Computer Engineering

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1. University Requirements: (23-24)
   Writing, Rhetoric and American Cultures (WRA) 4
   Integrative Studies in Humanities (IAH) 8
   IAH 210-211 and IAH 211 or >
   Integrative Studies in Social Sciences (ISS) 8
   ISS 2XX and ISS 3XX
   Bioscience (one of the following):
   BS 161, ENT 205, IBIO 150, MMG 141,
   MMG 201, PLB 105, PSL 250 3-4

2. College Requirements: (32)
   *CEM 141 General Chemistry 4
   *CSE 231 Introduction to Programming I 4
   *EGR 100 Introduction to Engineering Design 2
   *MTH 132 Calculus I 3
   *MTH 133 Calculus II 4
   MTH 234 Multivariable Calculus 4
   MTH 235 Differential Equations 3
   *PHY 183 Physics for Scientists & Engineers I 4
   *PHY 184 Physics for Scientists & Engineers II 4

   *College Admission Requirement

3. Major Requirements: (65)
   a. Complete one of the following courses: (1)
      CEM 161 Chemistry Laboratory I 1
      PHY 191 Physics Laboratory for Scientists I 1
   b. All of the following courses: (39)
      CSE 232 Introduction to Programming II 4
      CSE 260 Discrete Structures in Computer Sci 4
      CSE 325 Computer Systems 3
      CSE 331 Algorithms and Data Structures 3
      ECE 201 Circuits and Systems I 3
      ECE 202 Circuits and Systems II 3
      ECE 203 Electronic Circuits and Systems Lab 1
      ECE 230 Digital Logic Fundamentals 3
      ECE 280 Electrical Engineering Analysis 3
      ECE 302 Electronic Circuits 3
      ECE 303 Electronics Laboratory 1
      ECE 331 Microprocessors & Digital Systems 4
      ECE 366 Introduction to Signal Processing 3
      ECE 390 Ethics, Professionalism and
      Contemporary Issues 1
   c. One of the following courses: (4)
      ECE 480 Senior Design (W) 4
      ECE 489 Independent Senior Design 4
   d. Electives: (21)
      Complete 21 credits of electives as specified. Take at least 15 credits
      from the Focus Tracks including at least 6 credits from the Core track
      and at least one course with a lab (L). Additional credits to meet the 21
      credit requirement may be taken from Focus Track courses, any 400-
      level Computer Science and Engineering (CSE) or Electrical and
      Computer Engineering (ECE) courses, or by completing an approved 3
      or 4 credit experiential, out-of-classroom education experience obtained
      through engineering cooperative education or independent study.

   Focus Tracks
   a. Core
      At least 6 credits from the following:
      CSE 335 Object-Oriented Software Design 4
      CSE 420 Computer Architecture 3
      ECE 430 Embedded Cyber Physical Sys (L) 4
      CSE 422 Computer Networks 3
      or
      ECE 442 Intro to Communication Networks 3
      CSE 425 Intro to Computer Security 3
      or
      ECE 456 Intro to Comm & Network Security 3
      Both CSE 422 and ECE 442 may not be used to fulfill this requirement.
      Both CSE 425 and ECE 456 may not be used to fulfill this requirement.
   b. Hardware
      ECE 410 VSL Design (L) 4
      ECE 411 Electronic Design Automation (L) 4
      ECE 431 Smart Sensor Systems (L) 3
      ECE 445 Biomedical Instrumentation 3
   c. Software Systems
      CSE 410 Operating Systems 3
      CSE 415 Parallel Programming 3
      CSE 431 Algorithm Engineering 3
      CSE 435 Software Engineering 3
      CSE 450 Translation of Prog Languages 3
      CSE 476 Mobile Applications Development 3
      CSE 480 Database Systems 3
   d. Intelligent Systems
      CSE 404 Introduction to Machine Learning 3
      CSE 440 Introduction to Artificial Intelligence 3
      CSE 482 Big Data Analysis 3
      ECE 434 Autonomous Vehicles 3
      ECE 446 Biomedical Signal Processing 3
      ECE 466 Digital Signal Proc Filter Design 3
      STT 351 Probability & Statistics for Engr 3
      MTH 314 Matrix Algebra w/Comput Apls 3
   e. Electrical Systems
      ECE 305 Electromagnetic Fields & Waves I 4
      ECE 313 Control Systems 3
      ECE 377 Principles of Electronic Devices 3
      ECE 404 Radio Frequency ELEC Circuits (L) 4
      ECE 417 Robotics (L) 4

Other Electives (Variable)
Total Credits Required for Degree 128

The requirements listed apply to students admitted to the major of Computer Engineering beginning Fall, 2021. The Department of Electrical and Computer Engineering (ECE) constantly reviews program requirements and reserves the right to make changes as necessary. Students are encouraged to consult with their advisor to obtain assistance in planning an appropriate schedule. Students who have questions about Computer Engineering should contact the Electrical and Computer Engineering Department Advising Office, 2212 Engineering Building, phone (517) 355-5242.
Concentrations
The department offers the following concentrations to student wishing an area of specialization in their degree. Concentrations are available to, but not required of, any student enrolled in the Bachelor of Science degree in Computer Engineering. Courses completed to satisfy Requirement 3c. may also be used to satisfy the requirements of a concentrations. NOTE: Completing the Bachelor of Science degree in Computer Engineering with a concentration may require more than 128 credits. Upon completion of the required courses for a concentration, certification will appear on the student’s official transcript.

Biomedical Engineering Concentration: (15-17)
This concentration is for students who plan to pursue graduate work in biomedical areas or seek employment in selected medical-related areas. To earn a Bachelor of Science degree in Computer Engineering with a biomedical engineering concentration, students must complete requirements 1., 2., and 3. above and the following:
1. Complete 6 credits from the following:
   - ANTR 350 Human Gross Anatomy for Pre-Health Professionals 3
   - BS 161 Cell and Molecular Biology 3
   - PSL 250 Introductory Physiology 4
   - PSL 310 Physiology for Pre-Health Professionals 4

2. Complete 9 credits from the following:
   - BE 444 Biosensors for Medical Diagnostics 3
   - ECE 445 Biomedical Instrumentation 3
   - ECE 446 Biomedical Signal Processing 3
   - ECE 447 Introduction to Biomedical Imaging 3
   - ECE 448 Modeling and Analysis of Bioelectrical Systems 3
   - ECE 449 Fundamentals of Acoustics 3

Note: Students may enroll in 3 or 4 credits of ECE 490 or 491 with biomedical engineering content as approved by the student's advisor for partial fulfillment of this requirement.

Cybersecurity: (15)
This concentration is for students interested in the theory and practice of communication networks and security. To earn a Bachelor of Science degree in Computer Engineering with a cybersecurity concentration, students must complete requirements 1., 2., and 3. above and the following:
1. Complete all of the following:
   - ECE 442 Intro Communication Networks 3
   - ECE 456 Intro Communication & Network Security 3
   - ECE 457 Communication Systems 3

2. Complete 2 courses from the following:
   - CSE 402 Biometrics and Pattern Recognition 3
   - CSE 410 Operating Systems 3
   - CSE 425 Intro to Computer Security 3
   - CSE 482 Big Data Analysis 3

Robotics and Automation: (13-14)
This concentration is for students interested in graduate work or employment in robotics or automation areas. To earn a Bachelor of Science degree in Computer Engineering with a robotics and automation concentration, students must complete requirements 1., 2., and 3. above and the following:
1. Complete the following course:
   - ECE 417 Robotics (L) 4

2. Complete at least 9 credits from the following:
   - ECE 415 Computer Aided Manufacturing 3
   - ECE 416 Digital Control (L) 3
   - ECE 430 Embedded Cyber-Physical Systems (L) 4
   - ECE 431 Smart Sensors Systems (L) 3
   - ECE 434 Autonomous Vehicles (L) 3
   - ECE 466 Digital Signal Processing 3

Smart Systems: (13-15)
This concentration is for students interested in the design and implementation of smart devices and systems for graduate work or employment in consumer electronics, wearables, and internet of things (IoT) fields. To earn a Bachelor of Science degree in Computer Engineering with a smart systems concentration, students must complete requirements 1., 2., and 3. above and the following:
Complete at least 13 credits from the following:
   - ECE 410 VLSI Design (L) 4
   - ECE 411 Electronic Design Automation (L) 4
   - ECE 430 Embedded Cyber-Physical Systems (L) 4
   - ECE 431 Smart Sensors Systems (L) 3
   - ECE 445 Biomedical Instrumentation (L) 3
   - ECE 466 Digital Signal Processing 3
   - CSE 404 Introduction to Machine Learning 3
   - CSE 420 Computer Architecture 3
   - CSE 440 Introduction Artificial Intelligence 3
   - CSE 476 Mobile App Development 3
   - CSE 482 Big Data Analysis 3

Software Systems: (13-15)
This concentration is for students wishing to focus on software development for graduate work or employment in embedded systems, cloud services and other software intensive fields. To earn a Bachelor of Science degree in Computer Engineering with a software systems concentration, students must complete requirements 1., 2., and 3. above and the following:
Complete at least 13 credits from the following:
   - CSE 410 Operating Systems 3
   - CSE 415 Parallel Programming 3
   - CSE 435 Software Engineering 3
   - CSE 450 Translation Programming Languages 3
   - CSE 476 Mobile App Development 3
   - ECE 430 Embedded Cyber-Physical Systems (L) 4
Computer Engineering

Sample Program

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Last Revised April 2021

Program Educational Objectives

The bachelor's degree in electrical/computer engineering provides its graduates with a solid foundation on which they can build successful and sustainable careers in the ever-changing global work environment. The program prepares its graduates for a variety of career paths including engineering positions directly after program completion, entry to engineering graduate school, and entry to other professional graduate-level schools, and eventual leadership in scientific, technical, organizational, and entrepreneurial arenas.

Specifically, the electrical/computer engineering program graduates will:

- be independent and critical thinkers who identify problems and develop effective solutions;
- be competent and ethical engineers practicing in a diverse range of fields;
- maintain and increase their technical expertise through lifelong learning;
- use their expertise to the benefit of the larger community.