COMPUTER SCIENCE, BACHELOR OF SCIENCE (B.S.)

The Bachelor of Science in Computer Science is built on a rigorous, highly concentrated, accredited curriculum of computer science courses, and includes concentrations in cybersecurity, data science and software engineering. The program provides a strong foundation in the discipline and includes advanced study in several important areas of computer science.

The degree requires a minimum of 120 credit hours and includes undergraduate requirements, general education requirements and computer science major requirements.

Student learning outcomes

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

1. Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions
2. Design, implement and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline
3. Communicate effectively in a variety of professional contexts
4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline
6. Apply computer science theory and software development fundamentals to produce computing-based solutions

Special requirements

The B.S. in Computer Science requires a minimum of 120 credits. Students must receive a minimum grade of C in all computer science courses in order to graduate.

Based on the results of the Computer Science Placement Test, students may be required to take CMSC 254, which then can count toward the degree requirements as an elective.

Degree requirements for Computer Science, 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		
CMSC 235	Computing and Data Ethics	3
CMSC 254	Introduction to Problem-solving	4
CMSC 255	Object-oriented Programming	4
CMSC 256	Introduction to Data Structures	4
CMSC 302	Introduction to Discrete Structures	3
CMSC 303	Introduction to the Theory of Computation	3
CMSC 304	Programming Languages	3
CMSC 311	Computer Organization	3
CMSC 355	Fundamentals of Software Engineering	3
CMSC 357	Computer Systems	4
CMSC 401	Algorithm Analysis with Advanced Data Structures	3
CMSC 405	Operating Systems	3
CMSC 408	Databases	3
CMSC 440	Data Communication and Networking	3
CMSC 441 & CMSC 451	Senior Design Studio I (Laboratory/ Project Time) and Senior Project I	3
CMSC 442 & CMSC 452	Senior Design Studio II (Laboratory/ Project Time) and Senior Project II	3
• Major electives		
CMSC upper-level electives		9
Ancillary requirements		
ECON 205	The Economics of Product Development and Markets (satisfies general education BOK for social/ behavioral science and AOI for global perspectives)	3
ENGR 395	Professional Development	1
MATH 200	Calculus with Analytic Geometry I (satisfies general education quantitative foundations)	4
MATH 201	Calculus with Analytic Geometry II	4
STAT 212	Concepts of Statistics	3
Humanities electives (from list below)		6
MATH course (300 to 400 level)		3
Natural science option: Select from BIOL, CHEM or PHYS course with a lab (3-5 credits satisfy general education BOK for natural science and AOI for scientific and logical reasoning) [1]		4-5
Open electives		
Select any course.		9-10
Total Hours		**120**

[1]

Select one of the following options:

- Option A: CHEM 101 and CHEZ 101
- Option B: PHYS 207
- Option C: BIOL 151 and BIOZ 151

The minimum number of credit hours required for this degree is 120.

CMSC upper-level electives

Course	Title	Hours
CMSC 410	Introduction to Quantum Computing	3
CMSC 411	Computer Graphics	3
CMSC 412	Social Network Analysis and Cybersecurity Risks	3

CMSC 413	Introduction to Cybersecurity	3
CMSC 414	Computer and Network Security	3
CMSC 415	Introduction to Cryptography	3
CMSC 420	Software Project Management	3
CMSC 425	Introduction to Software Analysis and Testing	3
CMSC 426	Software as a Service	3
CMSC 427	Design and Implementation of User Interfaces	3
CMSC 428	Mobile Programming: iOS	3
CMSC 435	Introduction to Data Science	3
CMSC 436	Artificial Intelligence	3
CMSC 437	Introduction to Natural Language Processing	3
CMSC 438	Machine Learning	3
CMSC 491	Topics in Computer Science	1-3
CMSC 492	Independent Study	2-4
CMSC 506	Computer Networks and Communications	3

Approved humanities electives

Course	Title	Hours
Select six credits from the following programs or subject areas:		6
African-American studies		
American studies		
Anthropology		
School of the Arts		
English		
Foreign language		
History		
Philosophy		
Psychology		
Religious studies		
Social work		
Sociology		
Urban studies		

Some courses in other programs (including most honors modules and other courses that focus on human behavior, communication and/or social interaction) may be counted toward this requirement with departmental approval.

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.

Recommended course sequence/plan of study

Freshman year

Fall semester		**Hours**
CMSC 235	Computing and Data Ethics	3
CMSC 254	Introduction to Problem-solving	4
UNIV 111 Play course video for Introduction to Focused Inquiry: Investigation and Communication	Introduction to Focused Inquiry: Investigation and Communication (satisfies general education UNIV foundations)	3
General education course		3
Humanities elective (from list)		3
	Term Hours:	**16**
Spring semester		
CMSC 255	Object-oriented Programming	4
ECON 205	The Economics of Product Development and Markets (satisfies general education BOK for social/behavioral science and AOI for global perspectives)	3
MATH 200	Calculus with Analytic Geometry I (satisfies general education quantitative foundations)	4
UNIV 112 Play course video for Focused Inquiry II	Focused Inquiry II (satisfies general education UNIV foundations)	3
	Term Hours:	**14**

Sophomore year

Fall semester		
CMSC 256	Introduction to Data Structures	4
CMSC 302	Introduction to Discrete Structures	3
MATH 201	Calculus with Analytic Geometry II	4
UNIV 200	Advanced Focused Inquiry: Literacies, Research and Communication (satisfies general education UNIV foundations)	3
	Term Hours:	**14**
Spring semester		
CMSC 304	Programming Languages	3
CMSC 311	Computer Organization	3
ENGR 395	Professional Development	1
STAT 212	Concepts of Statistics	3
General education course		3
Humanities electives (from list)		3
	Term Hours:	**16**

Junior year

Fall semester		
CMSC 303	Introduction to the Theory of Computation	3
CMSC 355	Fundamentals of Software Engineering	3
CMSC 357	Computer Systems	4
Natural science option (4-5 credits satisfies general education BOK for natural science and AOI for scientific and logical reasoning) (select one):		4-5
CHEM 101 & CHEZ 101	General Chemistry I and General Chemistry Laboratory I	4

PHYS 207	University Physics I	5
BIOL 151 & BIOZ 151	Introduction to Biological Sciences I and Introduction to Biological Science Laboratory I	4
General education course		3
	Term Hours:	**17-18**
Spring semester		
CMSC 401	Algorithm Analysis with Advanced Data Structures	3
CMSC 405	Operating Systems	3
CMSC 408	Databases	3
MATH course (300 to 400 level)		3
General education course (select BOK for humanities/fine arts)		3
	Term Hours:	**15**
Senior year		
Fall semester		
CMSC 441	Senior Design Studio I (Laboratory/Project Time)	2
CMSC 451	Senior Project I	1
CMSC 440	Data Communication and Networking	3
CMSC upper-level electives		3
Open electives		6
	Term Hours:	**15**
Spring semester		
CMSC 442	Senior Design Studio II (Laboratory/Project Time)	2
CMSC 452	Senior Project II	1
CMSC upper-level elective		6
Open electives		3-4
	Term Hours:	**13**
	Total Hours:	**120-121**

The minimum number of credit hours required for this degree is 120.

Accelerated B.S. and M.S.

The accelerated B.S. and M.S. program allows qualified students to earn both the B.S.in Computer Science 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 twelve hours of graduate courses toward both the B.S. and M.S. degrees. Thus, the two degrees may be earned with a minimum of 138 credits rather than the 150 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 with a thesis option provides formal research experience and both options 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**" 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 computer science adviser and the faculty adviser to the graduate program.

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. Three reference letters (including one from the computer science undergraduate program director and at least one more from a computer science faculty member) must accompany the application. Students who do not meet the minimum GPA requirements may submit GRE scores to receive further consideration.

Degree requirements

The Bachelor of Science in Computer Science degree will be awarded upon completion of a minimum of 120 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.

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		
CMSC 441	Senior Design Studio I (Laboratory/ Project Time)	2
CMSC 451	Senior Project I	1
CMSC 440	Data Communication and Networking	3
Technical elective (consider BME course for accelerated pathway)		6
Open electives		3
Term Hours:		15
Spring semester		
CMSC 442	Senior Design Studio II (Laboratory/ Project Time)	2
CMSC 452	Senior Project II	1
Technical elective (consider BME course for accelerated pathway)		6
Open Elective		3
Term Hours:		12
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

[1] 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		
CMSC 441	Senior Design Studio I (Laboratory/ Project Time)	2
CMSC 451	Senior Project I	1
CMSC 440	Data Communication and Networking	3
Technical electives (consider BME course for accelerated pathway)		6
Open elective		3
Term Hours:		15
Spring semester		
CMSC 442	Senior Design Studio II (Laboratory/ Project Time)	2
CMSC 452	Senior Project II	1
Technical electives (consider BME course for accelerated pathway)		6
Open Elective		3
Term Hours:		12
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 electives		6
Term Hours:		11

[1] 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. 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 six hours of graduate courses toward both the B.S. and M.S. degrees. Thus, the two degrees may be earned with a minimum of 144 credits rather than the 150 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 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 including six computer science courses CMSC 255, CMSC 256, CMSC 257, CMSC 302, CMSC 303 and CMSC 311; an overall GPA of 3.0; and a GPA of 3.4 in the six courses identified above. 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**" 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 computer science adviser and the faculty adviser to the graduate program.

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. Three reference letters (including one from the computer science undergraduate program director and at least one more from a computer science faculty member) must accompany the application. Students who do not meet the minimum GPA requirements may submit GRE scores to receive further consideration.

Degree requirements

The Bachelor of Science in Computer Science degree will be awarded upon completion of a minimum of 120 credits and the satisfactory completion of all undergraduate degree requirements as stated in the Undergraduate Bulletin.

A maximum of 12 graduate credits may be taken prior to completion of the baccalaureate degree. At most, six of these graduate credits will substitute for open 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 computer science courses that may be taken as an undergraduate, once a student is admitted to the program, are:

Course	Title	Hours
Maximum for shared credits is 12.		
CMSC 501	Advanced Algorithms	3
CMSC 502	Parallel Algorithms	3
CMSC 510	Regularization Methods for Machine Learning	3
CMSC 516	Advanced Natural Language Processing	3
CMSC 525	Introduction to Software Analysis, Testing and Verification	3
CMSC 591	Topics in Computer Science	3

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
Junior year		
Fall semester		
CMSC 257	Computer Systems	4
CMSC 303	Introduction to the Theory of Computation	3
CMSC 355	Fundamentals of Software Engineering	3
Approved natural science course (BIOL, CHEM or PHYS course that counts toward the major in that science)		4-5
Select one of the following:		
BIOL 151 & BIOZ 151	Introduction to Biological Sciences I and Introduction to Biological Science Laboratory I	
CHEM 101 & CHEZ 101	General Chemistry I and General Chemistry Laboratory I	
PHYS 207	University Physics I	
General education course		3
Contact undergraduate and graduate program directors		
Term Hours:		17-18
Spring semester		
CMSC 401	Algorithm Analysis with Advanced Data Structures	3
CMSC 408	Databases	3
CMSC 440	Data Communication and Networking	3
MATH upper-level (300 to 400)		3
General education course (select BOK for humanities/fine arts)		3
Secure approval from undergraduate program director		
Apply to the M.S. program		
Term Hours:		15
Senior year		
Fall semester		
CMSC 441	Senior Design Studio I (Laboratory/ Project Time)	2
CMSC 451	Senior Project I	1
CMSC 501	Advanced Algorithms	3

CMSC 516	Advanced Natural Language Processing	3
Open electives		6
Term Hours:		15
Spring semester		
CMSC 312	Introduction to Operating Systems	3
CMSC 442	Senior Design Studio II (Laboratory/ Project Time)	2
CMSC 452	Senior Project II	1
CMSC 525	Introduction to Software Analysis, Testing and Verification (counts toward B.S. and M.S.)	3
CMSC 5XX (Select fourth shared graduate course from list above.)		3
Choose the M.S. thesis adviser		
Term Hours:		12
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 course (applied) [1]		3
Term Hours:		9

[1]

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

Recommended course sequence/plan of study for students pursuing a 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 junior year prior to admission to the accelerated program in the senior year.

Course	Title	Hours
Junior year		
Fall semester		
CMSC 257	Computer Systems	4
CMSC 303	Introduction to the Theory of Computation	3
CMSC 355	Fundamentals of Software Engineering	3
Approved natural science course (BIOL, CHEM or PHYS course that counts toward the major in that science)		4-5
Select one of the following:		
BIOL 151 & BIOZ 151	Introduction to Biological Sciences I and Introduction to Biological Science Laboratory I	
CHEM 101 & CHEZ 101	General Chemistry I and General Chemistry Laboratory I	
PHYS 207	University Physics I	
General education course		3
Contact undergraduate and graduate program directors		
Term Hours:		17-18
Spring semester		
CMSC 401	Algorithm Analysis with Advanced Data Structures	3
CMSC 408	Databases	3
CMSC 440	Data Communication and Networking	3
MATH upper-level (300 to 400)		3
General education course (select BOK for humanities/fine arts)		3
Term Hours:		15
Secure approval from the undergraduate program director		
Apply to the M.S. program		
Senior year		
Fall semester		
CMSC 441	Senior Design Studio I (Laboratory/ Project Time)	2
CMSC 451	Senior Project I	1
CMSC 501	Advanced Algorithms	3
CMSC 516	Advanced Natural Language Processing	3
Open electives		6
Term Hours:		15
Spring semester		
CMSC 312	Introduction to Operating Systems	3
CMSC 442	Senior Design Studio II (Laboratory/ Project Time)	2
CMSC 452	Senior Project II	1
CMSC 525	Introduction to Software Analysis, Testing and Verification (counts toward B.S. and M.S.)	3
CMSC 5XX (Select fourth shared graduate course from list above.)		3
Term Hours:		12
Fifth year		
Fall semester		
M.S. foundational area courses (theory, systems and applied) [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 Computer Science 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 Computer Science 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		
CMSC 257	Computer Systems	4
CMSC 303	Introduction to the Theory of Computation	3
CMSC 355	Fundamentals of Software Engineering	3
Approved natural science course (BIOL, CHEM or PHS course that counts toward the major in that science)		4-5
Select one of the following (BIOL 151 and CHEM 101 require associated laboratory course listed below)		
BIOL 151	Introduction to Biological Sciences I	
BIOZ 151	Introduction to Biological Science Laboratory I	
CHEM 101	General Chemistry I	
CHEZ 101	General Chemistry Laboratory I	
PHYS 207	University Physics I	
General education course		3
Contact undergraduate and graduate program directors		
Term Hours:		17-18
Spring semester		
CMSC 312	Introduction to Operating Systems	3
CMSC 401	Algorithm Analysis with Advanced Data Structures	3
CMSC 408	Databases	3
MATH upper-level (300-400)		3
Approved natural science course (BIOL, CHEM or PHS course that counts toward the major in that science)		4-5
Select one of the following (BIOL 152 and CHEM 102 require associated laboratory course listed below)		
BIOL 152	Introduction to Biological Sciences II	
BIOZ 152	Introduction to Biological Science Laboratory II	
CHEM 102	General Chemistry II	
CHEZ 102	General Chemistry Laboratory II	
PHYS 208	University Physics II	
Term Hours:		16-17

Senior year		
Fall semester		
CMSC 440	Data Communication and Networking	3
CMSC 441	Senior Design Studio I (Laboratory/ Project Time)	2
CMSC 451	Senior Project I	1
Technical elective (consider appropriate MS program course for accelerated pathway)		3
Open electives		3
Term Hours:		12
Spring semester		
CMSC 442	Senior Design Studio II (Laboratory/ Project Time)	2
CMSC 452	Senior Project II	1
Technical elective (consider appropriate MS program course for accelerated pathway)		6
Open Elective		3
Term Hours:		12

[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 Computer Science and M.S. in Mechanical and Nuclear Engineering 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 twelve hours of graduate courses toward both the B.S. and M.S. degrees. Thus, the two degrees may be earned with a minimum of 138 credits rather than the 150 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 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 mechanical and nuclear 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**" 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 computer science adviser and the faculty adviser to the graduate program.

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. Three reference letters (including one from the computer science undergraduate program director and at least one more from a computer science faculty member) must accompany the application. Students who do not meet the minimum GPA requirements may submit GRE scores to receive further consideration.

Degree requirements

The Bachelor of Science in Computer Science degree will be awarded upon completion of a minimum of 120 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.

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

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

For students pursuing the thesis option

Course	Title	Hours
Senior year		
Fall semester		
CMSC 441	Senior Design Studio I (Laboratory/ Project Time)	2
CMSC 451	Senior Project I	1
CMSC 440	Data Communication and Networking	3
Technical elective (consider MNE course for accelerated pathway)		3
Open electives		6
Term Hours:		15
Spring semester		
CMSC 442	Senior Design Studio II (Laboratory/ Project Time)	2
CMSC 452	Senior Project II	1
Technical electives (consider MNE course for accelerated pathway)		6
Open Elective		3
Term Hours:		12
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-level courses with permission of graduate program director)		3
Term Hours:		9

For students pursuing the non-thesis option

Course	Title	Hours
Senior year		
Fall semester		
CMSC 441	Senior Design Studio I (Laboratory/ Project Time)	2
CMSC 451	Senior Project I	1
CMSC 440	Data Communication and Networking	3
Technical electives (consider MNE course for accelerated pathway)		3
Open electives		6
Term Hours:		15
Spring semester		
CMSC 442	Senior Design Studio II (Laboratory/ Project Time)	2
CMSC 452	Senior Project II	1
Technical electives (consider MNE course for accelerated pathway)		6
Open Elective		3
Term Hours:		12
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-level courses with permission of graduate program director)		6
Technical electives (Select 500- or 600-level courses with permission of graduate program director)		3
Term Hours:		9