Introduction to Cyber-Physical Systems	3
EGRE 540	Microwave System Design	3
EGRE 541	Medical Devices	3
EGRE 553	Industrial Automation	3
EGRE 554	Advanced Industrial Automation	3
EGRE 555	Dynamics and Multivariable Control I	3
EGRE 573	Sustainable and Efficient Power Systems	3
ENGR 410	Review of Internship (Completion of internship required)	1
Approved electives outside electrical engineering		
CMSC 312	Introduction to Operating Systems	3
CMSC 355	Fundamentals of Software Engineering	3
CMSC 420	Software Project Management	3
EGMN 309	Material Science for Engineers	3
EGMN 321	Numerical Methods	3
EGRB 407	Physical Principles of Medical Imaging	3
EGRB 408	Advanced Biomedical Signal Processing	3
EGRB 507	Biomedical Electronics and Instrumentation	3
ENGR 497	Vertically Integrated Projects	1,2
MATH 351	Applied Abstract Algebra	3
PHYS 307	The Physics of Sound and Music	3

PHYS 320	Modern Physics	3
PHYZ 320	Modern Physics Laboratory	1

Math/science electives (3 credits)

Students must complete 3 credits using one course or a combination of courses from the list below.

Course	Title	Hours
BIOL 151	Introduction to Biological Sciences I	3
BIOZ 151	Introduction to Biological Science Laboratory I	1
BIOL 152	Introduction to Biological Sciences II	3
BIOZ 152	Introduction to Biological Science Laboratory II	1
CHEZ 101	General Chemistry Laboratory I	1
CHEM 102	General Chemistry II	3
CHEZ 102	General Chemistry Laboratory II	1
MATH 300	Introduction to Mathematical Reasoning	3
MATH 305	Elementary Number Theory	3
MATH 324	Mathematical Problem Solving	3
MATH 350	Introductory Combinatorics	3
MATH 351	Applied Abstract Algebra	3
MATH 356	Graphs and Algorithms	3
MATH 370	Mathematical Foundations for Artificial Intelligence	3
PHYS 208	University Physics II	5
PHYS 301	Classical Mechanics I	3
PHYS 302	Classical Mechanics II	3
PHYS 320	Modern Physics	3
PHYZ 320	Modern Physics Laboratory	1

What follows is a sample plan that meets the prescribed requirements within a four-year course of study at VCU. Please contact your adviser before beginning course work toward a degree.

Freshman year		
Fall semester		**Hours**
CHEM 101	General Chemistry I	3
EGRE 101	Introduction to Engineering	3
MATH 200	Calculus with Analytic Geometry I (satisfies general education quantitative foundations)	4
UNIV 111 Play course video for Introduction to Focused Inquiry: Investigation and Communicatio	Introduction to Focused Inquiry: Investigation and Communication (satisfies general education UNIV foundations)	3
General education course (select AOI for creativity, innovation and aesthetic inquiry)		3
	Term Hours:	**16**
Spring semester		
EGRE 201	Fundamentals of Electrical and Computer Engineering	3
EGRE 254	Digital Logic Design	4
MATH 201	Calculus with Analytic Geometry II	4
UNIV 112 Play course video for Focused Inquiry II	Focused Inquiry II (satisfies general education UNIV foundations)	3
General education course (select AOI for scientific and logical reasoning if not already satisfied)		3
	Term Hours:	**17**
Sophomore year		
Fall semester		
EGRE 206	Electric Circuits	4
EGRE 245	Engineering Programming	4
ENGR 395	Professional Development	1
MATH 301	Differential Equations	3
PHYS 207	University Physics I	5
	Term Hours:	**17**
Spring semester		
EGRE 207	Electric Circuits II	4
EGRE 246	Advanced Engineering Programming	3
EGRE 335	Signals and Systems	4
EGRE 337	Statistical Information Processing	3
MATH 310	Linear Algebra	3
	Term Hours:	**17**
Junior year		
Fall semester		
EGRE 306	Introduction to Microelectronics	4
EGRE 336	Introduction to Communication Systems	3
EGRE 364	Microcomputer Systems	4
MATH 307	Multivariate Calculus	4
	Term Hours:	**15**
Spring semester		
EGRE 309	Introduction to Electromagnetic Fields	3
EGRE 399	Fundamentals of Design and Analysis	3
PHIL 201	Introduction to Ethics	3
UNIV 200	Advanced Focused Inquiry: Literacies, Research and Communication	3
Technical electives		3
	Term Hours:	**15**
Senior year		
Fall semester		
EGRE 303	Electronic Devices	3
EGRE 310	Electromagnetic Fields and Waves	3
EGRE 404 or EGRE 406	Senior Design Studio I (Laboratory/Project Time) or Senior Design Studio I - VIP (Laboratory/Project Time)	2
Technical electives		7
	Term Hours:	**15**
Spring semester		

ECON 205	The Economics of Product Development and Markets	3
EGRE 405 or EGRE 407	Senior Design Studio II (Laboratory/Project Time) or Senior Design Studio II - VIP (Laboratory/Project Time)	2
Technical electives		4
Math/science elective		3
Open elective		3
	Term Hours:	**15**
	Total Hours:	**127**

The minimum number of credit hours required for this degree is 127.

Accelerated B.S. and M.S.

The accelerated B.S. and M.S. program allows qualified students to earn both the B.S. in Electrical Engineering and M.S. in Biomedical Engineering in a minimum of five years by completing approved graduate courses during the senior year of their undergraduate program. Students in the program may count up to 12 hours (non-thesis option) or 12 hours (thesis option) of graduate courses toward both the B.S. and M.S. degrees. Thus, the two degrees may be earned with a minimum of 148 credits rather than the 160 credits necessary if the two degrees are pursued separately.

Students holding these degrees will have a head start for pursuing careers in industry or continuing in academia. The M.S. degree provides formal research experience and can lead to expanded job opportunities, greater potential for job advancement and higher starting salaries.

Entrance to the accelerated program

Interested undergraduate students should consult with their adviser as early as possible to receive specific information about the accelerated program, determine academic eligibility and submit (no later than two semesters prior to graduating with a baccalaureate degree, that is, before the end of the spring semester of their junior year) an Accelerated Program Declaration Form to be approved by the graduate program director. Limited spaces may be available in the accelerated program. Academically qualified students may not receive approval if capacity has been reached.

Minimum qualifications for entrance to this accelerated program include an overall GPA of 3.0. Additionally, for students pursuing the thesis option of the master's program, a letter of endorsement from a prospective thesis adviser from the biomedical engineering faculty must accompany the application. Students who are interested in the accelerated program should consult with the faculty adviser to the biomedical engineering graduate program before they have completed 95 credits. Successful applicants would enter the program in the fall semester of their senior year.

Once enrolled in the accelerated program, students must meet the standards of performance applicable to graduate students as described in the "Satisfactory academic progress (https://bulletin.vcu.edu/academic-regs/grad/satisfactory-academic-progress/)" section of the Graduate Bulletin, including maintaining a 3.0 GPA. Guidance to students admitted to the accelerated program is provided by both the ECE undergraduate program director and the BME graduate program director.

Admission to the graduate program

Entrance to the accelerated program enables the student to take the approved shared courses that will apply to the undergraduate and graduate degrees. However, entry into an accelerated program via an approved Accelerated Program Declaration Form does not constitute application or admission into the graduate program. Admission to the graduate program requires a separate step that occurs through a formal application. In order to continue pursuing the master's degree after the baccalaureate degree is conferred, accelerated students must follow the admission to graduate study requirements outlined in the VCU Bulletin. A reference letter from an electrical engineering faculty member must accompany the application.

Degree requirements

The Bachelor of Science in Electrical Engineering degree will be awarded upon completion of a minimum of 130 credits and the satisfactory completion of all undergraduate degree requirements as stated in the **Undergraduate Bulletin**.

A maximum of 12 credits of graduate level courses may be taken prior to completion of the baccalaureate degree. These graduate credits will count as open or technical elective credits for the undergraduate degree. These courses are shared credits with the graduate program, meaning that they will be applied to both undergraduate and graduate degree requirements.

The graduate courses that may be taken as an undergraduate, once a student is admitted to the program, must be approved by the adviser or graduate program director and include 500-level courses from the following subject areas: EGMN, EGRM, ENGR, EGRN, EGRB, EGRE, CLSE, CMSC, PHYS, MATH, NANO, CHEM, BIOL, GRAD, LFSC, INNO and OVPR.

Recommended plan of study for thesis master's

What follows is the recommended plan of study for students interested in the accelerated program beginning in the fall of the senior year prior to admission to the accelerated program in the senior year.

Course	Title	Hours
Senior year		
Fall semester		
EGRE 404	Senior Design Studio I (Laboratory/Project Time)	2
or EGRE 406	Senior Design Studio I - VIP (Laboratory/Project Time)	
ENGR 402	Senior Design Studio (Seminar)	1
Technical elective (consider BME course for accelerated pathway)		6
Other required B.S. course work		7
Term Hours:		16
Spring semester		
EGRE 405	Senior Design Studio II (Laboratory/Project Time)	2
or EGRE 407	Senior Design Studio II - VIP (Laboratory/Project Time)	
ENGR 403	Senior Design Studio (Seminar)	1
Technical elective (consider BME course for accelerated pathway)		6
Other required B.S. course work		7

Term Hours:		16
Fifth year		
Fall semester		
EGRB 601	Numerical Methods and Modeling in Biomedical Engineering	4
EGRB 697	Directed Research in Biomedical Engineering	3
Open elective [1]		3
Term Hours:		10
Spring semester		
EGRB 602	Biomedical Engineering Systems Physiology	4
EGRB 690	Biomedical Engineering Research Seminar	1
EGRB 697	Directed Research in Biomedical Engineering	4
Term Hours:		9

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EGRB, EGMN, ENGR, PHYS, MATH, CMSC, BIOL, PHIS or BIOC at 500-level or above.

Recommended plan of study for non-thesis master's

What follows is the recommended plan of study for students interested in the accelerated program beginning in the fall of the senior year prior to admission to the accelerated program in the senior year.

Course	Title	Hours
Senior year		
Fall semester		
EGRE 404	Senior Design Studio I (Laboratory/ Project Time)	2
or EGRE 406	Senior Design Studio I - VIP (Laboratory/Project Time)	
ENGR 402	Senior Design Studio (Seminar)	1
Technical elective (consider BME course for accelerated pathway)		6
Other required B.S. course work		7
Term Hours:		16
Spring semester		
EGRE 405	Senior Design Studio II (Laboratory/ Project Time)	2
or EGRE 407	Senior Design Studio II - VIP (Laboratory/Project Time)	
ENGR 403	Senior Design Studio (Seminar)	1
Technical elective (consider BME course for accelerated pathway)		6
Other required B.S. course work		7
Term Hours:		16
Fifth year		
Fall semester		
EGRB 601	Numerical Methods and Modeling in Biomedical Engineering	4
EGRB technical electives (500-level or above)		3
Open elective [1]		6
Term Hours:		13
Spring semester		
EGRB 602	Biomedical Engineering Systems Physiology	4
EGRB 690	Biomedical Engineering Research Seminar	1
Open elective [1]		6
Term Hours:		11

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EGRB, EGMN, ENGR, PHYS, MATH, CMSC, BIOL, PHIS or BIOC at 500-level or above.

Accelerated B.S. and M.S.

The accelerated B.S. and M.S. program allows qualified students to earn both the B.S. in Electrical Engineering and M.S. in Computer Science in a minimum of five years by completing approved graduate courses during the senior year of their undergraduate program. Students in the program may count up to 12 hours (non-thesis option) or 12 hours (thesis option) of graduate courses toward both the B.S. and M.S. degrees. Thus, the two degrees may be earned with a minimum of 150 credits rather than the 162 credits necessary if the two degrees are pursued separately.

The program is designed to develop skills and educate computer science students to be major contributors in the computing industry. The graduate program in computer science provides state-of-the-art education through the use of didactic courses to those students who wish to further their knowledge and careers within the computing industry. The program emphasizes continuing self-development and broadening of the knowledge of individuals currently engaged in science, technology and engineering-related fields. It also prepares persons who have completed undergraduate majors in these fields for entry into a career in the numerous areas that use computing technology. Both the theoretical and applied aspects of computer science are emphasized in this program.

Entrance to the accelerated program

Interested undergraduate students should consult with their adviser as early as possible (sophomore year is recommended)

to receive specific information about the accelerated program, determine academic eligibility and submit (no later than two semesters prior to graduating with a baccalaureate degree, that is, before the end of the spring semester of their junior year) an Accelerated Program Declaration Form to be approved by the graduate program director. Limited spaces may be available in the accelerated program. Academically qualified students may not receive approval if capacity has been reached.

Minimum qualifications for entrance to this accelerated program include completion of 30 undergraduate credit hours with an overall GPA of 3.0. For acceptance into this accelerated pathway, students must have completed CMSC 257, CMSC 311, CMSC 355, and CMSC 401 courses with a GPA of at least 3.4. Successful applicants would enter the program in the fall semester of their senior year.

Once enrolled in the accelerated program, students must meet the standards of performance applicable to graduate students as described in the "Satisfactory academic progress (https://bulletin.vcu.edu/academic-regs/grad/satisfactory-academic-progress/)" section of

the Graduate Bulletin, including maintaining a 3.0 GPA. Guidance to students admitted to the accelerated program is provided by both the ECE undergraduate program director and the CS graduate program director.

Admission to the graduate program

Entrance to the accelerated program enables the student to take the approved shared courses that will apply to the undergraduate and graduate degrees. However, entry into an accelerated program via an approved Accelerated Program Declaration Form does not constitute application or admission into the graduate program. Admission to the graduate program requires a separate step that occurs through a formal application. In order to continue pursuing the master's degree after the baccalaureate degree is conferred, accelerated students must follow the admission to graduate study requirements outlined in the VCU Bulletin. A reference letter from an electrical engineering faculty member must accompany the application.

Degree requirements

The Bachelor of Science in Electrical Engineering degree will be awarded upon completion of a minimum of 130 credits and the satisfactory completion of all undergraduate degree requirements as stated in the **Undergraduate Bulletin**.

For students entering the non-thesis option, a maximum of six graduate credits may be taken prior to the completion of the baccalaureate degree. For students entering the thesis option, a maximum of 12 graduate credits may be taken. These graduate credits will count as open or technical elective credits for the undergraduate degree. These courses are shared credits with the graduate program, meaning that they will be applied to both undergraduate and graduate degree requirements.

The graduate courses that may be taken as an undergraduate, once a student is admitted to the program, must be approved by the adviser or graduate program director and include 500-level courses from the following subject areas: EGMN, EGRM, ENGR, EGRN, EGRB, EGRE, CLSE, CMSC, PHYS, MATH, NANO, CHEM, BIOL, GRAD, LFSC, INNO and OVPR.

Recommended course sequence/plan of study for students pursuing a thesis master's

What follows is the recommended plan of study for students interested in the accelerated program beginning in the fall of the junior year prior to admission to the accelerated program in the senior year.

Course	Title	Hours
Senior year		
Fall semester		
EGRE 404	Senior Design Studio I (Laboratory/ Project Time)	2
or EGRE 406	Senior Design Studio I - VIP (Laboratory/Project Time)	
ENGR 402	Senior Design Studio (Seminar)	1
Technical elective (consider CS course for accelerated pathway)		6
Other required B.S. course work		7
Term Hours:		16
Spring semester		
EGRE 405	Senior Design Studio II (Laboratory/ Project Time)	2
or EGRE 407	Senior Design Studio II - VIP (Laboratory/Project Time)	
ENGR 403	Senior Design Studio (Seminar)	1
Technical elective (consider CS course for accelerated pathway)		6
Other required B.S. course work		7
Term Hours:		16
Fifth year		
Fall semester		
CMSC 697	Directed Research	3
M.S. foundational area courses (theory and systems) [1]		6
Term Hours:		9
Spring semester		
CMSC 697	Directed Research	6
M.S. foundational area courses (applied)		3
Term Hours:		9

[1] See the Graduate Bulletin for the list of theory, systems, and applied foundational courses.

Recommended plan of study for non-thesis master's

What follows is the recommended plan of study for students interested in the accelerated program beginning in the fall of the senior year prior to admission to the accelerated program in the senior year.

Course	Title	Hours
Senior year		
Fall semester		
EGRE 404	Senior Design Studio I (Laboratory/ Project Time)	2
or EGRE 406	Senior Design Studio I - VIP (Laboratory/Project Time)	
ENGR 402	Senior Design Studio (Seminar)	1
Technical elective (consider CS course for accelerated pathway)		6
Other required B.S. course work		7
Term Hours:		16
Spring semester		
EGRE 405	Senior Design Studio II (Laboratory/ Project Time)	2
or EGRE 407	Senior Design Studio II - VIP (Laboratory/Project Time)	
ENGR 403	Senior Design Studio (Seminar)	1
Technical elective (consider CS course for accelerated pathway)		6
Other required B.S. course work		7
Term Hours:		16
Fifth year		
Fall semester		
M.S. foundational area courses (theory and systems) [1]		9
Term Hours:		9
Spring semester		

Graduate didactic course work	9
Term Hours:	9

[1]

See the Graduate Bulletin for the list of theory, systems, and applied foundational area courses.

Accelerated B.S. and M.S.

The accelerated B.S.-to-M.S. program allows qualified students to earn both the B.S. in Electrical Engineering and the M.S. in Engineering, concentration in aerospace engineering; chemical and life science engineering; electrical and computer engineering; engineering management; environmental and sustainable engineering; rehabilitation engineering; systems engineering; or tissue engineering and regenerative medicine in a minimum of five years by completing approved graduate courses during the senior year of their undergraduate program. Students in the program may count up to six hours (non-thesis option) or 12 hours (thesis option) of graduate courses toward both the B.S. and M.S. degrees.

Students holding these degrees will have a head start for pursuing careers in industry or continuing in academia. The M.S. degree provides formal research experience and can lead to expanded job opportunities, greater potential for job advancement and higher starting salaries.

Entrance to the accelerated program

Interested undergraduate students should consult with their adviser as early as possible to receive specific information about the accelerated program, determine academic eligibility and submit (no later than two semesters prior to graduating with a baccalaureate degree, that is, before the end of the spring semester of their junior year) an Accelerated Program Declaration Form to be approved by the graduate program director. Limited spaces may be available in the accelerated program. Academically qualified students may not receive approval if capacity has been reached.

Minimum qualifications for entrance to any accelerated program include completion of 95 undergraduate credit hours and a minimum overall GPA of 3.0. Students who are interested in the accelerated program should consult with the faculty adviser to the graduate program before they have completed 95 credits. Successful applicants would enter the program in the following semester after graduation with the bachelor's degree..

Once enrolled in the accelerated program, students must meet the standards of performance applicable to graduate students as described in the “Satisfactory academic progress (https://bulletin.vcu.edu/academic-regs/grad/satisfactory-academic-progress/)” section of the Graduate Bulletin, including maintaining a 3.0 GPA. Guidance to students admitted to the accelerated program is provided by both the undergraduate graduate program adviser and the graduate program director.

Admission to the graduate program

Entrance to the accelerated program enables the student to take the approved shared courses that will apply to the undergraduate and graduate degrees. However, entry into an accelerated program via an approved Accelerated Program Declaration Form does not constitute application or admission into the graduate program. Admission to the graduate program requires a separate step that occurs through a formal application to the master’s program, which is submitted through Graduate Admissions no later than a semester prior to graduation with the baccalaureate degree, that is before the end of the fall semester of the senior year. In order to continue pursuing the master’s degree after the baccalaureate degree is conferred, accelerated students must follow the admission to graduate study requirements outlined in the VCU Bulletin. The GRE and application fee is waived for admission to the program for all students. Additionally, for students pursuing the thesis option of the master’s program, a letter of endorsement from a prospective thesis adviser from a faculty member in the relevant department may accompany the application.

Degree requirements

The Bachelor of Science in Electrical Engineering Engineering degree will be awarded upon completion of all undergraduate degree requirements as stated in the Undergraduate Bulletin.

For students entering the non-thesis option, a maximum of six graduate credits may be taken prior to the completion of the baccalaureate degree. For students entering the thesis option, a maximum of 12 graduate credits may be taken. These graduate credits will count as open or technical elective credits for the undergraduate degree. These courses are shared credits with the graduate program, meaning that they will be applied to both undergraduate and graduate degree requirements.

The graduate courses that may be taken as an undergraduate, once a student is admitted to the program, must be approved by the adviser or graduate program director and include 500-level courses from the following subject areas: EGMN, EGRM, ENGR, EGRN, EGRB, EGRE, CLSE, CMSC, PHYS, MATH, NANO, CHEM, BIOL, GRAD, LFSC, INNO and OVPR.

Curriculum requirements

Concentration in aerospace engineering

Thesis option

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the advisory committee: This component allows the student to take courses in either engineering or science with approval of the student’s adviser.		12
Concentration component		
EGMN 604	Mechanical and Nuclear Engineering Materials	3
EGMN 605	Mechanical and Nuclear Engineering Analysis	3
EGMN 606	Mechanical and Nuclear Engineering Continuum Mechanics	3
EGMN 607	Heat and Mass Transfer Theory and Applications	3
Directed research component		
This component emphasizes research directed toward completion of degree requirements under the direction of an adviser and advisory committee.		
EGMN 697	Directed Research in Mechanical and Nuclear Engineering	6
Total Hours		**30**

Non-thesis option

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.		15
Concentration component		
EGMN 604	Mechanical and Nuclear Engineering Materials	3
EGMN 605	Mechanical and Nuclear Engineering Analysis	3
EGMN 606	Mechanical and Nuclear Engineering Continuum Mechanics	3
EGMN 607	Heat and Mass Transfer Theory and Applications	3
EGMN 661	Computational Fluid Dynamics	3
Total Hours		**30**

Concentration in chemical and life science engineering

Thesis option

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 6 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE, PESC) approved by the advisory committee: This component allows the student to take courses in either engineering or science with approval of the student's adviser.		9
Concentration component - CLSE course work		
CLSE 650	Quantitative Analysis in Chemical and Life Science Engineering	3
CLSE 654	Equilibrium Analysis in Chemical and Biological Systems	3
CLSE 655	Nonequilibrium Analysis in Chemical and Life Science Engineering	3
CLSE 656	Advanced Chemical Reaction Engineering	3
Choose additional CLSE course work at the 500 level or higher		3
Directed research		
Select six credit hours from the following:		6
CLSE 690	Research Seminar in Chemical and Life Science Engineering	
CLSE 697	Directed Research in Chemical and Life Science Engineering	
Total Hours		**30**

Non-thesis option

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE, PESC) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.		12
Concentration component - CLSE course work		
CLSE 650	Quantitative Analysis in Chemical and Life Science Engineering	3
CLSE 654	Equilibrium Analysis in Chemical and Biological Systems	3
CLSE 655	Nonequilibrium Analysis in Chemical and Life Science Engineering	3
CLSE 656	Advanced Chemical Reaction Engineering	3
Choose additional CLSE course work at the 500 level or higher		6
Total Hours		**30**

Concentration in electrical and computer engineering

Thesis option

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the advisory committee: This component allows the student to take courses in either engineering or science with approval of the student's adviser.		12
Concentration component		
EGRE course work (EGRE 500-level or higher or courses approved by the advisory committee): This component allows the student to pursue a series of courses that focus on a specific field of engineering and serve as the student's primary engineering discipline.		12
Directed research component		
This component emphasizes research directed toward completion of degree requirements under the direction of an adviser and advisory committee.		
EGRE 697	Directed Research in Electrical and Computer Engineering	6
Total Hours		**30**

Non-thesis option

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.		15
Concentration component		

EGRE course work (EGRE 500-level or higher or courses approved by the adviser): This component allows the student to pursue a series of courses that focus on a specific field of engineering and serve as the student's primary engineering discipline.	15
Total Hours	**30**

Concentration in engineering management

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.		18
Concentration component		
EGMN 507	Law and Engineering	3
ENGR 601	Engineering Project Management	3
ENGR 602	Engineering Contracts and Effective Negotiations	3
ENGR 696	Engineering Products and Economic Considerations	3
Total Hours		**30**

Concentration in environmental and sustainable engineering

Thesis option

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the advisory committee: This component allows the student to take courses in either engineering or science with approval of the student's adviser.		12
Concentration component		
CLSE 545	Water Essentials	3
CLSE 580	Sustainable Chemical Engineering	3
CLSE 650	Quantitative Analysis in Chemical and Life Science Engineering	3
CLSE 655	Nonequilibrium Analysis in Chemical and Life Science Engineering	3
Directed research component		
This component emphasizes research directed toward completion of degree requirements under the direction of an adviser and advisory committee.		
CLSE 697	Directed Research in Chemical and Life Science Engineering	6
Total Hours		**30**

Non-thesis option

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.		18
Concentration component		
CLSE 545	Water Essentials	3
CLSE 580	Sustainable Chemical Engineering	3
CLSE 650	Quantitative Analysis in Chemical and Life Science Engineering	3
CLSE 655	Nonequilibrium Analysis in Chemical and Life Science Engineering	3
Total Hours		**30**

Concentration in rehabilitation engineering

Thesis option

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 6 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the advisory committee: This component allows the student to take courses in either engineering or science with approval of the student's adviser.		8
Concentration component		
EGRB 520	Assistive Technology	3
EGRB 521	Human Factors Engineering	3
EGRB 523	Rehabilitation Engineering and Prostheses	3
EGRB 603	Biomedical Signal Processing	3
ANAT 610	Systems Neuroscience	4
Directed research		
EGRB 697	Directed Research in Biomedical Engineering	6
Total Hours		**30**

Non-thesis option

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.		14
Concentration component		
EGRB 520	Assistive Technology	3
EGRB 521	Human Factors Engineering	3
EGRB 523	Rehabilitation Engineering and Prostheses	3
EGRB 603	Biomedical Signal Processing	3

ANAT 610	Systems Neuroscience	4
Total Hours		**30**

Concentration in systems engineering

Thesis option

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the advisory committee: This component allows the student to take courses in either engineering or science with approval of the student's adviser.		12
Concentration component		
EGRE 510	Introduction to Internet of Things	3
EGRE 512	Intelligent Autonomous Systems	3
EGRE 513	Fundamentals of Modern Systems Engineering	3
EGRE 615	Systems Modeling	3
Directed research component		
This component emphasizes research directed toward completion of degree requirements under the direction of an adviser and advisory committee.		
EGRE 697	Directed Research in Electrical and Computer Engineering	6
Total Hours		**30**

Non-thesis option

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser: This component allows the student to take courses in either engineering or science with approval of the student's adviser.		18
Concentration component		
EGRE 510	Introduction to Internet of Things	3
EGRE 512	Intelligent Autonomous Systems	3
EGRE 513	Fundamentals of Modern Systems Engineering	3
EGRE 615	Systems Modeling	3
Total Hours		**30**

Concentration in tissue engineering and regenerative medicine

Thesis option

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the advisory committee: This component allows the student to take courses in either engineering or science with approval of the student's adviser.		12
Concentration component - TERM course work		
EGRB 512	Regenerative Engineering and Medicine	3
EGRB 613	Biomaterials	3
EGRB 614	Tissue Engineering	3
EGRB 616	Cell Engineering	3
Directed research		
EGRB 697	Directed Research in Biomedical Engineering	6
Total Hours		**30**

Non-thesis option

Course	Title	Hours
Required graduate-level coursework		
Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser: This component allows the student to take courses in either engineering or science with approval of the student's adviser.		15
Concentration component - TERM course work		
EGRB 512	Regenerative Engineering and Medicine	3
EGRB 613	Biomaterials	3
EGRB 614	Tissue Engineering	3
EGRB 616	Cell Engineering	3
Choose additional course work at the 500 level or higher		3
Total Hours		**30**

Recommended course sequence/plan of study

What follows is the recommended plan of study for students interested in the accelerated program beginning in the fall of the junior/senior year prior to admission to the accelerated program in the senior year.

Course	Title	Hours
Junior year		
Fall semester		
EGRE 306	Introduction to Microelectronics	4
EGRE 309	Introduction to Electromagnetic Fields	3
EGRE 337	Statistical Information Processing	3
EGRE 364	Microcomputer Systems	4
PHIL 201	Introduction to Ethics	3
Term Hours:		17
Spring semester		
ECON 205	The Economics of Product Development and Markets	3
EGRE 303	Electronic Devices	3
EGRE 310	Electromagnetic Fields and Waves	3
EGRE 336	Introduction to Communication Systems	3
Technical elective		4
Term Hours:		16

Senior year		
Fall semester		
EGRE 404	Senior Design Studio I (Laboratory/ Project Time)	2
OR		
EGRE 406	Senior Design Studio I - VIP (Laboratory/Project Time)	
ENGR 402	Senior Design Studio (Seminar)	1
EGRE (5xx)		6
Other required B.S. course work		7
Term Hours:		16
Spring semester		
EGRE 405	Senior Design Studio II (Laboratory/ Project Time)	2
OR		
EGRE 407	Senior Design Studio II - VIP (Laboratory/Project Time)	
ENGR 403	Senior Design Studio (Seminar)	1
EGRE 5xx [1]		6
Other required B.S. course work		7
Term Hours:		16

[1]

EGMN, EGRM, ENGR, EGRN, EGRB, EGRE, CLSE, CMSC, PHYS, MATH, NANO, CHEM, BIOL, GRAD, LFSC and OVPR at 500-level or above

Concentration in aerospace engineering

Course	Title	Hours
Fifth year		
Thesis option		
Fall semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
EGMN 604	Mechanical and Nuclear Engineering Materials	
EGMN 605	Mechanical and Nuclear Engineering Analysis	
EGMN 606	Mechanical and Nuclear Engineering Continuum Mechanics	
EGMN 607	Heat and Mass Transfer Theory and Applications	
Directed research [2]		3
EGMN 697	Directed Research in Mechanical and Nuclear Engineering	
Term Hours:		12
Spring semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
EGMN 604	Mechanical and Nuclear Engineering Materials	
EGMN 605	Mechanical and Nuclear Engineering Analysis	
EGMN 606	Mechanical and Nuclear Engineering Continuum Mechanics	
EGMN 607	Heat and Mass Transfer Theory and Applications	
Directed research [2]		3
EGMN 697	Directed Research in Mechanical and Nuclear Engineering	
Term Hours:		12
Non-thesis option		
Fall semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
EGMN 604	Mechanical and Nuclear Engineering Materials	
EGMN 605	Mechanical and Nuclear Engineering Analysis	
EGMN 606	Mechanical and Nuclear Engineering Continuum Mechanics	
EGMN 607	Heat and Mass Transfer Theory and Applications	
EGMN 661	Computational Fluid Dynamics	
Term Hours:		9
Spring semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
EGMN 604	Mechanical and Nuclear Engineering Materials	
EGMN 605	Mechanical and Nuclear Engineering Analysis	
EGMN 606	Mechanical and Nuclear Engineering Continuum Mechanics	
EGMN 607	Heat and Mass Transfer Theory and Applications	
EGMN 661	Computational Fluid Dynamics	
Term Hours:		9

[1]

Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.

[2]

This component emphasizes research directed toward completion of degree requirements under the direction of an adviser and advisory committee.

Concentration in chemical and life science engineering

Course	Title	Hours
Fifth year		
Thesis option		
Fall semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
CLSE 650	Quantitative Analysis in Chemical and Life Science Engineering	

CLSE 654	Equilibrium Analysis in Chemical and Biological Systems	
CLSE 655	Nonequilibrium Analysis in Chemical and Life Science Engineering	
CLSE 656	Advanced Chemical Reaction Engineering	
Directed research [2]		3
CLSE 690	Research Seminar in Chemical and Life Science Engineering	
CLSE 697	Directed Research in Chemical and Life Science Engineering	
Term Hours:		12
Spring semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
CLSE 650	Quantitative Analysis in Chemical and Life Science Engineering	
CLSE 654	Equilibrium Analysis in Chemical and Biological Systems	
CLSE 655	Nonequilibrium Analysis in Chemical and Life Science Engineering	
CLSE 656	Advanced Chemical Reaction Engineering	
Choose additional CLSE course work at the 500 level or higher		
Directed research [2]		3
CLSE 690	Research Seminar in Chemical and Life Science Engineering	
CLSE 697	Directed Research in Chemical and Life Science Engineering	
Term Hours:		12
Non-thesis option		
Fall semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
CLSE 650	Quantitative Analysis in Chemical and Life Science Engineering	
CLSE 654	Equilibrium Analysis in Chemical and Biological Systems	
CLSE 655	Nonequilibrium Analysis in Chemical and Life Science Engineering	
CLSE 656	Advanced Chemical Reaction Engineering	
Term Hours:		9
Spring semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
CLSE 650	Quantitative Analysis in Chemical and Life Science Engineering	
CLSE 654	Equilibrium Analysis in Chemical and Biological Systems	
CLSE 655	Nonequilibrium Analysis in Chemical and Life Science Engineering	
CLSE 656	Advanced Chemical Reaction Engineering	
Term Hours:		9

1

Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.

2

This component emphasizes research directed toward completion of degree requirements under the direction of an adviser and advisory committee.

Concentration in electrical and computer engineering

Course	Title	Hours
Fifth year		
Thesis option		
Fall semester		
Required graduate-level courses [1]		3
Concentration specifc courses [2]		6
Directed research [3]		3
EGRE 697	Directed Research in Electrical and Computer Engineering	
Term Hours:		12
Spring semester		
Required graduate-level courses [1]		3
Concentration specific courses [2]		6
Directed research [3]		3
EGRE 697	Directed Research in Electrical and Computer Engineering	
Term Hours:		12
Non-thesis option		
Fall semester		
Required graduate-level courses [1]		3
Concentration specific courses [2]		6
Term Hours:		9
Spring semester		
Required graduate-level courses [1]		3
Concentration specific courses [2]		6
Term Hours:		9

1

Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.

2

EGRE course work (EGRE 500-level or higher or courses approved by the advisory committee): This component allows the student to pursue a

series of courses that focus on a specific field of engineering and serve as the student's primary engineering discipline.

3

This component emphasizes research directed toward completion of degree requirements under the direction of an adviser and advisory committee.

Concentration in engineering management

Course	Title	Hours
Fifth year		
Fall semester		
Required graduate-level courses [1]		3
Concentration specifc courses		6
EGMN 507	Law and Engineering	
ENGR 601	Engineering Project Management	
ENGR 602	Engineering Contracts and Effective Negotiations	
ENGR 696	Engineering Products and Economic Considerations	
Term Hours:		9
Spring semester		
Required graduate-level courses		3
Concentration specific courses		6
EGMN 507	Law and Engineering	
ENGR 601	Engineering Project Management	
ENGR 602	Engineering Contracts and Effective Negotiations	
ENGR 696	Engineering Products and Economic Considerations	

1

Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.

Concentration in environmental and sustainable engineering

Course	Title	Hours
Fifth year		
Thesis option		
Fall semester		
Required graduate-level courses [1]		3
Concentration specific		6
CLSE 545	Water Essentials	
CLSE 580	Sustainable Chemical Engineering	
CLSE 650	Quantitative Analysis in Chemical and Life Science Engineering	
CLSE 655	Nonequilibrium Analysis in Chemical and Life Science Engineering	
Directed research [2]		3
CLSE 697	Directed Research in Chemical and Life Science Engineering	
Term Hours:		12
Spring semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
CLSE 545	Water Essentials	
CLSE 580	Sustainable Chemical Engineering	
CLSE 650	Quantitative Analysis in Chemical and Life Science Engineering	
CLSE 655	Nonequilibrium Analysis in Chemical and Life Science Engineering	
Directed research [2]		3
CLSE 697	Directed Research in Chemical and Life Science Engineering	
Term Hours:		12
Non-thesis option		
Fall semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
CLSE 545	Water Essentials	
CLSE 580	Sustainable Chemical Engineering	
CLSE 650	Quantitative Analysis in Chemical and Life Science Engineering	
CLSE 655	Nonequilibrium Analysis in Chemical and Life Science Engineering	
Term Hours:		9
Spring semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
CLSE 545	Water Essentials	
CLSE 580	Sustainable Chemical Engineering	
CLSE 650	Quantitative Analysis in Chemical and Life Science Engineering	
CLSE 655	Nonequilibrium Analysis in Chemical and Life Science Engineering	
Term Hours		9

1

Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.

2

This component emphasizes research directed toward completion of degree requirements under the direction of an adviser and advisory committee.

Concentration in rehabilitation engineering

Course	Title	Hours
Fifth year		
Thesis option		
Fall semester		
Required graduate-level courses [1]		3

Concentration specifc courses		6
EGRB 520	Assistive Technology	
EGRB 521	Human Factors Engineering	
EGRB 523	Rehabilitation Engineering and Prostheses	
EGRB 603	Biomedical Signal Processing	
ANAT 610	Systems Neuroscience	
Directed research [2]		3
EGRB 697	Directed Research in Biomedical Engineering	
Term Hours:		12
Spring semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
EGRB 520	Assistive Technology	
EGRB 521	Human Factors Engineering	
EGRB 523	Rehabilitation Engineering and Prostheses	
EGRB 603	Biomedical Signal Processing	
ANAT 610	Systems Neuroscience	
Directed research [2]		3
EGRB 697	Directed Research in Biomedical Engineering	
Term Hours:		12
Non-thesis option		
Fall semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
EGRB 520	Assistive Technology	
EGRB 521	Human Factors Engineering	
EGRB 523	Rehabilitation Engineering and Prostheses	
EGRB 603	Biomedical Signal Processing	
ANAT 610	Systems Neuroscience	
Term Hours:		9
Spring semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
EGRB 520	Assistive Technology	
EGRB 521	Human Factors Engineering	
EGRB 523	Rehabilitation Engineering and Prostheses	
EGRB 603	Biomedical Signal Processing	
ANAT 610	Systems Neuroscience	
Term Hours:		9

1

Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.

2

This component emphasizes research directed toward completion of degree requirements under the direction of an adviser and advisory committee.

Concentration in systems engineering

Course	Title	Hours
Fifth year		
Thesis option		
Fall semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
EGRE 510	Introduction to Internet of Things	
EGRE 512	Intelligent Autonomous Systems	
EGRE 513	Fundamentals of Modern Systems Engineering	
EGRE 615	Systems Modeling	
Directed research		3
EGRE 697	Directed Research in Electrical and Computer Engineering	
Term Hours:		12
Spring semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
EGRE 510	Introduction to Internet of Things	
EGRE 512	Intelligent Autonomous Systems	
EGRE 513	Fundamentals of Modern Systems Engineering	
EGRE 615	Systems Modeling	
Directed research [2]		3
EGRE 697	Directed Research in Electrical and Computer Engineering	
Term Hours:		12
Non-thesis option		
Fall semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
EGRE 510	Introduction to Internet of Things	
EGRE 512	Intelligent Autonomous Systems	
EGRE 513	Fundamentals of Modern Systems Engineering	
EGRE 615	Systems Modeling	
Term Hours:		9
Spring semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
EGRE 510	Introduction to Internet of Things	
EGRE 512	Intelligent Autonomous Systems	
EGRE 513	Fundamentals of Modern Systems Engineering	
EGRE 615	Systems Modeling	
Term Hours		9

1

Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.

2

This component emphasizes research directed toward completion of degree requirements under the direction of an adviser and advisory committee.

Concentration in tissue engineering and regenerative medicine

Course	Title	Hours
Fifth year		
Thesis option		
Fall semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
EGRB 512	Regenerative Engineering and Medicine	
EGRB 613	Biomaterials	
EGRB 614	Tissue Engineering	
EGRB 616	Cell Engineering	
Directed research [2]		3
EGRB 697	Directed Research in Biomedical Engineering	
Term Hours:		12
Spring semester		
Required graduate-level courses [1]		3
Concentration specific courses		6
EGRB 512	Regenerative Engineering and Medicine	
EGRB 613	Biomaterials	
EGRB 614	Tissue Engineering	
EGRB 616	Cell Engineering	
Directed research [2]		3
EGRB 697	Directed Research in Biomedical Engineering	
Term Hours:		12
Non-thesis option		
Fall semester		
Required graduate-level courses		3
Concentration specific courses		6
EGRB 512	Regenerative Engineering and Medicine	
EGRB 613	Biomaterials	
EGRB 614	Tissue Engineering	
EGRB 616	Cell Engineering	
Term Hours:		9
Required graduate-level courses		
Concentration specific courses		
EGRB 512	Regenerative Engineering and Medicine	
EGRB 613	Biomaterials	
EGRB 614	Tissue Engineering	
EGRB 616	Cell Engineering	
Term Hours:		9

1

Engineering or other relevant graduate course work (including a minimum of 9 credit hours from 500-level or higher courses in EGRE, ENGR, EGRB, EGMN, CMSC, CLSE) approved by the adviser. This component allows the student to take courses in either engineering or science with approval of the student's adviser.

2

This component emphasizes research directed toward completion of degree requirements under the direction of an adviser and advisory committee.

Accelerated B.S. and M.S.

The accelerated B.S. and M.S. program allows qualified students to earn both the B.S. in Electrical Engineering and M.S. in Mechanical and Nuclear Engineering in a minimum of five years by completing approved graduate courses during the senior year of their undergraduate program. Students in the program may count up to 12 credit hours of graduate courses toward both the B.S. and M.S. degrees. Thus, the two degrees may be earned with a minimum of 148 credits rather than the 160 credits necessary if the two degrees are pursued separately.

Students holding these degrees will have a head start for pursuing careers in industry or continuing in academia. The M.S. degree provides formal research experience and can lead to expanded job opportunities, greater potential for job advancement and higher starting salaries.

Entrance to the accelerated program

Interested undergraduate students should consult with their adviser as early as possible to receive specific information about the accelerated program, determine academic eligibility and submit (no later than two semesters prior to graduating with a baccalaureate degree, that is, before the end of the spring semester of their junior year) an Accelerated Program Declaration Form to be approved by the graduate program director. Limited spaces may be available in the accelerated program. Academically qualified students may not receive approval if capacity has been reached.

Minimum qualifications for entrance to this accelerated program includes an overall GPA of 3.0.

Once admitted into the accelerated program, students must meet the standards of performance applicable to graduate students as described in the "**Satisfactory academic progress (https://bulletin.vcu.edu/academic-regs/grad/satisfactory-academic-progress/)**" section of the Graduate Bulletin, including maintaining a 3.0 GPA. Guidance to students admitted to the accelerated program is provided by both the undergraduate mechanical engineering adviser and the graduate program director for the master's degree.

Admission to the graduate program

Entrance to the accelerated program enables the student to take the approved shared courses that will apply to the undergraduate and graduate degrees. However, entry into an accelerated program via an approved Accelerated Program Declaration Form does not constitute application or admission into the graduate program. Admission to the graduate program requires a separate step that occurs through a formal

application. In order to continue pursuing the master's degree after the baccalaureate degree is conferred, accelerated students must follow the admission to graduate study requirements outlined in the VCU Bulletin. A reference letter from an electrical engineering faculty member must accompany the application.

Degree requirements

The Bachelor of Science in Electrical Engineering degree will be awarded upon completion of a minimum of 130 credits and the satisfactory completion of all undergraduate degree requirements as stated in the **Undergraduate Bulletin**.

A maximum of 12 graduate credits of 500-level graduate courses may be taken prior to completion of the baccalaureate degree. These graduate credits will be utilized to fulfill engineering electives course requirements for the undergraduate degree. These courses are shared credits with the graduate program, meaning that they will be applied to both undergraduate and graduate degree requirements.

Once a student is admitted to the program, with the approval of their adviser, they may choose any 500-level course from the following subject areas: EGMN, EGRM, ENGR, EGRN, EGRB, EGRE, CLSE, CMSC, PHYS, MATH, NANO, CHEM, BIOL, GRAD, LFSC and OVPR.

Recommended course sequence/plan of study

What follows is the recommended plan of study for students interested in the accelerated program beginning in the fall of the junior year prior to admission to the accelerated program in the senior year.

For students pursuing the non-thesis option

Course	Title	Hours
Senior year		
Fall semester		
EGRE 404	Senior Design Studio I (Laboratory/ Project Time)	2
or EGRE 406	Senior Design Studio I - VIP (Laboratory/Project Time)	
ENGR 402	Senior Design Studio (Seminar)	1
Technical elective (consider BME course for accelerated pathway)		6
Other required B.S. course work		7
Term Hours:		16
Spring semester		
EGRE 405	Senior Design Studio II (Laboratory/ Project Time)	2
or EGRE 407	Senior Design Studio II - VIP (Laboratory/Project Time)	
ENGR 403	Senior Design Studio (Seminar)	1
Technical elective (consider BME course for accelerated pathway)		6
Other required B.S. course work		7
Term Hours:		16
Fifth year		
Fall semester		
EGMN 605	Mechanical and Nuclear Engineering Analysis	3
EGMN 606	Mechanical and Nuclear Engineering Continuum Mechanics	3
EGMN 610	Topics in Nuclear Engineering	3
Term Hours:		9
Spring semester		
Technical electives (Select 600-leve courses from: EGMN, EGRM, ENGR, EGRN, EGRB, EGRE, CLSE, CMSC, PHYS, MATH, NANO, CHEM, BIOL, GRAD, LFSC and OVPR)		6
Technical elective (Select 500- or 600-leve course from: EGMN, EGRM, ENGR, EGRN, EGRB, EGRE, CLSE, CMSC, PHYS, MATH, NANO, CHEM, BIOL, GRAD, LFSC and OVPR)		3
Term Hours:		9

For students pursuing the thesis option

Course	Title	Hours
Senior year		
Fall semester		
EGRE 404	Senior Design Studio I (Laboratory/ Project Time)	2
or EGRE 406	Senior Design Studio I - VIP (Laboratory/Project Time)	
ENGR 402	Senior Design Studio (Seminar)	1
Technical elective (consider BME course for accelerated pathway)		6
Other required B.S. course work		7
Term Hours:		16
Spring semester		
EGRE 405	Senior Design Studio II (Laboratory/ Project Time)	2
or EGRE 407	Senior Design Studio II - VIP (Laboratory/Project Time)	
ENGR 403	Senior Design Studio (Seminar)	1
Technical elective (consider BME course for accelerated pathway)		6
Other required B.S. course work		7
Term Hours:		16
Fifth year		
Fall semester		
EGMN 605	Mechanical and Nuclear Engineering Analysis	3
EGMN 606	Mechanical and Nuclear Engineering Continuum Mechanics	3
EGMN 610	Topics in Nuclear Engineering	3
Term Hours:		9
Spring semester		
EGMN 697	Directed Research in Mechanical and Nuclear Engineering	6
Technical electives (Select 600-leve courses from: EGMN, EGRM, ENGR, EGRN, EGRB, EGRE, CLSE, CMSC, PHYS, MATH, NANO, CHEM, BIOL, GRAD, LFSC and OVPR)		3
Term Hours:		9