

Department of

Engineering and Computer Science

Mission Statement

The Elmer W. Engstrom Department of Engineering and Computer Science offers accredited programs in Computer, Electrical, and Mechanical Engineering, as well as Computer Science. Our philosophy centers on a rigorous, back-to-basics education that is rich with hands-on opportunities to apply classroom theory. Our faculty share a common vision that states: "We, the Elmer W. Engstrom Department of Engineering and Computer Science, seek to honor the Lord Jesus Christ in every endeavor and earnestly desire to cultivate technical professionals who are committed to moral excellence and who are exemplary in character, conduct, and skill. Therefore, we strive to provide an excellent educational environment that will nurture our students to honor the Lord in all things and help them to grow in spiritual maturity, wisdom, knowledge, and expertise for purposeful lives of service."

Programs of Study

The department of engineering and computer science offers the following programs of study:

Majors

- Computer Science (B.S.)
- Computer Engineering (B.S.Cp.E.)
- Electrical Engineering (B.S.E.E.)
- Mechanical Engineering (B.S.M.E.)

Minors

- Biomedical Engineering
- Computer Science

Special Programs

- Cooperative Education Program
- Engineering Honors Program

Accreditation

The B.S.Cp.E., B.S.E.E., and B.S.M.E. degree programs are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). The B.S. in computer science degree program is accredited by the Computing Accreditation Commission of ABET, Inc.

Registration as a Professional Engineer

Senior engineering majors and graduate engineers are eligible to take the NCEES Fundamentals of Engineering (FE) Examination offered by the Ohio Society of Professional Engineers. This exam is the first of two required to become a registered professional engineer and is offered each spring at Cedarville University (CU). CU seniors have passed the FE exam at a rate that is consistently higher than the national pass rates.

Personal Requirements

Students interested in one of the programs housed within the department of engineering and computer science should possess a strong aptitude in mathematics and physical sciences. Those students who flourish in our programs typically enjoy applying their aptitude toward solving problems. Successful engineers and computer scientists are individuals who enjoy designing solutions to problems.

Department Requirements

New Students

Entering students are required to have an ACT composite score of at least 22 (or an SAT of at least 1010) in order to declare a major in the department. Students who do not meet this standard or do not demonstrate equivalent competency may request admission to the department on a provisional status.

To prepare for engineering or computer science, high school students should take a college preparatory curriculum that includes:

- 4 units of mathematics (algebra, geometry, trigonometry, and advanced mathematics or precalculus)
- 4 units of science (physical science, biology, chemistry, and physics)
- 2 units of the same foreign language

Experience with spreadsheets and word processors is helpful, but not required for entry.

Retention Requirement

Engineering students must demonstrate proficiency in certain lower-level courses to advance into upper-level 3000- and 4000-level courses. Therefore, all students must earn an overall GPA of at least 2.0 by the end of their sophomore year. In addition, each program within the department has its own specific retention requirements as follows.

Computer Engineering

To advance into the junior year, CpE majors must earn a combined GPA of at least 2.0 in the following engineering and computer science courses: CS-1210, 1220, and 2210, EGCP-1010, EGGN-1110, EGEE-2010, and EGME-1810 and 2510.

In addition, CpE majors must earn a combined GPA of at least 2.0 in the following cognate courses: MATH-1710, 1720, 2740 and MATH-3110; and PHYS-2110 and 2120.

Electrical Engineering

To advance into the junior year, EE majors must earn a combined GPA of at least 2.0 in the following engineering courses: EGCP-1010, EGGN-1110, EGEE-2010, and EGME- 1810, 2510, and 2630.

In addition, EE majors must earn a combined GPA of at least 2.0 in the following cognate courses: CS-1210; MATH-1710, 1720, 2710, and 2740; and PHYS-2110 and 2120.



Mechanical Engineering

To advance into the junior year, ME majors must earn a combined GPA of at least 2.0 in the following engineering courses: EGCP-1010, EGGN-1110, EGEE-2050, and EGME-1810, 2050, 2530, and 2630.

In addition, ME majors must earn a combined GPA of at least 2.0 in the following cognate courses: MATH-1710, 1720, 2710, and 2740 and PHYS-2110 and 2120.

Graduation Requirements

1. Earn a cumulative GPA of at least 2.0 in all major and cognate courses.
2. All engineering majors must take an assessment exam similar to the NCEES FE exam.
3. CS majors must achieve a grade of at least a C- in the following courses: CS-1210, 1220, 2210, 3410, 4810, and MATH-1710, 2510.

Technical Resources

Our modern laboratories include the following: fluids lab with an 18-inch cross-section wind tunnel, heat transfer, refrigeration, mechanics, materials testing, internal combustion engines, and dynamometers, CNC manufacturing, vibrations, dynamics of machines, electrical machines, feedback controls, circuits, electronics, communications, digital logic design, microprocessors, surface-mount soldering, and a parallel computing cluster. We also have extensive PC-based laboratories in which students use computer-based circuit design, 3-D solid modeling, FEA, CFD, CNC, and industry-standard IDE software.

Co-Curricular Opportunities

Engineering freshmen participate in an annual Cardboard Canoe Challenge. Other course-based competitions include statics and dynamics design competitions for sophomores, an Advanced Digital Logic Design competition, and an annual programming contest. The department provides students with opportunities to participate in national and international design competitions organized by professional engineering societies such as ACM, ASME, IEEE, SAE, ASEE, and SWE. Our students participate in Aero Design®, Formula SAE®, international programming, Mini Baja®, robotics, Solar Splash®, and Supermileage® competitions.



Career Opportunities

Engineering and computer science both involve the application of scientific and mathematical principles, experience, judgment, and common sense to develop devices which help people. Engineers redesign products to work more efficiently, more quickly, and less expensively. They design EKG and ultra-sound machines that help doctors diagnose medical problems, electrical engineering plants to power our cities, and more fuel-efficient cars and airplanes. Computer programmers develop the software solutions that are used to pilot spacecraft, combat terrorism, prevent collisions at airports, and keep our cars running.

Computer scientists and engineers spend a great deal of time interacting and communicating with others, often working on a team. Because of their strong background in science, mathematics, and technology, they often rise to leadership positions in organizations, managing programs in research, development, design, construction, production, operations, marketing, and sales.

In this era of rapid technological change, an engineering or computer science education serves our society well. In the decades ahead, society's needs and problems will call for technical contributions on a scale not previously experienced.

Engineering Educational Objectives

The Elmer W. Engstrom Department of Engineering and Computer Science educational objectives define God-honoring characteristics of our students three to five years after graduation from Cedarville University.

1. They are successful in a profession related to their field of study.
2. They are prepared for graduate-level education programs.
3. They continue to develop professionally and remain current in their field.
4. They make sound professional and ethical decisions based upon biblical truths.
5. They actively serve in and support Christian ministries, both in their communities and around the world.



Educational Philosophy for Engineering Programs

Each engineering program requires 140 hours to complete; of these, at least 67 hours are engineering topics. The programs are designed to give our graduates a solid background in engineering science and a meaningful design experience at the senior level appropriate to the chosen field of study. Although there are distinctives between the specific engineering programs (see the department website), the educational philosophy for all of the engineering programs can be summarized as follows:

1. Expose students to the basic laws of nature to encourage an understanding of the creation.
2. Equip students with mathematical modeling tools that will enable them to describe the behavior of systems.
3. Require students to apply theoretical models, computer simulations, and laboratory experimentation to analyze engineering systems.
4. Require students to use analytical and numerical techniques to systematically solve engineering problems.
5. Require students to work in teams to solve engineering problems.
6. Equip students to evaluate designs for conformance to technical and ethical standards.
7. Require students to demonstrate effective oral and written communication skills.
8. Promote engineering as a profession, encourage participation in engineering organizations, and foster professional development.
9. Encourage students to see engineering in the broader context of general education, to grow in their relationship with Jesus Christ, and to apply a Christian worldview to all life and learning.

The educational philosophy supports ABET's Criterion three desired outcomes (a) through (k).



Faculty

Samuel SanGregory, *Chair*: Professor of Electrical Engineering. *Education*: B.S.E., Wright State University, 1988; M.S.C.E., Air Force Institute of Technology, 1992; Ph.D., Air Force Institute of Technology, 1999. At Cedarville since 1993.

Robert Chasnov, Assistant to the Chair: Professor of Engineering. *Education*: B.S., Rensselaer Polytechnic Institute, 1978; M.S., University of Illinois, 1980; Ph.D., University of Illinois, 1983; registered professional engineer. At Cedarville since 1991.

Stanley Baczek, Dean, School of Natural and Applied Sciences: Professor of Polymer Science and Engineering. *Education*: B.S., Southeastern Massachusetts University, 1969; M.S., University of Massachusetts, 1975; Ph.D., University of Massachusetts, 1977. At Cedarville since 2003.

Gerald Brown, Assistant Professor of Electrical Engineering. *Education*: B.Engr., McMaster University, 1982; M.Engr., McMaster University, 1984; Ph.D., McMaster University, 1989. At Cedarville since 2004.

Timothy Dewhurst, Professor of Mechanical Engineering. *Education*: B.S.M.E., Cornell University, 1980; M.Eng.M., Cornell University, 1981; Ph.D., Cornell University, 1985; registered professional engineer. At Cedarville since 1996.

Vicki Fang, Assistant Professor of Computer Engineering. *Education*: B.S.E.E., Shanghai Jiao Tong University, 1992; M.S.E.T., Pittsburg State University, 1998; Ph.D., The University of Akron, 2004. At Cedarville since 2004.

David M. Gallagher, Professor of Computer Science. *Education*: B.S., Electrical Engineering, United States Air Force Academy, 1978; M.S., Electrical Engineering, Air Force Institute of Technology, 1987; Ph.D., Electrical Engineering, University of Illinois, 1995. At Cedarville since 2000.

Harwood Hegna, Professor of Mechanical Engineering. *Education*: B.S.A.E., University of Minnesota, 1969; M.S.A.E., University of Minnesota, 1971; M.S.M.E., University of Minnesota, 1973; Ph.D., Air Force Institute of Technology, 1981; registered professional engineer. At Cedarville since 1992.

Nan Jiang, Assistant Professor of Computer Science. *Education*: Bachelor of Civil Engineering and Computer Applications, Shenyang Jianzhu University, 1997; M.S., Computer Science, University of Oklahoma, 2003; Ph.D., Computer Science, 2009. At Cedarville since 2009.

Jay H. Kinsinger, Assistant Professor of Mechanical Engineering. *Education*: B.S., Mechanical Engineering and Manufacturing Engineering Technologies, University of Dayton, 1993; M.S., Rehabilitation Engineering, Wright State University, 2000. At Cedarville since 1999.

Clint Kohl, Professor of Computer Engineering. *Education*: B.S.E.E., South Dakota State University, 1988; M.S.E.E., University of North Dakota, 1990; Ph.D., Iowa State University, 1992. At Cedarville since 1994.

Timothy Norman, Professor of Mechanical Engineering. *Education*: B.S.A.A.E., Purdue University, 1982; M.S.A.A.E., Purdue University, 1986; Ph.D., Purdue University, 1989; registered professional engineer. At Cedarville since 2003.

Robert Schumacher, Assistant Professor of Mathematics and Computer Science. *Education*: B.S., Computer Science, United States Air Force Academy, 1970; M.S., Operations Research, Air Force Institute of Technology, 1979. At Cedarville since 1993.

Keith Shomper, Associate Professor of Computer Science. *Education*: B.A., University of Northern Colorado, 1983; M.S., Air Force Institute of Technology, 1984. Ph.D., The Ohio State University, 1993. At Cedarville since 2003.

D. Jeff Shortt, Professor of Electrical Engineering. *Education:* B.S.E.E., Virginia Polytechnic Institute and State University, 1974; M.S.E.E., Virginia Polytechnic Institute and State University, 1979; Ph.D., Virginia Polytechnic Institute and State University, 1982. At Cedarville since 1996.

Thomas Thompson, Associate Professor of Mechanical Engineering. *Education:* B.S.M.E., University of Nebraska-Lincoln, 1984; M.S.M.E., University of Nebraska-Lincoln, 1986; Ph.D., Iowa State University, 1995; registered professional engineer. At Cedarville since 1995.

Timothy Tuinstra, Assistant Professor of Electrical Engineering. *Education:* B.S.E.E., Cedarville University, 1996; M.S.E.E., University of Dayton, 1998; Ph.D. in progress (ABD), University of Dayton. At Cedarville since 2002.

Tim Yao, Associate Professor of Electrical Engineering. *Education:* B.S. in Computer Engineering, National Chiao-Tung University, 1987; M.S., Electrical Engineering, National Taiwan University, 1989; M.S., Electrical Engineering, University of Maryland at College Park, 1995; Ph.D., Electrical Engineering, University of Maryland at College Park 1997. At Cedarville since 2009.

Lawrence Zavodney, Senior Professor of Mechanical Engineering. *Education:* B.S.M.E., The University of Akron, 1974; M.S.M.E., The University of Akron, 1977; Ph.D., Virginia Polytechnic Institute and State University, 1987; registered professional engineer. At Cedarville since 1992.

Technical Support Staff

David Denlinger, Mechanical Engineering Technician. At Cedarville since 1993.

James Landers, Computer and Electrical Engineering Technician, *Education:* Gateway Electronics, Microsoft, FCC. At Cedarville since 2005.

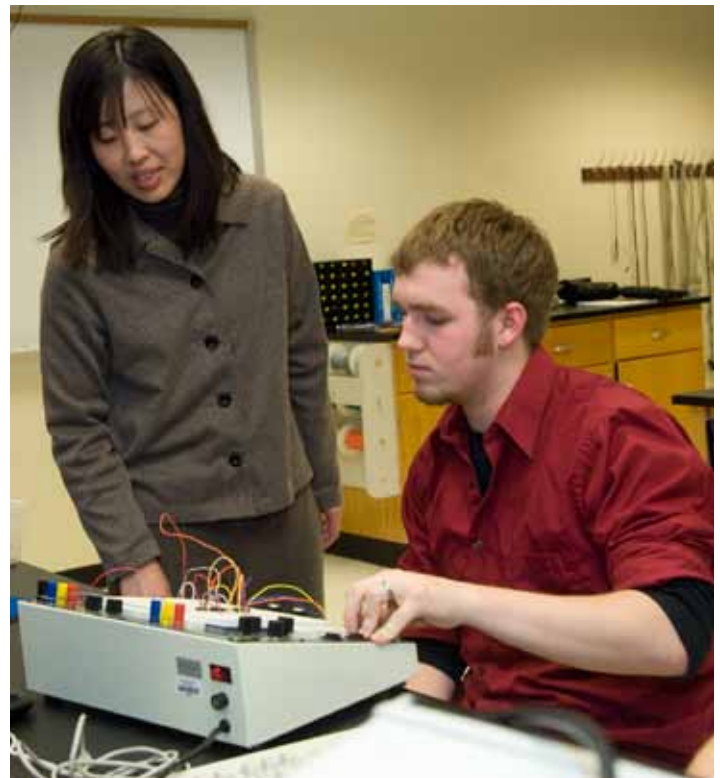


Engineering Advisory Council

The Engineering Advisory Council consists of professional engineers, researchers, and business leaders representing a variety of engineering-related businesses. Through annual meetings, these experts advise the University and evaluate its programs and plans for building upon Cedarville's reputation for excellence in undergraduate engineering education.

Council members include:

Eugene Apple, General Electric Corporation, retired
Ronald Baker, Hi-Tech Aero Spares
Carl Bertsche, Jr., Production Engineering Company
James Brandeberry, Wright State University
Joe Buonodono, Johnson Controls, Inc.
Hal Carter, University of Cincinnati
Gary Clasby, Duriron Company, Inc.
Tom Curran, WPAFB, Aero Propulsion and Power, retired
Jerry Drobinski, Global Development and Sourcing, Inc.
William Engstrom, Engstrom Foundation
Stephen Harris, Rixan Associates, Inc.
John Harshbarger, Video Instruments
Richard Holmes, Holmes and Mays
Phillip Houston, Greene County Department of Development
Dan Kerr, GM Specialty Cars Division
Frank Klatt, Rockwell International, retired
Ed Krupka, Burris Logistics
Tim Lawrence, Ball Aerospace and Technologies Corp.
Joe Mays, Holmes and Mays
Walker Mitchell, Mitchell Consulting
Bob Porter, Xetron (Northrop Grumman)
Dan Rogers, Duotech Services
Greg Smith, Northrop Grumman Space Technology
Terry Smith, Rittal Corporation
Jay Tieber, Ohio Department of Development
Don Wilkinson, ODL, Inc.
Edwin Young, University of Michigan



Computer Science – Bachelor of Science

Course requirements for the **B.S. degree in computer science** are comprised of the following and may be modified by the department chair.

Course requirements involve 51 semester hours including:

Computer Science Core Requirements45

CS-1210 C++ Programming.....	2
CS-1220 Object-Oriented Design Using C++.....	3
CS-2210 Data Structures Using Java.....	3
CS-3210 Programming Language Survey.....	3
CS-3310 Operating Systems.....	3
CS-3410 Algorithms.....	3
CS-3510 Compiler Theory and Practice.....	3
CS-3610 Database Organization and Design.....	3
CS-4220 Web Applications.....	3
*CS-4810,4820 Software Engineering I, II.....	7
EGCP-1010 Digital Logic Design.....	3
EGCP-2110 Microprocessors.....	3
EGGN-3110 Professional Ethics.....	3
EGGN-4010 Senior Seminar.....	0
MATH-2510 Discrete Mathematics for Computer Science.....	3

Technical Electives chosen from the following6

Any 3000- or 4000-level computer science course.....	3
EGCP-3010 Advanced Digital Logic Design.....	3
EGCP-3210 Computer Architecture.....	3
EGCP-4210 Advanced Computer Architecture.....	3
MATH-3500 Number Theory.....	3
MATH-3610 Linear Algebra.....	3
MATH-3760 Numerical Analysis.....	3
Other courses with pre-approval of department chair	

*Capstone Course

Required Cognates.....24.5

CHEM-1050 Chemistry for Engineers.....	3.5
(or CHEM-1110 General Chemistry I.....)	4)
MATH-1710,1720 Calculus I, II.....	10
MATH-3110 Probability and Statistics I.....	3
PHYS-2110, 2120 General Physics I, II.....	8

Optional Computer Science Tracks**9

Replace 6 hours of technical electives with 9 hours from one of the following computer science track

Computer Graphic Track

CS-4710 Computer Graphics.....	3
Choose one of the following groups:	
Group 1	
EMTC-2110 Video Technical Training.....	3
EMTC-3310 Advanced Video Production.....	3
Group 2	
EMTC-2601 Interactive Interface Design with Flash.....	3
EMTC-3630 Principles of Computer Animation.....	3
EMTC-3765 Animation Practicum.....	1

Distributed Computing Track

CS-4320 Network Security.....	3
CS-4410 Parallel Computing.....	3
EGCP-4310 Computer Networks.....	3

Hardware Track

Choose any three courses:	
EGCP-3010 Advanced Digital Logic Design.....	3
EGCP3210 Computer Architecture.....	3
EGCP-4210 Advanced Computer Architecture.....	3
EGCP-4310 Computer Networks.....	3

Operations Research Track

MATH-3240 Introduction to Operations Research.....	3
MATH-3610 Linear Algebra.....	3
MATH-4110 Probability and Statistics II.....	3

Computer Science Major (B.S.) Curriculum Summary

Proficiency Requirements.....	0-6
General Education Requirements.....	42.5
Computer Science Major Requirements.....	51-54
Required Cognates.....	24.5
Electives.....	7-10
Total (minimum, not including proficiency).....	128

A complete description of the general education requirements is found on page 24.

Suggested Four-Year Curriculum for a Major in Computer Science–B.S.

First year:

BEGE-1710 Christian Life and Thought.....	3
BEGE-1720 Spiritual Formation.....	3
CS-1210 C++ Programming.....	2
CS-1220 Object Oriented Design Using C++.....	3
EGCP-1010 Digital Logic Design.....	3
ENG-1400 Composition.....	3
GSS-1100 Politics and American Culture.....	3
MATH-1710, 1720 Calculus I, II.....	10
PEF-1990 Physical Activity and the Christian Life.....	1
Physical Education Activity Elective.....	1
Total.....	32

Second year:

BEGE-2730 Old Testament Literature.....	3
BEGE-2740 New Testament Literature.....	3
CHEM-1050 Chemistry for Engineers.....	3.5
COM-1100 Fundamentals of Speech.....	3
CS-2210 Data Structures Using Java.....	3
CS-3210 Programming Language Survey.....	3
MATH-2510 Discrete Mathematics for Computer Science.....	3
MATH-3110 Probability and Statistics I.....	3
PHYS 2110, 2120 General Physics I, II.....	8
Total.....	32.5

Third year:

BEGE-3750 Christian Worldview Development.....	2
BEGE-3760 Christian Worldview Integration.....	2
CS-3310 Operating Systems.....	3
CS-3410 Algorithms.....	3
CS-3510 Compiler Theory and Practice.....	3
CS-3610 Database Organization and Design.....	3
CS-4220 Web Applications.....	3
EGCP-2110 Microprocessors.....	3
GBIO-1000 Principles of Biology.....	3.5
HUM-1400 Introduction to the Humanities.....	3
Literature Elective.....	3
Total.....	31.5

Fourth year:

CS-4810, 4820 Software Engineering I, II.....	7
CS Technical Electives.....	6-9
EGGN-3110 Professional Ethics.....	3
EGGN-4010 Senior Seminar.....	0
History Elective.....	3
Social Science/Global Awareness Elective.....	3
Electives**.....	7-10
Total.....	32

**The optional computer science tracks allow specialization within the degree by focusing the technical elective hours into a designated area and shifting three general education elective hours into the technical electives.

A complete description of the general education requirements is found on page 24.

Computer Engineering

Course requirements for the B.S.Cp.E. degree are comprised of the following and may be modified by the department chair.

Course requirements involve 70 semester hours including:

CS-1210 C++ Programming.....	2
CS-1220 Object Oriented Design with C++	3
CS-2210 Data Structures Using Java	3
CS-3310 Operating Systems	3
CS-3410 Algorithms.....	3
EGCP-1010 Digital Logic Design	3
EGCP-2110 Microprocessors	3
EGCP-3010 Advanced Digital Logic Design.....	3
EGCP-3210 Computer Architecture	3
EGCP-4210 Advanced Computer Architecture.....	3
*EGCP-4810 Computer Engineering Senior Design I.....	4
*EGCP-4820 Computer Engineering Senior Design II.....	4
EGEE-2010 Circuits	5
EGEE-3110 Linear Systems	3
EGEE-3210 Electronics I	3
EGGN-1110 The Engineering Profession	1
¹ EGGN-3110 Professional Ethics	3
EGGN-4010 Senior Seminar.....	0
EGME-1810 Engineering Graphics.....	1
EGME-2510 Statics	3
EGME-3170 Thermal Systems	2
MATH-2510 Discrete Math: Computer Science	3
EGXX/CSXX Technical Electives (3000 or 4000-level)	6
EGXX/CSXX Technical Electives (4000-level).....	3

Required Cognates 27.5

³ CHEM-1050 Chemistry for Engineers	3.5
⁴ MATH-1710 Calculus I	5
MATH-1720 Calculus II	5
MATH-2740 Differential Equations	3
MATH-3110 Probability and Statistics I	3
PHYS-2110 General Physics I	4
PHYS-2120 General Physics II	4

¹Satisfies humanities general education requirements

³Satisfies physical science general education requirements

⁴Satisfies mathematics general education requirements

*Capstone Course

Computer Engineering Major Curriculum Summary

Proficiency Requirements.....	0-5
General Education Requirements.....	42.5
Comprehensive Computer Engineering Requirements	70
Required Cognates	27.5
Total (minimum, not including proficiency)	140



Suggested Four-Year Curriculum for a Major in Computer Engineering

First year:

BEGE-1710 Christian Life and Thought.....	3
BEGE-1720 Spiritual Formation	3
CHEM-1050 Chemistry for Engineers	3.5
CS-1210 C++ Programming.....	2
CS-1220 Object Oriented Design with C++	3
EGCP-1010 Digital Logic Design	3
EGGN-1110 The Engineering Profession.....	1
EGME-1810 Engineering Graphics.....	1
MATH-1710 Calculus I	5
MATH-1720 Calculus II	5
PHYS-2110 General Physics I	4
Total	33.5

Second year:

BEGE-2730 Old Testament Literature	3
COM-1100 Fundamentals of Speech.....	3
CS-2210 Data Structures Using Java	3
EGEE-2010 Circuits	5
EGME-2510 Statics	3
ENG-1400 Composition.....	3
MATH-2510 Discrete Math: Computer Science	3
MATH-2740 Differential Equations	3
MATH-3110 Probability and Statistics I	3
PEF-1990 Physical Activity and the Christian Life	1
PHYS-2120 General Physics II.....	4
Physical Education Activity Elective.....	1
Total	35

Third year:

BEGE-2740 New Testament Literature	3
CS-3310 Operating Systems	3
CS-3410 Algorithms.....	3
EGCP-2110 Microprocessors.....	3
EGCP-3010 Advanced Digital Logic Design	3
EGCP-3210 Computer Architecture	3
EGEE-3110 Linear Systems	3
EGEE-3210 Electronics I	3
EGGN-3110 Professional Ethics	3
HUM-1400 Introduction to Humanities.....	3
Literature Elective	3
Technical Electives	3
Total	36

Fourth year:

BEGE-3750 Christian Worldview Development.....	2
BEGE-3760 Christian Worldview Integration	2
EGCP-4210 Advanced Computer Architecture	3
EGCP-4810 Computer Engineering Senior Design I	4
EGCP-4820 Computer Engineering Senior Design II.....	4
EGGN-4010 Senior Seminar	0
EGME-3170 Thermal Systems	2
GSS-1100 Politics and American Culture.....	3
Biology Elective	3.5
Computer Engineering Electives	6
History Elective.....	3
Social Science/Global Awareness Elective.....	3
Total	35.5

Electrical Engineering

Course requirements for the B.S.E.E. degree are comprised of the following and may be modified by the department chair.

Course requirements involve 67 semester hours including:

CS-1210 C++ Programming	2
EGCP-1010 Digital Logic Design	3
EGCP-2110 Microprocessors	3
EGEE-2010 Circuits	5
EGEE-3110 Linear Systems	3
EGEE-3210 Electronics I	3
EGEE-3220 Electronics II	5
EGEE-3310 Electromagnetics	3
EGEE-3330 Communications Theory.....	4
EGEE-4110 Digital Signal Processing.....	2
EGEE-4410 Feedback Control Systems	4
*EGEE-4810 Electrical Engineering Senior Design I.....	4
*EGEE-4820 Electrical Engineering Senior Design II.....	4
EGGN-1110 The Engineering Profession	1
¹ EGGN-3110 Professional Ethics	3
EGGN-4010 Senior Seminar.....	0
EGME-1810 Engineering Graphics.....	1
EGME-2510 Statics	3
EGME-2630 Dynamics	3
EGME-3170 Thermal Systems	2
² Three Technical Electives (must include one 4000-level course).....	9

Required Cognates.....30.5

³ CHEM-1050 Chemistry for Engineers.....	3.5
⁴ MATH-1710 Calculus I	5
MATH-1720 Calculus II	5
MATH-2710 Calculus III	3
MATH-2740 Differential Equations	3
PHYS-2110 General Physics I	4
PHYS-2120 General Physics II	4
Select one Mathematics Elective from the following	3
EGEE-3370 Probability and Random Processes for Engineers	3
MATH-3610 Linear Algebra	3
MATH-3740 Complex Variables.....	3

¹Satisfies humanities general education requirements

²Technical electives must have EGXX designation at 3000- or higher level

³Satisfies physical science general education requirements

⁴Satisfies mathematics general education requirements

*Capstone Course

Electrical Engineering Major Curriculum Summary

Proficiency Requirements	0-5
General Education Requirements.....	42.5
Comprehensive Electrical Engineering Requirements	67
Required Cognates	30.5
Total (minimum, not including proficiency)	140

Suggested Four-Year Curriculum for a Major in Electrical Engineering

First year:

BEGE-1710 Christian Life and Thought.....	3
BEGE-1720 Spiritual Formation	3
CHEM-1050 Chemistry for Engineers	3.5
CS-1210 C++ Programming	2
EGCP-1010 Digital Logic Design	3
EGGN-1110 The Engineering Profession	1
EGME-1810 Engineering Graphics.....	1
ENG-1400 Composition.....	3
MATH-1710 Calculus I	5
MATH-1720 Calculus II.....	5
PHYS-2110 General Physics I	4
Total	33.5

Second year:

BEGE-2730 Old Testament Literature	3
COM-1100 Fundamentals of Speech.....	3
EGCP-2110 Microprocessors.....	3
EGEE-2010 Circuits	5
EGME-2510 Statics	3
EGME-2630 Dynamics	3
GSS-1100 Politics and American Culture.....	3
MATH-2710 Calculus III	3
MATH-2740 Differential Equations	3
PEF-1990 Physical Activity and the Christian Life	1
PHYS-2120 General Physics II.....	4
Physical Education Elective.....	1
Total	35

Third year:

BEGE-2740 New Testament Literature	3
EGEE-3110 Linear Systems	3
EGEE-3210 Electronics I	3
EGEE-3220 Electronics II.....	5
EGEE-3310 Electromagnetics	3
EGEE-3330 Communications Theory.....	4
EGGN-3110 Professional Ethics	3
HUM-1400 Introduction to Humanities.....	3
Electrical Engineering Elective	3
Mathematics Elective	3
Social Science/Global Awareness Elective.....	3
Total	36

Fourth year:

BEGE-3750 Christian Worldview Development.....	2
BEGE-3760 Christian Worldview Integration	2
EGEE-4110 Digital Signal Processing.....	2
EGEE-4410 Feedback Control Systems	4
EGEE-4810 Electrical Engineering Senior Design I	4
EGEE-4820 Electrical Engineering Senior Design II	4
EGGN-4010 Senior Seminar	0
EGME-3170 Thermal Systems	2
Biology Elective	3.5
Electrical Engineering Electives	6
History Elective.....	3
Literature Elective	3
Total	35.5

A complete description of the general education requirements is found on page 24.

Mechanical Engineering

Course requirements for the B.S.M.E. degree are comprised of the following and may be modified by the department chair.

Course requirements involve 70 semester hours including:

EGCP-1010 Digital Logic Design	3
EGEE-2050 Circuits and Instrumentation.....	4
EGEE-3530 Electrical Machines	3
EGGN-1110 The Engineering Profession.....	1
¹ EGGN-3110 Professional Ethics	3
EGGN-4010 Senior Seminar.....	0
EGME-1810 Engineering Graphics.....	1
EGME-2050 Computational Methods.....	4
EGME-2310 Manufacturing and Finance	3
EGME-2410 Properties of Engineering Materials.....	4
EGME-2530 Statics and Mechanics of Materials	5
EGME-2630 Dynamics	3
EGME-3010 Mechanical Engineering Lab I.....	2
EGME-3020 Mechanical Engineering Lab II	2
EGME-3110 Thermodynamics.....	5
EGME-3150 Heat Transfer.....	3
EGME-3210 Fluid Mechanics.....	3
EGME-3610 Kinematics and Design of Machines.....	3
EGME-3850 Mechanical Design	3
EGME-4660 Automatic Controls	3
*EGME-4810 Mechanical Engineering Senior Design I	3
*EGME-4820 Mechanical Engineering Senior Design II	3
Engineering Electives (must include one 4000-level course)	6

Required Cognates..... 27.5

² CHEM-1050 Chemistry for Engineers.....	3.5
³ MATH-1710 Calculus I.....	5
MATH-1720 Calculus II.....	5
MATH-2710 Calculus III.....	3
MATH-2740 Differential Equations.....	3
PHYS-2110 General Physics I.....	4
PHYS-2120 General Physics II.....	4

¹Satisfies humanities general education requirements

²Satisfies physical science general education requirements

³Satisfies mathematics general education requirements

*Capstone Course

Mechanical Engineering Major Curriculum Summary

Proficiency Requirements.....	0-5
General Education Requirements.....	42.5
Comprehensive Mechanical Engineering Requirements.....	70
Required Cognates.....	27.5
Total (minimum, not including proficiency)	140



Suggested Four-Year Curriculum for a Major in Mechanical Engineering

First year:

BEGE-1710 Christian Life and Thought.....	3
BEGE-1720 Spiritual Formation	3
CHEM-1050 Chemistry for Engineers	3.5
EGCP-1010 Digital Logic Design	3
EGGN-1110 The Engineering Profession.....	1
EGME-1810 Engineering Graphics.....	1
ENG-1400 Composition.....	3
MATH-1710 Calculus I	5
MATH-1720 Calculus II	5
PEF-1990 Physical Activity and the Christian Life	1
PHYS-2110 General Physics I	4
Physical Education Elective.....	1
Total	33.5

Second year:

BEGE-2730 Old Testament Literature	3
BEGE-2740 New Testament Literature	3
COM-1100 Fundamentals of Speech.....	3
EGEE-2050 Circuits and Instrumentation.....	4
EGME-2050 Computational Methods.....	4
EGME-2530 Statics and Mechanics of Materials	5
EGME-2630 Dynamics	3
MATH-2710 Calculus III.....	3
MATH-2740 Differential Equations	3
PHYS-2120 General Physics II.....	4
Total	35

Third year:

BEGE-3750 Christian Worldview Development.....	2
EGGN-3110 Professional Ethics	3
EGME-2410 Properties of Engineering Materials.....	4
EGME-3010 Mechanical Engineering Lab I.....	2
EGME-3020 Mechanical Engineering Lab II	2
EGME-3110 Thermodynamics.....	5
EGME-3150 Heat Transfer.....	3
EGME-3210 Fluid Mechanics	3
EGME-3610 Kinematics and Design of Machines.....	3
EGME-3850 Mechanical Design	3
HUM-1400 Introduction to Humanities.....	3
History Elective.....	3
Total	36

Fourth year:

BEGE-3760 Christian Worldview Integration	2
EGEE-3530 Electrical Machines	3
EGGN-4010 Senior Seminar	0
EGME-2310 Manufacturing and Finance	3
EGME-4660 Automatic Controls	3
EGME-4810 Mechanical Engineering Senior Design I	3
EGME-4820 Mechanical Engineering Senior Design II	3
GSS-1100 Politics and American Culture.....	3
Biology Elective	3.5
Engineering Elective.....	6
Literature Elective	3
Social Science/Global Awareness Elective.....	3
Total	35.5

Minors

Biomedical Engineering Minor

The **biomedical engineering minor** will help prepare computer, electrical, and mechanical engineering students for careers in the biomedical engineering field, graduate study in biomedical engineering, or medical school. While not required for the emphasis in biomedical engineering, students intending to pursue medical school should have two semesters of general chemistry and organic chemistry, as well as a semester of zoology, cell biology and junior level biochemistry.

Course requirements for the **biomedical engineering minor** involve 13.5-14 semester hours including:

GBIO-1000 Principles of Biology	3.5
(or BIO-1110 Introduction to Biology	4)
GBIO-2010 Human Anatomy and Physiology	4
EGGN-3610 Biomedical Engineering Systems.....	3
GBIO-2720 Bioethics and the Human Experience	3

Chose one elective from the following

EGEE-4610 Medical Imaging	3
EGME 4560 Biomechanics and Biomaterials	3

Computer Science Minor

The **computer science minor** allows students to take a focused set of courses which will enable them to effectively employ programming within their own discipline. Proficiency in computer programming is a skill which can be a strong asset in virtually every discipline. Course requirements for the **computer science minor** involve 27 semester hours including:

CS-1210 C++ Programming	2
CS-1220 Object-Oriented Design Using C++	3
CS-2210 Data Structures Using JAVA	3
CS-3410 Algorithms	3
EGCP-1010 Digital Logic Design	3
MATH-1710, 1720 Calculus I, II	10

Electives chosen from the following

EGEE-3370 Probability and Random Processes for Engineers	3
MATH-3110 Probability and Statistics I.....	3

Special Programs

Cooperative Education Program

The **cooperative education program** option has been a traditional program option for engineering education for the last 100 years. The co-op program offers students who want to work an opportunity to gain industrial experience as part of their formal education. Co-op is the established program that the industry has developed with academic institutions to provide supervised work experiences for students. Engineering and computer science students who select this option will require an extra year to obtain their B.S. degree; they will receive a certificate stating that they have satisfactorily completed the co-op program option.

Course requirements for the cooperative education program include:

EGGN-3910 Co-Op I	0
(or EGGN-3911 Co-Op IA	0)
(and EGGN- 3912 Co-Op IB	0)
EGGN-3920 Co-Op II	0
(or EGGN-3921 Co-Op IIA.....	0)
(and EGGN- 3922 Co-Op IIB	0)
EGGN-3930 Co-Op III	0
(or EGGN-3931 Co-Op IIIA.....	0)
(and EGGN- 3932 Co-Op IIIB	0)

Engineering Honors Program

The **engineering honors program** is designed to challenge exceptional students and encourage them to reach their highest possible potential. Because the program is integrated with the University's honors program, students who wish to participate must first be admitted into the honors program; the details are listed in the Interdisciplinary Studies section of the catalog. Admission can occur in either the freshman or sophomore year. Admission to the engineering honors program occurs after the student completes the sophomore year. A cumulative GPA of 3.5 or above is required for participation.

Engineering coursework involves taking the honors version of three courses and one additional engineering elective course. These engineering honors courses are the regularly scheduled courses and are taken with other students, but they have enrichment opportunities and exposure to advanced topics through special assignments and extra sessions with the professor.

Course requirements for the **engineering honors program** include:

HON-1010 and 1020 Making of the Modern Mind (substitutes for HUM-1400 and HIST elective).....	10
EGXX-4XXX Additional Engineering Elective	3

Honors version of the following courses:

Requirements for computer engineering majors include:

EGCP-3210 Computer Architecture	3
EGCP-3010 Advanced Digital Logic Design.....	3
EGEE-3210 Electronics I	3

Requirements for electrical engineering majors include:

EGEE-3210 Electronics I	3
EGEE-3330 Communications Theory.....	4
EGEE-4410 Feedback Controls.....	4

Requirements for mechanical engineering majors include:

EGME-3110 Thermodynamics	5
EGME-3850 Mechanical Design	3
EGME-4660 Automatic Controls	3

Students who earn a "B" or above in HON-1010 and 1020, earn a "B" or above in all engineering honors courses, and graduate with a cumulative GPA of 3.5 or higher will earn the "engineering honors graduate" designation.

