Engineering

School of Engineering, Nursing, and Science

Purpose Statement

The engineering program at Cedarville University blends the academic subjects required of all accredited engineering programs with "hands-on" experience through extensive laboratory work and design projects. Our curriculum introduces freshmen to 3-D Solid Modeling in the Computer-Aided Engineering Graphics course and digital electronics in the Digital Logic Design course. This provides students with practical experience and early insight into subsequent theory.

Our program enjoys the rich technical environment in the surrounding community and provides frequent opportunities for interaction with engineers working on the latest aerospace, automotive, and electronics technology.

The department faculty have the following vision: "We, the Elmer W. Engstrom Department of Engineering, seek to honor the Lord Jesus Christ in every endeavor and earnestly desire to cultivate engineers 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."

Personal Requirements

Students interested in studying engineering but uncertain of the specific engineering major have until the spring semester of the freshman year to choose computer, electrical, or mechanical engineering as a major. Faculty advisors, the Career Services Office, and engineering field trips represent some of the resources available to students contemplating which engineering major to choose.

Department Requirements

New students

Students who enjoy and excel in science and mathematics, and who want to help people, have the highest potential for careers as engineers. 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 an engineering major. 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, high school students should take a college preparatory curriculum that includes:

- 4 units of English
- 4 units of mathematics (algebra, geometry, trigonometry, and advanced mathematics or precalculus)
- 4 units of science (physical science, biology, chemistry, and physics)
- 3 units of social science
- 2 units of a single foreign language

It is also helpful for students to have some computer programming experience using a language such as BASIC, VisualBasic, PASCAL, C, C++, or FORTRAN. Experience with spreadsheets and word processors is also helpful.

Retention Requirement

Engineering majors must demonstrate proficiency in certain lower-level courses to advance into upper-level, 3000-level courses. Hence, all engineering majors must earn an overall GPA of 2.0 or higher by the end of their sophomore year. Furthermore, to advance into the junior year, all engineering majors must earn a combined GPA of 2.0 or higher in all of their engineering courses and a combined GPA of 2.0 or higher in the following courses: MATH-1710, 1720, and 2710 - Calculus I,II, and III*, MATH-2740 - Differential Equations, and PHYS-2110 and 2120 - General Physics I and II.

*not included for computer engineering

Graduation Requirements

1. Earn a cumulative grade point average of 2.0 or above in all engineering and cognate courses.
2. Take an assessment exam similar to the Fundamentals of Engineering Examination.

Programs of Study

The Department of Engineering offers three programs of study:

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

Accreditation

The B.S.E.E., and B.S.M.E. programs are accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET).

State Approval

The B.S.Cp.E, B.S.E.E. and B.S.M.E. programs have full approval by the Ohio Board of Regents.

Registration as a Professional Engineer

Seniors and graduates 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. Cedarville University seniors have consistently had a passing rate above the state and national average.

Technical Resources

Our modern labs include the following: senior design labs, fluids lab with an 18-inch cross-section wind tunnel, heat transfer, refrigeration, mechanics, materials testing, internal combustion engine dynamometers, CNC manufacturing, electrical machines, feedback controls, circuits, electronics, communications, digital logic, microprocessors, surface-mount soldering, vibrations, and dynamics of machines. We also have computer-based circuit design tools, 3-D solid-modeling, FEA, CFD, and CNC software.

Co-Curricular Opportunities

Engineering freshmen participate in the annual Cardboard Canoe Challenge at Homecoming. Other events include the sophomore Statics and Dynamics design competitions and the Advanced Digital Logic Design competition.

The department provides engineering students an opportunity to participate in some of the national and international engineering design competitions organized by professional engineering societies. Student chapters of national organizations (ASME, IEEE, SAE, ASEE, and SWE) encourage their members to participate in Aerodesign, Formula SAE, Micro-Baja, Mini-Baja, Robotics, Solar Splash, and Supermileage competitions.

Recently, Cedarville University took first place in SAE's Supermileage (2000), SAE's Aerodesign West (2003), AEC/ASME Solar Splash (2004), and ASEE's Autonomous Vehicle (2001,2002,2003).

Career Opportunities

Engineering is the art of applying scientific and mathematical principles, experience, judgment, and common sense to make things that help people. Engineers are problem solvers; they

make things work better, more efficiently, more quickly, and less expensively. Engineers design EKG and ultra-sound machines to help doctors diagnose medical problems, spacecraft to explore planets, machines to generate electricity to power cities, and technology to combat terrorism. They are designing faster and more powerful computers, advanced communication systems, and safer and more fuel-efficient cars and airplanes. Engineers are on the cutting edge of technology.

Engineers spend a lot of time interacting and communicating with others, often working on a team with others. With a strong science, mathematics, and technology background, the engineer often rises to leadership positions in a variety of settings, working at all stages—research, development, design, construction, production, operations, marketing, sales, and management—to develop new ideas into products.

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

Faculty

Lawrence Zavodney, Chairman: 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.

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.

Charles Allport, Assistant to the Academic Vice President; Associate Professor of Mechanical Engineering. *Education:* B.S., United States Air Force Academy, 1962; M.A., George Washington University, 1963; M.S.E., Arizona State University, 1965; registered professional engineer. At Cedarville since 1990.

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.

Peter Burban, Associate Professor of Mechanical Engineering. *Education*: B.S.Ch.E., University of Illinois, 1980; Ph.D., University of Delaware, 1984. At Cedarville since 2001.

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., Shaghai Jiao Tong University, 1992; M.S.E.T., Pittsburg State University, 1998; Ph.D., The University of Akron, 2004. At Cedarville since 2004.

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.

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, Associate Professor of Electrical 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.

Robert Laramore, Professor of Electrical Engineering. *Education:* B.S.E.E., University of Missouri at Rolla, 1973; M.S.E.E., University of Missouri at Rolla, 1975; registered professional engineer. At Cedarville since 1992.

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. At Cedarville since 2003.

Samuel SanGregory, Associate 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.

D. Jeff Shortt, Associate 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, University of Dayton. At Cedarville since 2002.

Technical Support Staff

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

Jonathan Gain, Electrical Engineering Technician. *Education:* B.S.E.T., LeTourneau University, 1968. At Cedarville since 1992.

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 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
Robert Bremer, Jr.
Gary Clasby, Duriron Company, Incorporated
Donald Copland, Procter and Gamble Company, retired, ANOVA Limited
Harry Couch, Delco Products Division GMC
Kevin Crawford, Dayton Power and Light
Tom Curran, WPAFB, Aero Propulsion and Power, retired
Jerry Drobinski, Global Development and Sourcing, Inc.
James Engelman, Delphi Energy and Engine Management, retired
William Engstrom, Engstrom Foundation
Dennis Ferrigno, Bateman Engineering, Incorporated
Stephen Harris, Rixan Associates, Incorporated
Dennis Hess, DataTel Communications
Richard Holmes, Holmes and Mays
Phillip Houston, Greene County Department of Development
Dan Kerr, GM Specialty Cars Division
Frank Klatt, Rockwell International, retired
Tim Lawrence, Ball Aerospace and Technologies Corp.
Joe Mays, Holmes and Mays
Walker Mitchell, Mitchell Consulting
Fritz Russ, Russ Venture Group, Incorporated
H. Ted Santo, Dayton Power and Light
Terry Smith, Rittal Corporation
Ted Tate, Tate Model and Engineering, Incorporated
Jay Tieber, Ohio Department of Development
Ron Weber, Lowrance Electronics, Incorporated
Walt Weisel, Robotic Workspace Technologies
Don Wilkinson, Johnson Controls, Inc.
Bryan Williams, Procter and Gamble
Riad Yammine, Speedway/Super America, retired
Edwin Young, University of Michigan

Engineering

School of Engineering, Nursing, and Science

Computer Engineering

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

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-2630 Dynamics 3
EGME-3170 Thermal Systems 2
MATH-2510 Discrete Math: Computer Science 3
Two EGCP 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-2740 Differential Equations 3
MATH-3110 Probability and Statistics I 3
PHYS-2110 General Physics I 4
PHYS-2120 General Physics II 4

[1]Satisfies humanities General Education Requirements
[2]Satisfies physical science General Education Requirements
[3]Satisfies 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

A complete description of the General Education Requirements is found on page 18

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
EGME-2630 Dynamics 3
ENG-1400 Composition 3
MATH-2740 Differential Equations 3
MATH-2510 Discrete Math: Computer Science 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
GSS-1000 Foundations of Social Science 3
HUM-1400 Introduction to Humanities 3
Literature Elective 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
MATH-3110 Probability and Statistics I 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 chairman.

Course requirements involve 67 semester hours including:

EGCP-1010 Digital Logic Design 3
EGCP-1310 Algorithmic Programming 2
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
Three EGEE Electives *(must include one 4000-level course)* 9

Required Cognates *30.5*
[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
Mathematics Elective (Select one of the following:) 3
  EGEE-3370 Probability and Random Processes for Engineers 3
  MATH-3610 Linear Algebra 3
  MATH-3740 Complex Variables 3

[1]Satisfies humanities General Education Requirements
[2]Satisfies physical science General Education Requirements
[3]Satisfies 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

A complete description of the General Education Requirements is found on page 18

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
EGCP-1010 Digital Logic Design 3
EGCP-1310 Algorithmic Programming 2
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-1000 Foundations of Social Science 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

Engineering

School of Engineering, Nursing, and Science

Mechanical Engineering

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

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 & 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

[1]Satisfies humanities General Education Requirements
[2]Satisfies physical science General Education Requirements
[3]Satisfies 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

A complete description of the General Education Requirements is found on page 18

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 & Finance 3
EGME-4660 Automatic Controls 3
EGME-4810 Mechanical Engineering Senior Design I 3
EGME-4820 Mechanical Engineering Senior Design II 3
GSS-1000 Foundations of Social Science 3
Biology Elective 3.5
Engineering Elective 6
Literature Elective 3
Social Science/Global Awareness Elective 3
Total 35.5

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 University's 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 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
EGGN-3110 Professional Ethics-Honors 3
EGXX-4XXX 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.

Cedarville entered the Formula SAE competition for the first time in 2004 and was one of 134 teams that entered the competition. Engineering students designed and built this formula-style race car (which can accelerate from zero to sixty mph in four seconds) to compete in a series of selected events.

Course Descriptions

General Engineering Courses

EGGN-1110 The Engineering Profession–Fa **1 hour**
Introduction to the basic concepts and skills necessary to function effectively as a Christian engineer, participation in group activities and design projects, introduction to ethical and moral issues in engineering practice, and introduction to engineering computer applications. Term project introduces Christian heritage in science and engineering. (Fee: $50)

EGGN-3110 Professional Ethics–Sp **3 hours**
Introduction to the theories of morality and philosophical issues of determining what is true and what is good. Applications are made to professional conduct, engineer-client relations, and product liability. Legal problems and the engineering code of ethics are discussed from a biblical perspective.

EGGN-4010 Senior Seminar–Fa **0 hours**
Required weekly meeting of senior engineering majors to discuss the transition into the professional work environment. *Prerequisite: senior status in engineering*. (Fee: $35)

Engineering Competition Courses

EGGN-1960 Competition Project–Sp **0 hours**
Engineering freshmen on a Department of Engineering Intercollegiate Design Competition may use this course to provide on their transcript a record of their participation throughout the year. The name of the competition will be designated.

EGGN-2960 Competition Project–Sp **0 hours**
Engineering sophomores on a Department of Engineering Intercollegiate Design Competition may use this course to provide on their transcript a record of their participation throughout the year. The name of the competition will be designated.

EGGN-3960 Competition Project–Sp **0 hours**
Engineering juniors on a Department of Engineering Intercollegiate Design Competition may use this course to provide on their transcript a record of their participation throughout the year. The name of the competition will be designated.

EGGN-4960 Competition Project–Sp **0 hours**
Engineering seniors on a Department of Engineering Intercollegiate Design Competition may use this course to provide on their transcript a record of their participation throughout the year. The name of the competition will be designated.

Computer Engineering Courses

EGCP-1010 Digital Logic Design–Fa,Sp **3 hours**
Introduction to the fundamentals of digital logic design, number systems, Boolean Algebra, Karnaugh maps, computer simulation tools, combinational network design, flip flops, counters, state machines, and sequential networks. Circuits are designed in class and are built and evaluated in the laboratory. Two lecture hours and one two-hour laboratory per week. (Fee: $100)

EGCP-1310 Algorithmic Programming–Sp **2 hours**
Introduction to algorithmic computer programming for engineering and scientific problem solving, fundamentals of coding, and debugging programs. A language such as C, C++, or Java is used. Algorithms and data structures are applied to scientific and engineering problems.

EGCP-2110 Microprocessors–Fa **3 hours**
Introduction to the fundamentals of microprocessors, including

assembly language programming, memory hierarchies, peripheral device interfacing, interrupts, and microcomputer design. Two lecture hours and one two-hour laboratory per week; design project required. *Prerequisite: EGCP-1010 Digital Logic Design*. (Fee: $100)

EGCP-3010 Advanced Digital Logic Design–Fa **3 hours**

Advanced treatment of digital logical design techniques and practices with emphasis on rapid electronic prototyping and effective use of advanced computer-aided design tools; schematic, textual, and VHDL design entry; arithmetic circuits, advanced finite-state machines, and advanced controller implementations. Three lecture hours and one two-hour laboratory per week; multiple projects and laboratory experiences including a class design contest usually involving a robot. *Prerequisites: EGCP-1010 Digital Logic Design; CS-1210 C++ Programming; junior status or permission of instructor.* (Fee: $100)

EGCP-3210 Computer Architecture–Sp **3 hours**

Introduction to computer architecture with an emphasis on hardware, RISC vs. CISC, pipeline and vector processing, I/O, and memory hierarchy including caches. Students design and construct a small microprocessor using a logic simulator and then write an assembler for their processor. *Prerequisites: EGCP-2110 Microprocessors; CS-1210 C++ Programming.*

EGCP-3510 Software Engineering–Fa **3 hours**

Discussion of the engineering process as it applies to software development, life-cycle analysis and modeling, software metrics and management tools, project cost and size estimation, system requirement analysis, software design paradigms, and software testing and verification. *Prerequisites: CS-3410 Algorithms; CS-3310 Operating Systems.*

EGCP-3920 Computer Engineering Internship 1-3 hours

An opportunity for a computer engineering student to work closely with an industrial advisor. Specific attention is given to solving a particular problem(s) in that industry or firm. A faculty advisor assists in supervising and approving the internship, including assessing the number of credit hours. A final report (approximately seven pages per credit hour) describing the experience, including the problem and solution, is required. Must be arranged with a faculty sponsor and work supervisor before starting and cannot be used to satisfy elective credit requirements. *Prerequisites: junior or senior engineering major status; faculty advisor's permission.*

EGCP-3950 Topics in Computer Engineering 1-3 hours

Selected topics in computer engineering at the 3000-level that will complement or extend existing 2000- and 3000-level courses or expose students to topics not taught in other courses; may be proposed by the engineering faculty or students. *Prerequisite: instructor's permission.*

EGCP-3980 1-3 hours
Independent Study in Computer Engineering

Opportunity to perform independent study or research in computer engineering and allied fields of application. A formal proposal for study must be approved by the faculty advisor before registering for this course. Up to three credit hours of engineering electives can be satisfied by an equivalent number of independent-study hours. *Prerequisites: junior or senior engineering major status; faculty advisor's permission.*

EGCP-3990 1-3 hours
Project Design in Computer Engineering

An elective course for students to get academic credit for extracurricular design work in computer engineering; project may be related to a design competition, ministry, industry, or personal interest. Cannot be used to satisfy engineering elective requirements. *Prerequisite: instructor's permission.*

EGCP-4210 Advanced Computer Architecture–Fa **3 hours**

Advanced study of computer architecture with an emphasis on performance, performance metrics, benchmarks, integer and floating point concepts, data-path and control, super-scalar processing and pipelining, memory hierarchy, I/O and peripherals, vector, array and parallel processors, and multiprocessors. *Prerequisites: EGCP-3010 Advanced Digital Logic Design; EGCP-3210 Computer Architecture.*

EGCP-4810 4 hours
Computer Engineering Senior Design I–Fa

Design and development of electronic products to meet specific requirements. Introduction to computer system design, power supply design, hardware-software co-design, software engineering, system performance trade-offs, electronic design tools, prototype methods, estimating and managing time and cost constraints, and project management. Student teams prepare a project proposal, design and prototype a microprocessor-based system or sub-system, use computerized design tools, submit weekly progress reports, and conduct design reviews. Three lecture hours and one two-hour laboratory per week. *Prerequisite: senior status in computer engineering. Corequisite: EGCP-4210 Advanced Computer Architecture.* (Fee: $100)

EGCP-4820 4 hours
Computer Engineering Senior Design II–Sp

Continuation of EGCP-4810 Computer Engineering Senior Design I. Student teams will complete their capstone project, submit weekly progress reports, prepare a formal final report, and make a formal design review presentation. *Prerequisite: EGCP-4810 Computer Engineering Senior Design I.* (Fee: $100)

Clinching the Aerodesign West Competition in 2003, brothers Brian and Nathan Foote found themselves the proud owners of the first-place trophy. Made from carbon fiber composite materials, their unique 5.25-lb plane lifted 23 pounds of cargo. They also received the best technical report award.

EGCP-4950 **1-3 hours**
Advanced Topics in Computer Engineering
Selected topics in computer engineering at the 4000-level that expand the depth of existing 3000- and 4000-level courses or expose the students to advanced concepts not taught in other courses. Topics may be proposed by the engineering faculty or students. *Prerequisite: instructor's permission.*

Electrical Engineering Courses
EGEE-2010 Circuits–Sp **5 hours**
Introduction to basic circuit analysis using Ohm's law, Kirchoff's laws, independent and dependent sources, Thévenin and Norton equivalency and source transformations, transient responses in RC, RL, and RLC circuits, phasor analysis of RLC circuits, power in AC circuits, introduction to 3-phase circuits, mutual inductance, frequency response, Transforms, Laplace circuit analysis, Fourier Series, and introduction to transfer functions. Computer simulations and bread-board circuits are constructed and evaluated in the laboratory. Four lecture hours and one two-hour laboratory per week. Design project required. *Prerequisites: PHYS-2120 General Physics II; MATH-2740 Differential Equations.* (Fee: $100)

EGEE-2050 Circuits and Instrumentation–Sp **4 hours**
Introduction to basic circuit analysis using Ohm's law, Kirchoff's laws, independent and dependent sources, Thévenin and Norton equivalency and source transformations, transient responses in RC, RL, and RLC circuits, operational amplifiers, and introduction to polyphase AC circuits. Circuit applications for transducers such as resistance strain gages, piezoelectric load cells, piezoelectric accelerometers, and thermocouples are emphasized along with measurement uncertainty analysis and statistical methods. Circuits are designed, simulated, constructed and tested in the laboratory. Three lecture hours and one two-hour laboratory per week. *Prerequisites: PHYS-2120 General Physics II; MATH-2740 Differential Equations.* (Fee: $100)

EGEE-3110 Linear Systems–Fa **3 hours**
Introduction to linear time-invariant analysis of continuous and discrete-time systems, using both time and frequency domain methods that include convolution, Fourier Series, Fourier, Laplace, and Z transforms; classical and computer solution methods are utilized. *Prerequisite: EGEE-2010 Circuits*.

EGEE-3150 Analog Filters–Sp **3 hours**
Introduction to theory, design, and how to implement passive and active analog filters; basic filter structures, passive network synthesis, operational amplifier limitations, multiple-amplifier filters, and filter realization methods. *Prerequisite: EGEE-3110 Linear Systems*. (odd years)

EGEE-3210 Electronics I–Fa **3 hours**
Introduction to the analysis of semiconductor electronic device theory and application, diodes, bipolar-junction transistors (BJTs), field-effect transistors (FETs), and the non-ideal characteristics of operational amplifiers. Two lecture hours and one two-hour lab or recitation period per week. *Prerequisite: EGEE-2010 Circuits.* (Fee: $100)

EGEE-3220 Electronics II–Sp **5 hours**
Continuation of EGEE-3210 Electronics I to include differential amplifiers, frequency response of amplifier circuits, multi-stage amplifiers, power amplifiers, feedback circuits, power supplies, filters, digital logic families, and oscillators. Four lecture hours and one two-hour lab per week. *Prerequisite: EGEE-3210 Electronics I.* (Fee: $100)

EGEE-3310 Electromagnetics–Fa **3 hours**
Engineering applications of vector calculus, phasors and Maxwell's equations to electrostatic, magnetostatic and time varying fields, transmission lines, Smith Chart, propagation of uniform plane waves, and single-stub matching. Laboratory exercises introduce field-plotting, transmission line concepts using wave guides, single stub-tuning, introduction to the network analyzer, polarization, and radiation fields. Two lecture hours and one two-hour laboratory or recitation period per week. *Prerequisites: MATH-2710 Calculus III; EGEE-2010 Circuits.* (Fee: $100)

EGEE-3330 Communications Theory–Sp **4 hours**
Introduction to analog and digital communications theory. Probability and random processes are developed to facilitate noise analysis in modulation techniques. Three lecture hours and one two-hour laboratory per week; design project required. *Prerequisite: EGEE-3110 Linear Systems.* (Fee: $100)

EGEE-3370 **3 hours**
Probability and Random Processes for Engineers–Sp
Introduction to sample points, sample spaces, probability, random variables, random vectors, statistical averages, linear transformations, random processes, linear system response to stochastic input, spectral analysis with application of the central-limit theorem, and Gaussian processes to engineering problems. May be used to satisfy the mathematics elective requirement for electrical engineers. *Prerequisite: EGEE-3330 Communications Theory.*

EGEE-3510 Power Electronics–Sp **3 hours**
Introduction to the fundamentals of power electronics, characteristics and application of semiconductor switches, motor control, device applications, and power processing design. Design project required. *Prerequisite: EGEE-3210 Electronics I.* (Fee: $50) (odd years)

EGEE-3530 Electrical Machines–Fa **3 hours**
Introduction to the fundamentals of power circuits and the principles of analysis and characteristics of transformers and AC and DC rotating machines. Two lecture hours and one two-hour laboratory per week. *Prerequisite: EGEE-2010 Circuits; or EGEE-2050 Circuits and Instrumentation.* (Fee: $100)

In the championship 300-meter sprint pitting the three fastest boats, Brian Morgan (BSME '04) steers the Cedarville Boat past Cal Poly (foreground) in the final 50 meters to cinch first place in the 2004 Solar Splash Sprint. When combined with 3rd place in solar endurance, 2nd place in solar slalom and 3rd place in the technical report, Cedarville was named the 2004 World Champions! The team also received the Outstanding System Design Trophy. Details of the competition are posted at ***www.solarsplash.com****.*

EGEE-3920 Electrical Engineering Internship **1-3 hours**
An opportunity for an electrical engineering student to work closely with an industrial advisor. Specific attention is given to solving a particular problem(s) in that industry or firm. A faculty advisor assists in supervising and approving the internship, including assessing the number of credit hours. A final report (approximately seven pages per credit hour) describing the experience, including the problem and solution, is required. Must be arranged with faculty sponsor and work supervisor before starting and cannot be used to satisfy elective credit requirements. *Prerequisites: junior or senior engineering major status; faculty advisor's permission.*

EGEE-3950 Topics in Electrical Engineering **1-3 hours**
Selected topics in electrical engineering at the 3000-level that will complement or extend existing 2000- and 3000-level courses or expose students to topics not taught in other courses; may be proposed by the engineering faculty or students. *Prerequisite: instructor's permission.*

EGEE-3980 **1-3 hours**
Independent Study in Electrical Engineering
Opportunity to perform independent research or study in electrical engineering and allied fields of application. A formal proposal for study must be approved by the faculty advisor before registering for this course. Up to three credit hours of engineering electives can be satisfied by an equivalent number of independent-study hours. *Prerequisites: junior or senior engineering major status and faculty advisor's permission.*

EGEE-3990 **1-3 hours**
Project Design in Electrical Engineering
An elective course for students to get academic credit for extracurricular design work in computer engineering; project may be related to a design competition, ministry, industry, or personal interest. Cannot be used to satisfy engineering elective requirements. *Prerequisite: instructor's permission.*

EGEE-4110 Digital Signal Processing-Fa **2 hours**
Introduction to digital signal processing with emphasis on FIR and IIR filter design, application of Z-transforms and Fourier Transforms, spectral analysis, realization and frequency response of discrete-time systems, and properties and design of FIR and IIR filters with infinite and finite word-length processors. Filter designs are implemented in Matlab. Design project required. *Prerequisites: EGEE-3110 Linear Systems; EGCP-1310 Algorithmic Programming or equivalent.*

A recent addition to the annual Cardboard Canoe Challenge for students taking the Introduction to the Engineering Profession course is the "King of The Lake Demolition Dunking Derby." Teams that are successful in crossing the lake in the timed race are eligible to compete. The goal is to sink an opposing canoe by ramming into it. Winners of the Demolition Dunking Derby receive a trophy declaring them "King (or Queen) of the Lake."

EGEE-4250 CMOS VLSI Design–Sp **3 hours**
Introduction to CMOS VLSI design with emphasis on circuit analysis, modeling, mask layout, simulation, and design verification; both theoretical concepts and CAD tools are used together for circuit design and verification. Three lecture hours per week with integrated laboratory. *Prerequisite: EGEE-3210 Electronics* I. (Fee: $50) (even years)

EGEE-4330 **3 hours**
Advanced Communications and Networks-Sp
Analysis of the performance of analog and digital communication systems and networks in the presence of noise, M-ary signals, signal space concepts, orthogonal signals, and introduction to communication networks. *Prerequisite: EGEE-3330 Communications Theory. Corequisite: EGEE-3370 Probability and Random Processes for Engineers or instructor's permission.*

EGEE-4410 Feedback Control Systems-Fa **4 hours**
Introduction to the analysis and design of analog feedback control systems with emphasis on modeling, transfer functions, root locus, frequency response, Bodé plots, Nyquist Criterion, stability, compensator design for performance and robustness, PID, phase-lead, phase-lag, lead-lag, and performance indices. Three lecture hours and one two-hour laboratory or recitation per week. Design project required. *Prerequisite: EGEE-3110 Linear Systems.* (Fee: $100)

EGEE-4450 Digital Control Systems-Sp **3 hours**
Introduction to analysis and design of discrete-time sampled-data control systems, signal sampling, A/D and D/A conversion, quantization, application of Z-domain transfer function techniques, transient response, frequency response, stability and performance of computer controlled systems, digital compensation, and controller design. Design project required. *Prerequisite: EGEE-4410 Feedback Control Systems.* (Fee: $50)

EGEE-4510 Power Systems-Sp **3 hours**
Principles of electrical power generation, transmission, and distribution, three-phase power circuits, power system analysis, load flow, symmetrical components, fault currents, system protection, and stability. *Prerequisite: EGEE-3310 Electromagnetics.* (Fee: $50) (even years)

EGEE-4810 **4 hours**
Electrical Engineering Senior Design I-Fa
Design and development of electronic products to meet specific requirements using the top-down design method. Introduction to serial communication design, design for reliability, product cost and safety, environmental issues, project management, electronic design tools, prototype methods, noise analysis in data conversion, and circuit-board layout. Student teams prepare a project proposal, design and prototype electronic subsystems using analog and digital integrated circuits and microcontrollers, use computerized design tools, and conduct design reviews. Three lecture hours and one two-hour lab per week. *Prerequisites: EGEE-3220 Electronics II; EGCP-2110 Microprocessors; EGEE-3110 Linear Systems; senior status in electrical engineering.* (Fee: $100)

EGEE-4820 **4 hours**
Electrical Engineering Senior Design II-Sp
Continuation of EGEE-4810 implementing the top-down design method. Students design, build, and test a working electronic product to meet specific requirements within budget. Engineering time, team management costs, and component

costs are incorporated into the total cost and grade for the final product. Formal design reports and presentations required. Two three-hour laboratories per week. *Prerequisite: EGEE-4810 Electrical Engineering Senior Design I.* (Fee: $100)

EGEE-4950 **1-3 hours**
Advanced Topics in Electrical Engineering
Selected topics in electrical engineering at the 4000-level that expand the depth of existing 3000- and 4000-level courses or expose the students to advanced concepts not taught in other courses; topics may be proposed by the engineering faculty or students. *Prerequisite: instructor's permission.*

Mechanical Engineering Courses

EGME-1810 Engineering Graphics–Fa **1 hour**
Introduction to basic techniques of sketching, drawing, dimensioning, multiple views, sectioning, multi-view projections, and pictorial views. Introduction to commercial software for three-dimensional solid modeling and preparing engineering drawings. (Fee: $25)

EGME-1820 Solid Modeling–Sp **1 hour**
Advanced techniques using a PC and commercial solid-modeling software to create three-dimensional solid models; techniques of solid modeling including extrusions, cuts, lofting, sweeps, drawing generation and assemblies. Includes bill of material management, sheet metal, and mold design. *Prerequisite: EGME-1810 Engineering Graphics.* (Fee: $25)

EGME 2050 Computational Methods–Sp **4 hours**
Introduction to computer programming and the numerical methods for solving roots of equations, simultaneous linear algebraic equations, ordinary differential equations, integration, introduction to finite-difference approximations, and least-squares curve fits. *Pre- or Corequisites: MATH-2710 Calculus III; MATH-2740 Differential Equations*.

EGME-2310 Manufacturing and Finance–Fa **3 hours**
Introduction to the fundamentals of manufacturing and contemporary materials processing, molding, casting, forming, machining, inspection techniques, and quality assurance. Applications to the time value of money, break-even and payback analysis, and economic analysis of engineering alternatives. *Prerequisite: EGME-2410 Properties of Engineering Materials.*

EGME-2410 Properties of Engineering Materials–Sp **4 hours**
Introduction to the properties of metallic, ceramic, polymeric, and composite materials; plastic deformation, strengthening, fracture, fatigue, corrosion, diffusion, equilibrium and nonequilibrium processes, phase diagrams, electrical and magnetic properties, and application to materials selection. Three lecture hours and one two-hour laboratory per week. *Prerequisite: EGME-2530 Statics and Mechanics of Materials.* (Fee: $100)

EGME-2510 Statics–Fa **3 hours**
Introduction to analyzing forces in isolated and connected rigid-body systems; vector analysis, forces, moments, resultants, two- and three-dimensional equilibrium, centroids, moment of inertia, friction, trusses, frames, and machines. Design project required. *Prerequisites: EGME-1810 Engineering Graphics; PHYS-2110 General Physics I; MATH-1720 Analytical Geometry and Calculus II.* (Fee: $10)

EGME-2530 Statics and Mechanics of Materials–Fa **5 hours**
Introduction to analyzing forces in isolated and connected rigid-body systems; vector analysis, forces, moments, resultants, two- and three-dimensional equilibrium, centroids, distributed loading, moment of inertia, friction, trusses, frames, and machines. Introduction to the theoretical and experimental analysis of deformable bodies subject to applied loads; normal and shear stress and strain, strain energy, torsion, stresses in beams, deflection of beams, combined stress, stress transformation, failure theories, and buckling of columns. Design project required. *Prerequisites: EGME-1810 Engineering Graphics; PHYS-2110 General Physics I; MATH-1710 Calculus I.* (Fee: $25)

EGME-2630 Dynamics–Sp **3 hours**
Introduction to kinematic and kinetic analysis of particles, systems of particles, and rigid bodies; position, velocity, acceleration, non-rotating and rotating frames of reference, Newton's laws, work, energy, impulse, momentum, conservative and non-conservative systems, and vibration of single-degree-of-freedom systems. Design project required. *Prerequisite: EGME-2510 Statics* or *EGME-2530 Statics and Mechanics of Materials. Pre- or Corequisite: MATH-2740 Differential Equations.* (Fee: $10)

EGME-3010 **2 hours**
Mechanical Engineering Laboratory I–Fa
Experiments using the wind tunnel, engine test cell, testing machines in the mechanics laboratory, vibrations laboratory, fluids laboratory, refrigeration laboratory, and heat transfer laboratory are conducted. Students measure mechanical phenomena such as acceleration, force, pressure, temperature, strain, fluid flow, viscosity, and heat transfer using transducers, instrumentation, and PC-based data acquisition. Students design some of the experiments. Two two-hour laboratories per week. *Prerequisites: EGME-2630 Dynamics; EGEE-2050 Circuits and Instrumentation. Corequisites: EGME-3110 Thermodynamics; EGME-3210 Fluid Mechanics.* (Fee: $100)

The 2003 Home Fire-Fighting Robot team designed and built an autonomous robot that was able to overcome floor obstacles and navigate around furniture in the rooms while on a "seek and put-out-the-fire" mission. The robot's main components included two battery-powered servo motors, seven distance sensors, one flame sensor, one micro-controller, and one large Field Programmable Gate Array. At the international competition in Hartford, Connecticut, the Cedarville team took 1st place in the college division. Faculty advisor, Dr. Clint Kohl, entered a robot in the most advanced division and took fourth place.

EGME-3020 **2 hours**
Mechanical Engineering Laboratory II–Sp
Continuation of EGME-3010. Two two-hour laboratories per week. *Prerequisite: EGME-3010 Mechanical Engineering Laboratory I. Corequisite: EGME-3150 Heat Transfer.* (Fee: $100)

EGME-3050 **3 hours**
Introduction to Finite Element Analysis–Sp
Introduction to basic components of the finite element method including element selection, shape functions, strain-displacement and stress-strain relations, formulation of the stiffness matrix for 1-D, 2-D, and 3-D elements, linear strain and isoparametric formulations, application of boundary conditions, and interpretation of results; application to 2-D and 3-D problems and experience using a commercial code. *Prerequisites: EGME-2050 Computational Methods; EGME-2530 Statics and Mechanics of Materials.* (Fee: $25)

EGME-3110 Thermodynamics–Fa **5 hours**
Introduction to engineering thermodynamics, properties of pure substances, work, heat, first and second laws of thermodynamics, energy, enthalpy, and entropy. Specific application to power, refrigeration cycles, and combustion processes. *Prerequisites: CHEM-1050 Chemistry for Engineers; PHYS-2120 General Physics II; MATH-2710 Calculus III.*

EGME-3130 Internal Combustion Engines–Sp **3 hours**
Introduction to internal combustion engines, fuel-air cycles, engine simulation, emissions, engine performance and alternative fuels. *Prerequisites: EGME-2630 Dynamics; EGME-3110 Thermodynamics.*

EGME-3150 Heat Transfer–Sp **3 hours**
Introduction to conduction, convection, and radiation heat transfer in one and two dimensions; free and forced convection, analytical and computational techniques applied to Fourier's Law of conduction, Newton's Law of cooling, and Stefan-Boltzman's Law of thermal radiation. A heat exchanger design project is required. *Prerequisites: EGME-3110 Thermodynamics; EGME-3210 Fluid Mechanics. Corequisite: EGME-2050 Computational Methods.*

EGME-3170 Thermal Systems **2 hours**
Introduction to engineering thermodynamics, properties of pure substances, work, heat, enthalpy, and first law of thermodynamics. Introduction to conduction and convection modes of heat transfer. *Prerequisites: PHYS-2120 General Physics II; CHEM-1050 Chemistry for Engineers; MATH-2740 Differential Equations.*

EGME-3210 Fluid Mechanics–Fa **3 hours**
Introduction to fluid properties, fluid statics, and the concepts, definitions, and basic equations for subsonic fluid dynamics; Navier-Stokes equation, viscous and invisid fluid flows, potential flow analysis, boundary layers, laminar and turbulent flows, analytical and computational solutions, vector fields, and finite-integral-control-volume method. *Prerequisites: MATH-2710 Calculus III; MATH-2740 Differential Equations.*

EGME-3430 Principles of Physical Metallurgy **3 hours**
Introduction to the physical and mechanical properties of metals and alloys; crystal structure, phase equilibria, defects, strengthening mechanisms, and kinetics of reactions. *Prerequisite: EGME-2410 Properties of Engineering Materials.*

EGME-3450 Plastic and Composite Materials **2 hours**
Introduction to the properties and processing of plastics, resins, and adhesives; rheology, creep-deformation history, and injection molding. Fiber-reinforced, carbon-carbon, and metal-matrix composites are analyzed for strength, anisotropy, and applicability. *Prerequisite: EGME-2410 Properties of Engineering Materials.*

EGME-3610 **3 hours**
Kinematics and Design of Machines–Sp
Introduction to the analysis and synthesis of motion in planar mechanisms and linkages; velocity and acceleration analysis, cam design, gears, simple and compound gear trains, computer solution and simulation. Design project required. *Prerequisite: EGME-2630 Dynamics.* (Fee: $40)

EGME-3850 Mechanical Design–Sp **3 hours**
Further development of load determination, stress, strain, deflection and failure theories; integration of an iterative problem solver in the design process; and analysis of fatigue failure. Introduction to the design of mechanical components including shafts, keys, couplings, bearings, gears, springs, and fasteners. *Prerequisite: EGME-2410 Properties of Engineering Materials. Corequisites: EGME-3020 Mechanical Engineering Laboratory II; EGME-3610 Kinematics and Design of Machines.* (Fee: $25)

EGME-3920 Mechanical Engineering Internship **1-3 hours**
An opportunity for a mechanical engineering student to work closely with an industrial advisor. Specific attention is given to solving a particular problem(s) in that industry or firm. A faculty advisor assists in supervising and approving the internship, including assessing the number of credit hours. A final report (approximately seven pages per credit hour) describing the experience, including the problem and solution, is required. Must be arranged with faculty sponsor and work supervisor before starting and cannot be used to satisfy elective credit requirements. *Prerequisites: junior or senior engineering major status; faculty advisor's permission.*

EGME-3950 Topics in Mechanical Engineering **1-3 hours**
Selected topics in mechanical engineering at the 3000-level that will compliment or extend present 2000- or 3000-level courses or expose students to topics not taught in other courses; may be proposed by the engineering faculty or students. *Prerequisite: instructor's permission.*

EGME-3980 **1-3 hours**
Independent Study in Mechanical Engineering
Opportunity to perform independent study or research in the various branches of engineering and allied fields of application. A formal proposal for study must be approved by the faculty advisor before registering for this course. Up to three credit hours of engineering electives can be satisfied by an equivalent number of hours of independent study. *Prerequisites: junior or senior engineering major status; faculty advisor's permission.*

EGME-3990 **1-3 hours**
Project Design in Mechanical Engineering
An elective course for students to get academic credit for extracurricular design work in mechanical engineering; project may be related to a design competition, ministry, industry, or personal interest. Cannot be used to satisfy engineering elective requirements. *Prerequisite: instructor's permission.*

EGME-4050 **2 hours**
Finite Difference Methods In Engineering
Finite-difference approximations for derivatives and differential equations applied to solve engineering problems; consistency, stability, truncation error, and introduction to grid generation. *Prerequisites: EGME-2050 Computational Methods; MATH-2710 Calculus III.*

EGME-4160 Radiation and Solar Energy **2 hours**
Introduction to the fundamentals of radiation heat transfer including shape factors, wave-length dependence, and material properties. Applications to solar energy engineering and design problems. *Prerequisite: EGME-3150 Heat Transfer.*

EGME-4250 Propulsion **2 hours**
Introduction to the principles of thrust production, compressible flow of gases, thermodynamics of jet propulsion systems, and parametric performance analysis of jet engines. *Prerequisites: EGME-3110 Thermodynamics; EGME-3210 Fluid Mechanics.*

EGME-4270 Compressible Fluid Flow **2 hours**
Introduction to the compressible flow of gases in engineering systems; isentropic flow in variable-area passages, shock and expansion waves; and flow with wall friction and heat transfer. *Prerequisites: EGME-2050 Computational Methods; EGME-3110 Thermodynamics; EGME-3210 Fluid Mechanics.*

EGME-4410 Introduction to Fracture Mechanics **3 hours**
Introduction to failure modes caused by static and dynamic loading, brittle fracture criteria, elastic behavior, stress fields around cracks, fatigue failure, stress corrosion cracking, and strain hardening mechanisms. *Prerequisite: EGME-2410 Properties of Engineering Materials.*

EGME-4530 Advanced Mechanics of Materials–Fa **3 hours**
Advanced treatment of stress and strain including coordinate transformations, the eigenvalue problem, Mohr's circle and linear constitutive equations. Failure theories and energy methods, including Castigliano's theorems, are studied; applications to classical topics including analysis of beams with non-symmetrical sections, non-circular torsion, thin-wall beams, and beams on elastic foundations. *Prerequisite: EGME-2530 Statics and Mechanics of Materials.*

EGME-4610 Dynamics of Machines **3 hours**
Dynamic analysis of machines and mechanisms; Newton's laws of motion, energy methods, force analysis, shaking forces, static and dynamic balancing, engine dynamics, multi-cylinder engines, and cam dynamics. *Prerequisite: EGME-3610 Kinematics and Design of Machines.*

EGME-4660 Principles of Automatic Controls–Fa **3 hours**
Introduction to theoretical and experimental analysis of classical analog feedback control systems with emphasis on modeling, transfer function formulation, frequency response, root locus, Bodé plots, stability, and compensator design. Three lecture hours and one two-hour laboratory or recitation per week; design project required. *Prerequisite: EGEE-2050 Circuits and Instrumentation.* (Fee: $100)

EGME-4710 Vibrations **3 hours**
Free and forced vibrations of mechanical systems having lumped mass and elasticity, single and multiple degree-of-freedom systems, matrix formulation, eigenvalues and eigenvectors, normal mode theory, Laplace Transform, dissipative systems, introduction to random, continuous, nonlinear vibrations, and engineering applications. *Prerequisite: EGME-2630 Dynamics.* (Fee: $15)

EGME-4720 Vibrations Lab **1 hour**
Laboratory experiments to demonstrate and support EGME-4710 Vibrations; function and calibration of instrumentation and motion detection transducers, measuring the frequency response and impulse response function, electrodynamic shakers, instrumentation, Fast Fourier Transform, spectral analysis, and experience using a commercial FFT analyzer. One two-hour laboratory per week. *Pre- or Corequisite: EGME-4710 Vibrations.* (Fee: $100)

EGME-4750 **3 hours**
Random Vibrations and Signature Analysis
Introduction to vibration analysis of discrete and continuous systems to random excitation, harmonic vibration, transient response, convolution integral, Laplace and Fourier Transform, Discrete Fourier Transform, Fast Fourier Transform, random variables, coherence, correlation, auto- and cross-correlation, power spectral density, transfer function, and modal analysis; experience using a commercial FFT analyzer. Design project required. *Prerequisite: EGME-4710 Vibrations.* (Fee: $100)

EGME-4810 **3 hours**
Mechanical Engineering Senior Design I–Fa
This is the senior capstone design project for mechanical engineers. Student teams work independently on a design project to find a solution consistent with stated specifications using principles studied in previous courses. Work in this semester includes writing the proposal and performing background research and preliminary design. Students conduct a mid-term design review and end-of-semester oral and written presentation. Projects are advised by a faculty committee; course includes weekly written progress reports and meetings with the faculty project advisor. *Prerequisites: EGME-3850 Mechanical Design; EGME-3610 Kinematics and Design of Machines; EGME-3150 Heat Transfer; EGME-3020 Mechanical Engineering Lab II; and senior status.* (Fee: $100)

EGME-4820 **3 hours**
Mechanical Engineering Senior Design II–Sp
A continuation of EGME-4810, emphasizing detailed design, prototyping, troubleshooting, design modifications, project completion, reporting, and oral presentation. Students submit written progress reports and attend meetings each week with the faculty project advisor, conduct an oral presentation, and prepare the final report. *Prerequisite: EGME-4810 Mechanical Engineering Senior Design I.* (Fee: $100)

EGME-4950 **1-3 hours**
Advanced Topics in Mechanical Engineering
Selected topics in mechanical engineering at the 4000-level that expand the depth of existing 3000- and 4000-level courses or expose the students to advanced concepts not taught in other courses. Topics may be proposed by the engineering faculty or students. *Prerequisite: instructor's permission.*

Every year, the sophomore engineering students participate in the mechanics class competitions. The Dynamics class of Spring 2004 designed and built a baseball catcher, using only coffee-stirring sticks and 1.25 ounces of Elmer's glue. The catcher had to span a 20-inch support and catch a baseball dropped from 15 feet. Shown above are the first place winners Josh Parker and Daniel Gallagher, who built the lightest-weight successful catcher.