

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

102A SCIENCE AND ENGINEERING BUILDING

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Assistant professors: *Jia Li, Hongwei Qu, Osamah Rawashdeh*

Adjunct professor: *Mutasim Salman*

Adjunct associate professors: *Anson Lee*

Adjunct assistant professors: *Randy Graca*

Advisory Board

The Electrical and Computer Engineering External Advisory and Development Board assists the department in enhancing its educational and research programs and ensuring their relevance to current and emerging technological needs. Board members are:

Gerald Grzadzinski, (retired) Senior Technical Manager, Chrysler LLC

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Kathleen S. McMahon, Ph.D., Engineering Group Manager, General Motors Corporation

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Timothy Talty, Ph.D., GM R&D and Planning, General Motors Corporation

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Mission

The Department of Electrical and Computer Engineering carries out the mission of the school of Engineering and Computer Science by offering separate undergraduate majors in electrical Engineering and Computer Engineering. The department also offers master's programs in Electrical and Computer Engineering, Systems Engineering, and a doctoral program in Electrical and Computer Engineering.

Major in electrical engineering

Electrical engineering is a broad field encompassing a number of disciplines. Oakland University's undergraduate program in electrical engineering is designed to provide students with the basic knowledge and skills for challenging careers in electrical engineering in the coming decades. The curriculum offers strong fundamentals in analog and digital circuits, communications, computers, controls, electromagnetics, electronics including VLSI systems, electronic devices, and power systems. In addition, a strong laboratory component of the program offers numerous design opportunities and allows students to relate theoretical ideas to practical problems using modern equipment and hardware/software tools.

The program also provides numerous engineering design experiences. Electrical and computer engineering faculty members are engaged in research related to new developments in the field. Their activities contribute to a well-developed, up-to-date curriculum.

Program Educational Objectives

The undergraduate program in Electrical Engineering will provide educational experiences aimed toward producing graduates who will:

- design electrical and/or electronic components or systems meeting user specifications;
- use laboratory (instrumentation, testing, prototyping, etc.) and/or computer skills engineering analysis and design;
- adapt and contribute to new technologies and methods, and use these in engineering design;
- if desired, pursue successfully graduate study in electrical engineering or related disciplines;
- function successfully in local, national or global technology-driven industries;
- exhibit the willingness and flexibility to seek, accept and be effective in a variety of roles, such as developing and implementing solutions to problems with technical and non-technical elements, serving as a team member and leading others;
- communicate effectively in both written and verbal forms;
- exhibit high standards of personal and professional integrity and ethical responsibility.

To earn the degree of Bachelor of Science in Engineering with a major in electrical engineering, students must complete a minimum of 128 credits, demonstrate writing proficiency (see *Undergraduate degree requirements*) and meet the following requirements:

	Credits
General Education	24
Mathematics and Science	
MTH 154-155 Calculus	8
APM 255 Introduction to Differential Equations with Matrix Algebra	4
MTH 254 Multivariable Calculus	4
CHM 143 Chemical Principles (or CHM 157 or 162)	4
PHY 151-152 Introductory Physics	8
Approved math or science elective*	<u>4</u>
	32
Engineering core	
EGR 120 Computer Graphics and CAD	1
EGR 141 Computer Problem Solving in Engineering and Computer Science	4
EGR 240 Introduction to Electrical and Computer Engineering	4
EGR 250 Introduction to Thermal Engineering	4
EGR 260 Introduction to Industrial and Systems Engineering	4
EGR 280 Design and Analysis of Electromechanical Systems	<u>4</u>
	21
Required Professional Subjects	
ECE 276 Circuits and Systems	4
ECE 327 Electronic Circuits Design	4
ECE 335 Signals and Systems	3
ECE 345 Electric and Magnetic Fields	3
ECE 351 Electromechanical Energy Conversion	3
ECE 378 Digital Logic and Microprocessor Design	4
ECE 384 Electronic Materials and Devices	3
ECE 431 Automatic Control Systems	4

ECE 437	Communication Systems	4
ECE 491	Senior Design	<u>4</u>
		36

Professional electives:

Three professional depth area option courses (see below)	12
Free electives: (may be used to satisfy writing requirement)	<u>3</u>
Total	128

**Approved math or science electives:*

Students majoring in Electrical Engineering are advised to take MTH 275 to broaden their knowledge of Linear Algebra. However, students who have an explicit interest in broadening their knowledge in a specific area of math or science should select an elective from the following approved course list:

APM 263, APM 332, APM 357, APM 433, APM 434, APM 455, APM 463, APM 477, BIO 111, BIO 341, BIO 351, BIO 443, CHM 158, 163, PHY 325, PHY 326, PHY 331, PHY 361, PHY 371, PHY 431, PHY 445, MTH 352, or others by approval by petition to the SECS Committee on Academic Standing.

Economics requirement

In addition to the requirements stated above, electrical engineering students must fulfill the economics requirement. This may be met by completion of ECN 150, 200, 201 or 210. However, ECN 201 is not part of the general education requirement.

Performance requirements

In addition to previously stated requirements, satisfactory completion of the program requires an average grade of at least 2.0 within each required group: namely, mathematics and science, core subjects and professional subjects. Within professional subjects, at most two grades below 2.0 are permitted, at most two different courses may be repeated and a total of three repeat attempts is permitted.

Professional Electives

Electrical engineering students must complete at least three (3) additional 400- or 500- level courses with an ECE designation. However, students may not take ECE 490** and ECE 494** more than once. Also other professional engineering courses carrying CSE, ME or ISE designations may be taken when called for by the options below or with prior approval of the chairperson of the Department of Electrical and Computer Engineering. Students are encouraged to consult their academic advisers in selecting professional elective courses.

Students interested in broadening their knowledge in a specific area of electrical engineering could elect sequences of courses as described in the specialized professional options listed below to satisfy the electrical engineering electives requirement.

Alternatively, they may elect any combination of the elective courses listed below under professional depth area options.

**ECE 490 and ECE 494 require prior permission of the chairperson of the Department of Electrical and Computer Engineering.

Suggested professional depth area courses**1. Communication systems option**

ECE 426	Advanced Electronics Circuit Designs (4)
ECE 450	Satellite-Based Positioning System (4)
ECE 527	High-frequency Electronics (4)
ECE 534	Principles of Digital Communications (4)
ECE 537	Digital Signal Processing (4)

2. Computer control systems option

ECE 423	Robotic Systems and Control (4)
ECE 433	Control System Design (4)
ECE 472	Microcomputer-Based Control Systems (4)
ECE 470	Microprocessors-Based Systems Design (4)

3. Electromagnetics option

ECE 443	Electric and Magnetic Fields (4)
ECE 447	Antennas (4)
ECE 527	High-frequency Electronics (4)

4. Electronics option

ECE 426	Advanced Electronic Circuit Designs (4)
ECE 428	Industrial Electronics (4)
ECE 429	Power Electronics (4)
ECE 485	VLSI Circuits and Systems Design of Digital Chips (4)
ECE 525	Instrumentation and Measurements (4)

5. Mechatronic systems option

ECE 470	Microprocessors-based Systems Design (4)
ECE 472	Microcomputer-Based Control Systems (4)
ECE 475	Automotive Mechatronics I (4)
ME 308	Computer-Aided Design (3)

6. Microelectronics option

ECE 485	VLSI Circuits and Systems Design of Digital Chips (4)
ECE 487	Integrated Electronics (4)
ECE 581	Integrated Circuits and Devices (4)

7. Power systems option

ECE 428	Industrial Electronics (4)
ECE 429	Introduction to Power Electronics (4)
ECE 441	Electromechanical Energy Conversion (4)
ECE 458	Electrical Energy Systems (4)
ME 454	Alternative Energy Systems (4)

Sample electrical engineering program schedule

Students entering the School of Engineering and Computer Science with the required background may follow a schedule such as the one indicated below. However, students will need additional time to complete the program if they do not have the required background upon entrance to the program.

Freshman	Cr	Sophomore	Cr	Junior	Cr	Senior	Cr
<i>Fall semester</i>		<i>Fall semester</i>		<i>Fall Semester</i>		<i>Fall semester</i>	
EGR 120	1	MTH 254	4	ECE 276	4	ECE 351	3
MTH 154	4	EGR 250	4	ECE 378	4	ECE 431	
						or ECE 437	4
EGR 141	4	PHY 152	4	Gen Ed	4	Prof Elective	4
				Approved			
CHM 143	4			math or			
Rhetoric or				science			
Gen Ed	<u>4</u>	Gen Ed	<u>4</u>	elective	<u>4</u>	Prof Elective	<u>4</u>
	17		16		16		15

<i>Winter semester</i>		<i>Winter semester</i>		<i>Winter semester</i>		<i>Winter semester</i>	
MTH 155	4	APM 255	4	ECE 327	4	ECE 431	
				ECE 335	3	or ECE 437	4
PHY 151	4	EGR 260	4	ECE 345	3	ECE 491	4
EGR 240	4	EGR 280	4	ECE 384	3	Prof. Elective	4
Gen Ed	<u>4</u>	Gen Ed	<u>4</u>	Gen Ed	<u>4</u>	Free Elective	<u>3</u>
	16		16		17		15

Major in Computer Engineering

Major technological advances are being made in the computer field at a rapid pace, and it is essential that computer engineering students are not only aware of these advances but prepared to work in this changing environment. Students should gain a strong background in the fundamentals of computer engineering and develop a willingness to accept and thrive on change.

The computer engineering program at Oakland University is designed to provide students with the basic knowledge and skills needed to function effectively in computer-related activities in the years ahead. It is unique in offering a focus on wireless embedded systems. A balance between theoretical and practical experience and an emphasis on the software and hardware aspects of computers are key elements to the university's computer engineering major.

Program Educational Objectives

The objectives of the Computer Engineering program are to produce graduates who will:

- design, implement and/or test hardware and/or software systems or components;
- use laboratory (instrumentation, testing, prototyping, etc.) and/or computer skills for engineering analysis and design;
- adapt and contribute to new technologies and methods, and use these in engineering design;
- if desired, pursue successfully graduate study in computer engineering or related disciplines;
- function successfully in local, national or global technology-driven industries;
- exhibit the willingness and flexibility to seek, accept and be effective in a variety of roles, such as developing and implementing solutions to problems with technical and non-technical elements, serving as a team member and leading others;
- communicate effectively in both written and verbal forms;
- exhibit high standards of personal and professional integrity and ethical responsibility.

To earn the degree of Bachelor of Science in Engineering with a major in computer engineering, students must complete a minimum of 128 credits and satisfy the writing requirements. They must meet the following requirements: (also see *Undergraduate degree requirements*)

	Credits
General Education	24
Mathematics and science	
MTH 154-155 Calculus	8
APM 255 Introduction to Differential Equations with Matrix Algebra	4
APM 263 Discrete Mathematics	4
MTH 254 Multivariable Calculus	4
CHM 143 Chemical Principles (or CHM 157 or 162)	4
PHY 151-152 Introductory Physics	<u>8</u>
	32
Engineering core	

EGR 120	Engineering Graphics and CAD	1
EGR 141	Computer Problem Solving in Engineering and Computer Science	4
EGR 240	Introduction to Electrical and Computer Engineering	4
EGR 250	Introduction to Thermal Engineering	4
EGR 260	Introduction to Industrial and Systems Engineering	4
EGR 280	Design and Analysis of Electromechanical Systems	<u>4</u>
		21

Professional subjects**Required:**

CSE 230	Object-Oriented Computing I	4
CSE 231	Object-Oriented Computing II	4
CSE 247	Introduction to Computer Networks	4
CSE 364	Computer Organization	4
ECE 276	Circuits and Systems	4
ECE 327	Electronic Circuits and Devices	4
ECE 378	Digital Logic and Microprocessor Design	4
ECE 470	Microprocessor-based System Design	4
ECE 491	Senior Design	<u>4</u>
		36

Electives —**Professional electives: 7 or 8 credits chosen from:**

7-8

Any 300-, 400-, or 500-level engineering, computer science courses, or concentrations (see below), or approved mathematics and science electives (see below)*

At least 4 credits must be a 400- or 500-level course.

Suggested Professional Elective Concentrations:**Wireless Communications**

ECE 335	Signals and Systems (3)
ECE 437	Communication Systems (4)
ECE 450	Satellite-Based Positioning Systems (4)

Microelectronics

ECE 384	Electronic Materials and Devices (4)
ECE 485 VLSI	Circuits and Systems Design of Digital Chips (4)

Mechatronics

ECE 431	Automatic Control Systems (4)
ECE 475	Automotive Mechatronics I (4)

Computer Science

CSE 361	Design and Analysis of Algorithms (4)
CSE 450	Operating Systems (4)

Wireless Networking

CSE 447	Computer Communications (4)
CSE 549	Multimedia and Networks (4)

Free electives: (may be used to satisfy writing requirement)

	<u>7-8</u>
Total	128

*Approved mathematics and science electives:

Students who have an explicit interest in broadening their knowledge in a specific area of math or science should select an elective from the following approved course list. For more information about these selections, students are encouraged to visit with an undergraduate advisor before registering for an approved math or science elective.

APM 332	Applied Matrix Theory
APM 357	Elements of Partial Differential Equations
APM 433	Numerical Methods
APM 434	Applied Numerical Methods: Matrix Methods
APM 463	Graph Theory and Combinatorial Mathematics
APM 477	Computer Algebra
BIO 111	Biology
CHM 158	General Chemistry II
CHM 163	Honors General Chemistry for Engineers II
MOR 242	Elementary Models in Operations Research
PHY 325	Biological Physics
PHY 326	Medical Physics
PHY 331	Optics
PHY 366	Vibrations and Waves
PHY 371	Foundations of Modern Physics
MTH 275	Linear Algebra
MTH 352	Complex Variables

or others by approval by petition to the SECS Committee on Academic Standing.

Economics requirement

In addition to the requirements stated above, computer engineering students must fulfill the economics requirement. This may be met by completion of ECN 150, 200, 201 or 210. However, ECN 201 is not part of the general education requirement.

Performance requirements

In addition to the previously stated requirements, satisfactory completion of the program requires an average grade of at least 2.0 within each group: namely, mathematics and science, core subjects and professional subjects. Within professional subjects, at most two grades below 2.0 are permitted; at most two different courses may be repeated, and a total of three repeat attempts is permitted.

Sample computer engineering schedule

Students entering the School of Engineering and Computer Science with the required background may follow a schedule such as the one indicated below. However, students will need additional time to complete the program if they do not have the required background upon entrance to the program.

Freshman	Cr	Sophomore	Cr	Junior	Cr	Senior	Cr
<i>Fall semester</i>		<i>Fall semester</i>		<i>Fall Semester</i>		<i>Fall semester</i>	
EGR 120	1	APM 255	4	MTH 254	4	CSE 230	4
MTH 154	4	EGR 250	4	CSE 247	4	CSE 470	4
EGR 141	4	PHY 152	4	ECE 276	4	Gen Ed	4
CHM 143	4	Rhetoric or		Gen Ed	<u>4</u>	Free Elective	<u>3</u>
Gen Ed	<u>4</u>	Gen Ed	<u>4</u>		16		15
	17		16				
<i>Winter semester</i>		<i>Winter semester</i>		<i>Winter semester</i>		<i>Winter semester</i>	
MTH 155	4	APM 263	4	ECE 327	4	CSE 364	4
PHY 151	4	EGR 260	4	ECE 378	4	ECE 491	4
EGR 240	4	EGR 280	4	Gen Ed	4	Prof Elective	4
Gen Ed	<u>4</u>	CSE 231	<u>4</u>	Prof Elective	<u>4</u>	Free Elective	<u>4</u>
	16		16		16		16