

# CASE SCHOOL OF ENGINEERING UNDERGRADUATE DEGREE REQUIREMENTS

## Bachelor of Science in Engineering Degree

Candidates for the Bachelor of Science in Engineering (BSE) degree, in addition to meeting the **general requirements for bachelor's degrees**, including the SAGES and physical education requirements, must also complete the following requirements:

- A minimum of 128-133 credit hours as specified by the requirements for each BSE major.
- The General Education Requirements of the Case School of Engineering listed below.
- The requirements for the specific engineering major listed below as presented in this Bulletin in the section devoted to each department or program. At least half the requirements for the major must be completed with Case Western Reserve University courses. Major requirements include all required and elective work completed in the major department combined with required courses completed in related fields.

Note that most students pursuing a degree from the Case School of Engineering will complete ENGR 398 and ENGL 398 to fulfill the SAGES Departmental Seminar requirement and will complete an engineering senior project in their major to fulfill the SAGES Senior Capstone requirement.

### Majors Available for the Bachelor of Science in Engineering degree:

- Aerospace Engineering
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Electrical Engineering
- Engineering Physics
- Materials Science and Engineering
- Mechanical Engineering
- Polymer Science and Engineering
- Systems and Control Engineering
- General Engineering

## General Education Requirements of the Case School of Engineering

These requirements provide a foundation in mathematics and the sciences for programs in engineering leading to the Bachelor of Science degree. The CSE general education requirements are also designed to develop communication skills and to provide breadth beyond mathematics, the sciences, and engineering in each student's education.

Course credit earned by Advanced Placement, International Baccalaureate, proficiency examinations, and transfer may be used to satisfy Case School of Engineering general education requirements.

### Mathematics, Sciences, and Engineering Requirements (44 credit hours)

Code	Title	Hours
Mathematics		14
MATH 121	Calculus for Science and Engineering I	
MATH 122	Calculus for Science and Engineering II or MATH 124 Calculus II	
MATH 223	Calculus for Science and Engineering III or MATH 227 Calculus III	
MATH 224	Elementary Differential Equations or MATH 228 Differential Equations	
Chemistry *		4
CHEM 111	Principles of Chemistry for Engineers	
Physics		8
PHYS 121	General Physics I - Mechanics or PHYS 123 Physics and Frontiers I - Mechanics	
PHYS 122	General Physics II - Electricity and Magnetism or PHYS 124 Physics and Frontiers II - Electricity and Magnetism	
Engineering		18
ENGR 130	Foundations of Engineering and Programming ** or CSDS 132 Programming in Java	
ENGR 145	Chemistry of Materials	
ENGR 200	Statics and Strength of Materials ***	
ENGR 210	Introduction to Circuits and Instrumentation ****	
ENGR 225	Thermodynamics, Fluid Dynamics, Heat and Mass Transfer *****	
<b>Total Hours</b>		<b>44</b>

- \* The chemistry-materials course sequence CHEM 105-CHEM 106-ENGR 145 (or a materials-focused course in chemical engineering for Chemical Engineering majors) may be substituted for the sequence CHEM 111-ENGR 145.
- \*\* Computer engineering and the computer-oriented concentrations in biomedical engineering specifically require CSDS 132.
- \*\*\* Students majoring in Chemical Engineering may substitute an engineering elective for this course.
- \*\*\*\* This course is not required for Civil Engineering majors pursuing the Environmental Engineering sequence.
- \*\*\*\*\* Students pursuing a polymer science and engineering major or the biomaterials concentration in the biomedical engineering major may substitute EMAC 351 and EMAC 352 for ENGR 225. Students pursuing majors in aerospace or mechanical engineering may substitute EMAE 251, EMAE 252, and EMAE 353 for ENGR 225. This course is not required for Civil Engineering majors pursuing the Structural Engineering, Geotechnical Engineering, Construction Management, or Pre-Architecture sequence.

## Natural Sciences, Mathematics, or Statistics Elective Requirement (3 credit hours)

Course designated by major department.

### Breadth Requirement (15 credit hours)

Code	Title	Hours
ENGL 398	Professional Communication for Engineers	2
ENGR 398	Professional Communication for Engineers	1

Twelve credit hours comprised of 3- or 4-credit hour courses outside of the areas of engineering, natural science, and mathematics offered by the College of Arts and Sciences; the Weatherhead School of Management; the Frances Payne Bolton School of Nursing; the Jack, Joseph, and Morton Mandel School of Applied Social Sciences; the School of Medicine Department of Bioethics; the Cleveland Institute of Music; or the Cleveland Institute of Art. Other courses approved by the School of Engineering's Undergraduate Studies Committee are also acceptable. The selection of courses to satisfy this requirement should be done in consultation with the student's academic advisor(s).

**Total Hours** 15

## Bachelor of Science in Computer Science Degree

Candidates for the Bachelor of Science in Computer Science degree, in addition to meeting the **general requirements for bachelor's degrees**, including the SAGES and physical education requirements, must also complete the following requirements:

- A minimum of 126 credit hours.
- The General Education Requirements of the Case School of Engineering as modified for the Bachelor of Science in Computer Science degree and listed below.
- The requirements for the computer science Bachelor of Science major as presented in this Bulletin. At least half the requirements for the major must be completed with Case Western Reserve University courses. Major requirements include all required and elective work completed in the major department combined with required courses completed in related fields.

Note that most students pursuing a degree from the Case School of Engineering will complete ENGR 398 and ENGL 398 to fulfill the SAGES Departmental Seminar requirement and will complete a senior project in their major to fulfill the SAGES Senior Capstone requirement.

### General Education Requirements of the Case School of Engineering

The CSE general education requirements provide a foundation in mathematics and the sciences for the Bachelor of Science program in computer science. They are also designed to develop communication skills and to provide breadth beyond mathematics, the sciences, and engineering in each student's education. The requirements are modified for the Bachelor of Science in Computer Science degree.

Course credit earned by Advanced Placement, International Baccalaureate, proficiency examinations, and transfer may be used to satisfy Case School of Engineering general education requirements.

## Mathematics, Sciences, and Engineering Requirements (29 credit hours)

Code	Title	Hours
<b>Mathematics</b>		<b>14</b>
MATH 121	Calculus for Science and Engineering I	
MATH 122	Calculus for Science and Engineering II or MATH 124Calculus II	
MATH 223	Calculus for Science and Engineering III or MATH 227Calculus III	
MATH 201	Introduction to Linear Algebra for Applications or MATH 307Linear Algebra	
<b>Chemistry</b> *		<b>4</b>
CHEM 111	Principles of Chemistry for Engineers	
<b>Physics</b>		<b>8</b>
PHYS 121	General Physics I - Mechanics or PHYS 123Physics and Frontiers I - Mechanics	
PHYS 122	General Physics II - Electricity and Magnetism or PHYS 124Physics and Frontiers II - Electricity and Magnetism	
<b>Engineering</b>		<b>3</b>
CSDS 132	Programming in Java	
<b>Total Hours</b>		<b>29</b>

\* The chemistry course sequence CHEM 105-CHEM 106 may be substituted for CHEM 111.

## Natural Sciences, Mathematics, or Statistics Requirement (3 credit hours)

Course designated by major department.

### Breadth Requirement (15 credit hours)

Code	Title	Hours
ENGL 398	Professional Communication for Engineers	2
ENGR 398	Professional Communication for Engineers	1

Twelve credit hours comprised of 3- or 4-credit hour courses outside of the areas of engineering, natural science, and mathematics offered by the College of Arts and Sciences; the Weatherhead School of Management; the Frances Payne Bolton School of Nursing; the Jack, Joseph, and Morton Mandel School of Applied Social Sciences; the School of Medicine Department of Bioethics; the Cleveland Institute of Music; or the Cleveland Institute of Art. Other courses approved by the School of Engineering's Undergraduate Studies Committee are also acceptable. The selection of courses to satisfy this requirement should be done in consultation with the student's academic advisor(s).

**Total Hours** 15

## Bachelor of Science in Data Science and Analytics Degree

Candidates for the Bachelor of Science in Data Science and Analytics degree, in addition to meeting the **general requirements for bachelor's degrees**, including the SAGES and physical education requirements, must also complete the following requirements:

- a. A minimum of 125 credit hours.
- b. The General Education Requirements of the Case School of Engineering as modified for the Bachelor of Science in Data Science and Analytics degree and listed below.
- c. The requirements for the major in data science and analytics as presented in this Bulletin. At least half the requirements for the major must be completed with Case Western Reserve University courses. Major requirements include all required and elective work completed in the major department combined with required courses completed in related fields.

Note that most students pursuing a degree from the Case School of Engineering will complete ENGR 398 and ENGL 398 to fulfill the SAGES Departmental Seminar requirement and will complete a senior project in their major to fulfill the SAGES Senior Capstone requirement.

## General Education Requirements of the Case School of Engineering

The CSE general education requirements provide a foundation in mathematics and the sciences for the Bachelor of Science program in data science and analytics. They are also designed to develop communication skills and to provide breadth beyond mathematics, the sciences, and engineering in each student's education. The requirements are modified for the Bachelor of Science in Data Science and Analytics degree.

Course credit earned by Advanced Placement, International Baccalaureate, proficiency examinations, and transfer may be used to satisfy Case School of Engineering general education requirements.

## Mathematics, Sciences, and Engineering Requirements (29 credit hours)

Code	Title	Hours
<b>Mathematics</b>		<b>14</b>
MATH 121	Calculus for Science and Engineering I	
MATH 122	Calculus for Science and Engineering II or MATH 124 Calculus II	
MATH 223	Calculus for Science and Engineering III or MATH 227 Calculus III	
MATH 224	Elementary Differential Equations or MATH 228 Differential Equations	
<b>Chemistry*</b>		<b>4</b>
CHEM 111	Principles of Chemistry for Engineers	
<b>Physics</b>		<b>8</b>
PHYS 121	General Physics I - Mechanics or PHYS 123 Physics and Frontiers I - Mechanics	
PHYS 122	General Physics II - Electricity and Magnetism or PHYS 124 Physics and Frontiers II - Electricity and Magnetism	
<b>Engineering</b>		<b>3</b>
CSDS 132	Programming in Java	
<b>Total Hours</b>		<b>29</b>

\* The chemistry course sequence CHEM 105-CHEM 106 may be substituted for CHEM 111.

## Natural Sciences, Mathematics, or Statistics Requirement (3 credit hours)

Course designated by major department.

## Humanities and Social Sciences (15 credit hours)

Code	Title	Hours
ENGL 398	Professional Communication for Engineers	2
ENGR 398	Professional Communication for Engineers	1

Twelve credit hours comprised of 3- or 4-credit hour courses outside of the areas of engineering, natural science, and mathematics offered by the College of Arts and Sciences; the Weatherhead School of Management; the Frances Payne Bolton School of Nursing; the Jack, Joseph, and Morton Mandel School of Applied Social Sciences; the School of Medicine Department of Bioethics; the Cleveland Institute of Music; or the Cleveland Institute of Art. Other courses approved by the School of Engineering's Undergraduate Studies Committee are also acceptable. The selection of courses to satisfy this requirement should be done in consultation with the student's academic advisor(s).

<b>Total Hours</b>	<b>15</b>
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