MSOE UNIVERSITY
Computer Engineering

APPROVED ELECTIVES

The Computer Engineering curriculum requires students to choose two technical program electives that deepen study within areas of computer engineering. Technical content can also be chosen for the curriculum's free elective. Note that elective courses can be chosen from multiple areas. The **electives below** are approved by the program faculty. Consult the MSOE academic catalog for course descriptions (http://catalog.msoe.edu).

Prerequisites completely met by Computer Engineering required courses

Computer Architecture

- CPE 4510 – Superscalar, Multicore, and Multiprocessor Architecture
- CPE 4520 – Memory System and I/O System Architecture
- CPE 4530 – Fault Tolerant Computer Architecture
- CSC 4241 – GPU Programming

Computer Science

- CSC 2611 – AI Tools
- CSC 3210 – Operating Systems
- CSC 3310 – Algorithms and Advanced Data Structures
- CSC 3320 – Databases
- CSC 4243 – Compiler Construction
- CSC 4911 – Mobile Application Development

Electrical and Electronic Circuits

- ELE 3401 – Electric Power and Machines
- ELE 3701 – Control Systems
- ELE 3111 – Electronics II
- ELE 4440 – Power Electronics

Embedded Systems

- CPE 4530 – Fault Tolerant Computer Architecture
- CPE 4610 – Embedded Systems Fabrication

Signal Processing

- BME 3210 – Medical Imaging Systems
- CSC 4651 – Deep Learning in Signal Processing
- ELE 3310 – Introduction to Probability and Random Processes[1]
- ELE 4320 – Applications of Digital Signal Processing (DSP)

Software Design

- SWE 2410 – Design and Cloud Patterns
- SWE 2511 – Web Applications
- SWE 2710 – Software Tools and Processes
- SWE 4411 – Game Development

Undergraduate Research

- UGR 4970 – Research Experience (must be 3 credits)
- UGR 4971 – Undergraduate Research Thesis 1

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[1] This course cannot replace the required MTH 2480 Probability and Statistics course due to lack of statistics depth.

APPROVED ELECTIVES

Prerequisites not completely met by Computer Engineering required courses. Students must complete all other prerequisite courses before registration.

Computer Science

- CSC 2621 – Introduction to Data Science
- CSC 4201 – Microservices and Cloud Computing
- CSC 4601 – Theory of Machine Learning
- CSC 4611 – Introduction to Deep Learning
- CSC 4631 – Artificial Intelligence
- CSC 4641 – Natural Language Processing
- CSC 4801 – Data Science Practicum

Electrical and Electronic Circuits

- ELE 3201 – Electromagnetics and Transmission Lines
- ELE 4142 – Modern Electronic Systems
- ELE 4240 – Advanced Electromagnetics and Antenna Theory
- ELE 4300 – Principles of Communications
- ELE 4701 – Control System Applications

Embedded Systems

- CSC 4941 – Robotics
- SWE 4211 – Real-time Systems

Software Engineering

- SWE 2721 – Introduction to Software Verification
- SWE 3411 – Software Requirements and Architecture

Undergraduate Research

- UGR 4972 – Undergraduate Research Thesis 2

Topics Courses

From time to time, faculty teach special courses not regularly offered for registration. These courses are offered under Topics labels and students must get approval from the Computer Engineering Program Director before registration. Not all Topics courses will be approved for registration. These courses are labeled as:

- CPE 4980 – Topics in Computer Engineering
- CPE 4981 – Topics in Computer Engineering with Lab
- CSC 4980 – Topics in Computer Science
- CSC 4981 – Topics in Computer Science with Lab
- ELE 4980 – Topics in Electrical Engineering
- ELE 4981 – Topics in Electrical Engineering with Laboratory
- SWE 4980 – Topics in Software Engineering
- SWE 4981 – Topics in Software Engineering with Lab

Students often ask advisors for recommendations to **focus training in one area of computer engineering**. These depth focus plans illustrate how the two program electives, and one free elective, could be used to focus study in an area. The EECS department cannot guarantee that all courses will be offered in any academic year unless they are required courses in the majors offered by our department. Courses scheduled to run every year are highlighted in **green** in this table.

Program and Free Elective Recommendations – CPE Focus Areas

Computer Architecture	Computer Science
CPE 4510: Superscalar Architecture **CPE 4520**: Memory and I/O System Architecture **CPE 4530**: Fault Tolerant Computer Architecture	**CSC 3210**: Operating Systems **CSC 3310**: Algorithms and Advanced Data Structures **CSC 3320**: Databases
Electrical and Electronic Circuits	**Embedded Systems**
ELE 3111: Electronics II **ELE 3701**: Control Systems **ELE 4440**: Power Electronics	**CPE 4530**: Fault Tolerant Computer Architecture **CPE 4610**: Embedded Systems Fabrication **ELE 3701**: Control Systems
Signal Processing	**Software Design**
BME 3210: Medical Imaging Systems **CSC 4651**: Deep Learning in Signal Processing **ELE 4320**: Applications of DSP	**SWE 2410**: Design and Cloud Patterns **SWE 2411**: Web Applications **SWE 2710**: Software Tools and Processes

Courses highlighted in **green** are offered every year.

Students interested in **pursuing minors or language certificates** can choose program, free, and Raider Core electives to meet the requirements. Here are example plans.

Minor Study Areas – Example Plans

Data Science Minor		Electrical Engineering Minor	
CSC 2611: AI Tools	(Free Elective)	**ELE 3111**: Electronics II	(Program Elective)
CSC 2621: Intro to Data Science	(Program Elective)	**ELE 3701**: Control Systems	(Program Elective)
CSC 4801: Data Science Practicum	(Program Elective)		
Mathematics Minor		**Physics Minor**	
MTH 2130: Calculus III	(Free Elective)	**PHY 3530**: Quantum and Modern Physics	(Free Elective)
MTH 3340: Abstract Algebra	(Raider Core: Student Choice)	**PHY 3910**: Astronomy and Astrophysics	(Raider Core: Student Choice)
German Language Certificate		**Spanish Language Certificate**	
GER 1001: Elementary German	(Raider Core: Embrace Diversity)	**SPN 1001**: Elementary Spanish	(Raider Core: Embrace Diversity)
GER 2001: Intermediate German	(Raider Core: Exhibit Curiosity)	**SPN 2001**: Intermediate Spanish	(Raider Core: Exhibit Curiosity)
GER 3001: Advanced German	(Raider Core: Student Choice)	**SPN 3001**: Advanced Spanish	(Raider Core: Student Choice)
GER 4980: Topics in the German Speaking World	(Free Elective)	**SPN 4980**: Topics in the Spanish Speaking World	(Free Elective)

Courses highlighted in **green** are offered every year.