NOTE: Changes to programs may require course changes, which must be processed electronically. Any questions should be directed to Associate Provost David Reinhold at 7-4564 or david.reinhold@wmich.edu

DEPARTMENT: ECE
PROPOSED EFFECTIVE FALL YEAR: 2020

PROPOSED IMPROVEMENTS: Academic Program Proposed Improvements
☐ New degree*
☐ New major*
☒ New curriculum*
☐ New concentration*
☐ New certificate*
☐ Admission requirements
☐ Graduation requirements
☐ Deletion*
☐ Revised major
☐ Revised minor

☒ Other (explain**)
** Other: Only revised general education requirements for WMU Essential Studies

Title of degree, curriculum, major, minor, concentration, or certificate: Electrical Engineering

Chair, Department Curriculum Committee: ________________________________ Date 10/9/19

CHECKLIST FOR DEPARTMENT CHAIRS/DIRECTORS
☐ For new programs and other changes that have resource implications, the dean has been consulted.
☐ When appropriate, letters of support from department faculty are attached.
☐ When appropriate, letters of support from other departments in the same college are attached.
☐ The proposal has been reviewed by HIGE for possible implications for international student enrollment.
☐ The proposal is consistent with the departmental assessment plan, and identifies measurable learning outcomes for assessment.
☐ Detailed resource plan is attached where appropriate.
☐ All questions attached have been completed and supporting documents are attached.
☐ The proposal is written and complete as outlined in the Faculty Senate guidelines and the curriculum change guides.

Chair/Director: ________________________________ Date 10/9/19

CHECKLIST FOR COLLEGE CURRICULUM COMMITTEE
☐ The academic quality of the proposal and the faculty involved has been reviewed.
☐ Detailed resource plan is attached where appropriate.
☐ Consistency between the proposal and the relevant catalog language has been confirmed.
☐ The proposal has been reviewed for effect on students transferring from Michigan community colleges. Detailed information on transfer articulation must be included with undergraduate proposals.
☐ Consistency between the proposal and the College and department assessment plans has been confirmed.
☐ Consistency between the proposal and the College and department strategic plans has been confirmed.
☐ All questions attached have been completed and supporting documents are attached.
☐ The proposal is written and complete as outlined in the Faculty Senate guidelines and the curriculum change guides.

Chair, College Curriculum Committee: ________________________________ Date

Revised Sept. 2018. All previous forms are obsolete and should not be used.
**CHECKLIST FOR COLLEGE DEANS**

- For new programs and proposed program deletions, the provost has been consulted.
- For new programs, letter of support from University Libraries Dean indicating library resource requirements have been met.
- When appropriate, letters of support from other college faculty and/or chairs are attached.
- When appropriate, letters of support from other college deans, whose programs/courses may be affected by the change, are attached.
- The proposal has been reviewed for implications for accreditation, certification, or licensure.
- Detailed resource plan is attached where appropriate.
- All questions attached have been completed and supporting documents are attached.
- The proposal is written and complete as outlined in the Faculty Senate guidelines and the curriculum change guides.

---

<table>
<thead>
<tr>
<th>Dean:</th>
<th>Date</th>
</tr>
</thead>
</table>

---

**FOR PROPOSALS REQUIRING REVIEW BY:**
GSC/USC; EPGC, GRADUATE COLLEGE, and/or FACULTY SENATE EXECUTIVE BOARD

- **Return to Dean**
- **Forward to:**
  - Curriculum Manager: Date:
  - *needs review by*
  - Chair, GSC/USC: Date
  - *needs review by*
  - Chair, EPGC: Date
  - *needs review by*
  - Graduate College Dean: Date
  - *needs review by*
  - Faculty Senate President: Date

- **Approve**
- **Disapprove**

---

Revised Sept. 2018. All previous forms are obsolete and should not be used.
1. Explain briefly and clearly the proposed improvement:
   
   Updated program content to address WMU Essential Studies Program requirements
   
   To incorporate credit hour changes to courses (WES and ECE 3570).
   
   To make computer engineering “Engineering Science Electives” courses match electrical engineering
   “Engineering Mathematics and Science Electives” courses.
   
   To increase the number of Computer Science Elective courses.
   
2. Rationale. Give your reason(s) for the proposed improvement.
   
   Required to remove references to general education requirements and update with WMU Essential
   Studies Program requirements.
   
   To incorporate 1 credit hour change (adding a lab) to ECE 3570.
   
   To simplify selection of Engineering Science Electives so that electrical and computer engineers have the
   same choices instead of tracking two lists with similar names.
   
   Computer Science is adjusting to ABET accreditation requirements, changing their requirements, the
   frequency and requirement for course offerings, and adding new upper division course that undergraduates can
   take. This computer engineering change should ensure that one or more courses is available in this category
   every semester to support student timely graduation.

3. Effect on other colleges, departments, or programs. If consultation with others is required, attach evidence of
   consultation and support. If objections have been raised, document the resolution. Demonstrate that the program
   you propose is not a duplication of an existing one.
   
   No effect. CS course changes were proposed by the CS chair, Dr. Carr. E-mail attached.

4. Effect on your department's programs. Show how the proposed change fits with other departmental offerings.
   
   This change will add two credit hours to this program.

5. Alignment with college's and department's strategic plan, mission, and vision.
   
   Provides broad-based liberal arts education for computer engineering students and supports ABET
   accreditation requirements to ensure we graduate well-rounded computer engineers.

6. Effects on enrolled students: Are program conflicts avoided? Will your proposal make it easier or harder for
   students to meet graduation requirements? Can students complete the program in a reasonable time? Show that
   you have considered scheduling needs and demands on students’ time.
   
   No effect on enrolled students as they will continue under the catalog year with which they entered. A
deliberate transition will occur university-wide to address any WES issues that arise for current and future
students.

7. Student or external market demand. What is your anticipated student audience? What evidence of student or
   market demand or need exists? What is the estimated enrollment? What other factors make your proposal
   beneficial to students?
   
   Not applicable.

8. Effects on resources. Explain how your proposal would affect department and University resources, including
   faculty, equipment, space, technology, and library holdings. If proposing a new program, include a letter and/or
   email of support from the university libraries affirming that the library resource issues have been reviewed. Tell
   how you will staff additions to the program. If more advising will be needed, how will you provide for it? What will
   be the initial one-time costs and the ongoing base-funding costs for the proposed program? (Attach additional
   pages, as necessary.)
   
   None. All revisions to the computer engineering program in response to the new WMU Essential Studies
   Program were coordinated across the college and university through the WMU Essential Studies Program
   design. The additional CS courses were suggested by the CS Department chair, Dr. Steve Carr.

Revised Sept. 2018. All previous forms are obsolete and should not be used.
9. List the learning outcomes for the revised or proposed major, minor, or concentration. The department will use these outcomes for future assessments of the program.

No change to the required ABET program outcomes.

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. an ability to communicate effectively with a range of audiences.
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

10. Describe how this change is a response to assessment outcomes that are part of a department or college assessment plan or informal assessment activities.

The changes were in response to a university-wide revised general education program and to course changes in the curriculum.

11. (Undergraduate proposals only) Describe in detail how this change affects transfer articulation for Michigan community colleges. For new majors or minors, describe transfer guidelines to be developed with Michigan community colleges. For revisions to majors or minors, describe necessary revisions to Michigan community college guidelines. Department chairs should seek assistance from college advising directors or from the admissions office in completing this section.

This aspect is being addressed by the Director of the WMU Essential Studies Program, the Associate Provost for Assessment and Undergraduate Studies, and the advising staff.

12. Please offer both "Current Catalog Language" and "Proposed Catalog Language" if there is to be a change in the catalog description for a given program. For the "current" language, please copy and paste relevant language from the most current catalog and for the "proposed" language, please share the exact proposed new catalog language. As possible, bold or otherwise note the key changes in the new proposed catalog language.

CURRENT CATALOG COPY


Program Educational Objectives

Computer Engineering Graduates, within a few years of graduation, should:

1. Use their understanding of computer engineering fundamentals to solve problems in professional practice while exhibiting rigorous analysis and creative design skills that reflect their technical depth and ability to draw on multiple disciplines;

2. Continue their intellectual development through professional development courses, including online learning opportunities, and/or graduate education; and

3. Practice their career in a manner consistent with a high degree of professional ethics, and participate in their community and professional organizations.

(For up-to-date program educational objectives and learning outcomes, see the Department web page at www.wmich.edu/electrical-computer)

Admission

Revised Sept. 2018. All previous forms are obsolete and should not be used.
1. To be admitted to this Engineering curriculum, a student must complete all pre-engineering requirements with grades of “C” or better. These requirements may be found in the beginning of the College of Engineering and Applied Sciences section.

2. Students seeking admission to this curriculum must submit an application following procedures established by the College of Engineering and Applied Sciences. Upper level transfer students may complete an application prior to their first semester of enrollment. Only students in good academic standing as defined by the University will be admitted to this curriculum.

Baccalaureate-Level Writing Requirement

Students who have chosen the Computer Engineering curriculum will satisfy the Baccalaureate-Level Writing Requirement by successfully completing IEE 3160 - Report Preparation Credits: 3 hours.

Requirements

Candidates for the Bachelor of Science in Engineering (Computer) must satisfy the following requirements in addition to those required by Western Michigan University:

1. A grade point average of 2.0 or better must be earned in courses presented for graduation with ECE, IEE, and ME prefixes.

2. Students may enroll in an ECE course only after earning at least a “C” in its prerequisite course(s).

3. No more than two grades of “D” or “DC” in courses presented for graduation may be counted for graduation.

4. The following program of 128 or more semester credit hours must be completed. For transfer students at least 16 credit hours of ECE course work must be completed at WMU. The schedule below is an example of one leading to graduation in eight semesters, beginning with fall. Pre-engineering requirements are indicated.

5. The Computer Engineering curriculum requires students to complete a course in General Education Area I, Area II, Area III, Area IV, Area V, and Area VIII. At least two of the General Education Area courses must be at the 3000/4000-level, and no more than two courses from any one department may be used to satisfy the Area requirements.

First Semester (16 hours)

- **General Education Credits: 2 hours**
- **CHEM 1100 - General Chemistry I Credits: 3 hours**
  Pre-engineering requirement
- **CHEM 1110 - General Chemistry Laboratory I Credits: 1 hour**
  Pre-engineering requirement
- **ECE 2500 - Digital Logic Credits: 3 hours**
  Pre-engineering requirement
- **IEE 1020 - Technical Communication Credits: 3 hours**
  Pre-engineering requirement
- **MATH 1220 - Calculus I Credits: 4 hours**
  Pre-engineering requirement
  or
- **MATH 1700 - Calculus I, Science and Engineering Credits: 4 hours**
  Pre-engineering requirement

Revised Sept. 2018. All previous forms are obsolete and should not be used.
Second Semester (16 hours)
- General Education Credits: 3 hours
- CS 1110 - Computer Science I Credits: 4 hours
  Pre-engineering requirement
- MATH 1230 - Calculus II Credits: 4 hours
  Pre-engineering requirement
  or
- MATH 1710 - Calculus II, Science and Engineering Credits: 4 hours
  Pre-engineering requirement
- PHYS 2050 - University Physics I Credits: 4 hours
  Pre-engineering requirement
- PHYS 2060 - University Physics I Laboratory Credits: 1 hour
  Pre-engineering requirement

Third Semester (17 hours)
- CS 1120 - Computer Science II Credits: 4 hours
- ECE 2510 - Introduction to Microprocessors : 4 hours
- MATH 2720 - Multivariate Calculus and Matrix Algebra : 4 hours
  Pre-engineering requirement
- PHYS 2070 - University Physics II Credits: 4 hours
  Pre-engineering requirement
- PHYS 2080 - University Physics II Laboratory Credits: 1 hour
  Pre-engineering requirement

Fourth Semester (17 hours)
- General Education Credits: 3 hours
- ECE 2100 - Circuit Analysis Credits: 4 hours
  Pre-engineering requirement
- ECE 3570 - Introduction to Computer Architecture Credits: 3 hours
- MATH 1450 - Discrete Mathematical Structures Credits: 3 hours
- MATH 3740 - Differential Equations and Linear Algebra Credits: 4 hours

Fifth Semester (17 hours)
- CS 3310 - Data and File Structures Credits: 3 hours
- ECE 2210 - Electronics I Credits: 4 hours
- ECE 3100 - Network Analysis Credits: 3 hours
- ECE 4525 - Digital Design Credits: 4 hours
- IEE 3100 - Engineering Economy Credits: 3 hours

Sixth Semester (16 hours)
- General Education Credits: 3 hours
- ECE 3710 - Linear Systems Credits: 3 hours
- ECE 3800 - Probabilistic Methods of Signal and System Analysis Credits: 3 hours
- ECE 4510 - Microcontroller Applications Credits: 4 hours
- IEE 3160 - Report Preparation Credits: 3 hours

Revised Sept. 2018. All previous forms are obsolete and should not be used.
Seventh Semester (14 hours)

- General Education Credits: 3 hours
- Engineering Science Elective Credits: 3 hours
  or
- Computer Science Algorithm or OS Elective Credits: 3 hours
- Electrical and Computer Engineering/Computer Science Elective Group Credits: 3 hours
- Electrical and Computer Engineering/Computer Science Elective Group Credits: 3 hours
- ECE 4810 - Electrical/Computer Engineering Design I Credits: 2 hours
- Permission form required to be signed by ECE advisor and department chair. Must complete IEE 3160 and ECE 2510 and ECE 3710, and either (ECE 3200 or ECE 3300) or (ECE 4525 and ECE 4510).

Eighth Semester (15 hours)

- General Education Credits: 3 hours
- Engineering Science Elective Credits: 3 hours
  or
- Computer Science Algorithm or OS Elective Credits: 3 hours
- Electrical and Computer Engineering Elective Group Credits: 3 hours
- Electrical and Computer Engineering Elective Group Credits: 3 hours
- ECE 4820 - Electrical/Computer Engineering Design II Credits: 3 hours

Computer Engineering Electives

Engineering Science Electives

Students must complete one elective course (minimum of 3 credit hours).

- AE 2610 - Introduction to Aerospace Engineering Credits: 3 hours
- AE 3610 - Aerodynamics I Credits: 4 hours
- CHEG 1010 - Introduction to Chemical Engineering Credits: 3 hours
- CHEG 1810 - Introduction to Chemical Engineering Computation Credits: 2 hours
- CHEM 3770 - Organic Chemistry II Credits: 3 hours
- PHYS 3090 - Introductory Modern Physics Credits: 4 hours
- PHYS 3300 - Thermodynamics Credits: 3 hours
- PHYS 4200 - Analytical Mechanics Credits: 3 hours
- PHYS 4600 - Quantum Mechanics Credits: 3 hours
- ME 2320 - Thermodynamics I Credits: 3 hours
- ME 2560 - Statics Credits: 3 hours
- ME 2570 - Mechanics of Materials Credits: 3 hours
- ME 2580 - Dynamics Credits: 3 hours

Note:
Other courses may be used in place of these courses if PRIOR approval is obtained from the Electrical and Computer Engineering Advisor and Department Chair.

Computer Science Elective Group

Students must complete one elective course (minimum of 3 credit hours).

- CS 4310 - Design and Analysis of Algorithms Credits: 3 hours
- CS 4540 - Operating Systems Credits: 3 hours

Revised Sept. 2018. All previous forms are obsolete and should not be used.

Program Educational Objectives

Computer Engineering Graduates, within a few years of graduation, should:

1. Use their understanding of computer engineering fundamentals to solve problems in professional practice while exhibiting rigorous analysis and creative design skills that reflect their technical depth and ability to draw on multiple disciplines;

2. Continue their intellectual development through professional development courses, including online learning opportunities, and/or graduate education; and

3. Practice their career in a manner consistent with a high degree of professional ethics, and participate in their community and professional organizations.

(For up-to-date program educational objectives and learning outcomes, see the Department web page at www.wmich.edu/electrical-computer)

Admission

1. To be admitted to this Engineering curriculum, a student must complete all pre-engineering requirements with grades of “C” or better. These requirements may be found in the beginning of the College of Engineering and Applied Sciences section.

2. Students seeking admission to this curriculum must submit an application following procedures established by the College of Engineering and Applied Sciences. Upper level transfer students may complete an application prior to their first semester of enrollment. Only students in good academic standing as defined by the University will be admitted to this curriculum.

WMU Essential Studies Program Requirements

Students who have chosen the Computer Engineering curriculum will satisfy the WMU Essential Studies Program Requirements as outlined within the course listings below. To satisfy these requirements students take courses in twelve (12) categories. Six (6) of the courses are designated within the computer engineering program requirements and six (6) are free electives which students choose from a list of courses in the corresponding course category. Students will meet the planetary sustainability outcome in ECE 4820: Senior Project and must select a course that satisfies the Diversity and Inclusion outcome when choosing a course in the other six (6) categories.

Requirements

Candidates for the Bachelor of Science in Engineering (Computer) must satisfy the following requirements in addition to those required by Western Michigan University:

1. A grade point average of 2.0 or better must be earned in courses presented for graduation with ECE, IEE, and ME prefixes.

2. Students may enroll in an ECE course only after earning at least a “C” in its prerequisite course(s).

3. No more than two grades of “D” or “DC” in courses presented for graduation may be counted for graduation.

4. The following program of 130 or more semester credit hours must be completed. For transfer students at least 16 credit hours of ECE course work must be completed at WMU. The schedule below is an example of one leading to graduation in eight semesters, beginning with fall. Pre-engineering requirements are indicated.

Revised Sept. 2018. All previous forms are obsolete and should not be used.
First Semester (17 hours)
- WMU Essential Studies Level 2: Personal Wellness Course Elective Credits: 3 hours
- CHEM 1100 - General Chemistry I Credits: 3 hours
  Pre-engineering requirement
- CHEM 1110 - General Chemistry Laboratory I Credits: 1 hour
  Pre-engineering requirement
- ECE 2500 - Digital Logic Credits: 3 hours
  Pre-engineering requirement
- IEE 1020 - Technical Communication Credits: 3 hours
  Pre-engineering requirement
  (Satisfies WMU Essential Studies Level 1: Writing Course Requirement)
- MATH 1220 - Calculus I Credits: 4 hours
  Pre-engineering requirement
  or
- MATH 1700 - Calculus I, Science and Engineering Credits: 4 hours
  Pre-engineering requirement
  (Satisfies WMU Essential Studies Level 1: Quantitative Literacy Course Requirement)

Second Semester (16 hours)
- WMU Essential Studies Level 2: Artistic Theory and Practice Course Elective Credits: 3 hours
- CS 1110 - Computer Science I Credits: 4 hours
  Pre-engineering requirement
- MATH 1230 - Calculus II Credits: 4 hours
  Pre-engineering requirement
  or
- MATH 1710 - Calculus II, Science and Engineering Credits: 4 hours
  Pre-engineering requirement
- PHYS 2050 - University Physics I Credits: 4 hours
  Pre-engineering requirement
  (Satisfies WMU Essential Studies Level 2: Laboratory Science Course Requirement)
- PHYS 2060 - University Physics I Laboratory Credits: 1 hour
  Pre-engineering requirement
  (Satisfies WMU Essential Studies Level 2: Laboratory Science Course Requirement)

Third Semester (17 hours)
- CS 1120 - Computer Science II Credits: 4 hours
- ECE 2510 - Introduction to Microprocessors: 4 hours
- MATH 2720 - Multivariate Calculus and Matrix Algebra: 4 hours
  Pre-engineering requirement
- PHYS 2070 - University Physics II Credits: 4 hours
  Pre-engineering requirement
- PHYS 2080 - University Physics II Laboratory Credits: 1 hour
  Pre-engineering requirement

Revised Sept. 2018. All previous forms are obsolete and should not be used.
Fourth Semester (18 hours)
- WMU Essential Studies Level 2: Societies and Cultures Course Elective  Credits: 3 hours
- ECE 2100 - Circuit Analysis Credits: 4 hours
  Pre-engineering requirement
- ECE 3570 - Introduction to Computer Architecture Credits: 4 hours
- MATH 1450 - Discrete Mathematical Structures Credits: 3 hours
- MATH 3740 - Differential Equations and Linear Algebra Credits: 4 hours

Fifth Semester (17 hours)
- CS 3310 - Data and File Structures Credits: 3 hours
- ECE 2210 - Electronics I Credits: 4 hours
  (Satisfies WMU Essential Studies Level 1: Oral and Digital Communication Course Requirement)
- ECE 3100 - Network Analysis Credits: 3 hours
- ECE 4525 - Digital Design Credits: 4 hours
  IEE 3100 - Engineering Economy Credits: 3 hours
  (Satisfies WMU Essential Studies Level 2: Science and Technology Course Requirement)

Sixth Semester (16 hours)
- WMU Essential Studies Level 1: Inquiry and Engagement Course Elective  Credits: 3 hours
- ECE 3710 - Linear Systems Credits: 3 hours
- ECE 3800 - Probabilistic Methods of Signal and System Analysis Credits: 3 hours
- ECE 4510 - Microcontroller Applications Credits: 4 hours
- IEE 3160 - Report Preparation Credits: 3 hours

Seventh Semester (14 hours)
- WMU Essential Studies Level 2: World Language and Cultures Course Elective  Credits: 3 hours
- Engineering Science Elective  Credits: 3 hours
  or
- Computer Science Algorithm or OS Elective  Credits: 3 hours
- Electrical and Computer Engineering/Computer Science Elective Group Credits: 3 hours
  or
- Electrical and Computer Engineering/Computer Science Elective Group Credits: 3 hours
- ECE 4810 - Electrical/Computer Engineering Design I Credits: 2 hours
  Permission form required to be signed by ECE advisor and department chair. Must complete IEE 3160 and ECE 2510 and ECE 3710, and either (ECE 3200 or ECE 3300) or (ECE 4525 and ECE 4510).

Eighth Semester (15 hours)
- WMU Essential Studies Level 3: Global Perspectives Course Elective  Credits: 3 hours
- Engineering Science Elective  Credits: 3 hours
  or
- Computer Science Algorithm or OS Elective  Credits: 3 hours
- Electrical and Computer Engineering Elective Group Credits: 3 hours
- Electrical and Computer Engineering Elective Group Credits: 3 hours
  ECE 4820 - Electrical/Computer Engineering Design II Credits: 3 hours
  (Satisfies WMU Essential Studies Level 3: Local and National Perspectives Course Requirement and the required Planetary Sustainability outcome.)

Revised Sept. 2018. All previous forms are obsolete and should not be used.
Computer Engineering Electives

Engineering Science Electives

Students must complete one elective course (minimum of 3 credit hours).

- CHEM 3770 - Organic Chemistry II Credits: 3 hours
- PHYS 3090 - Introductory Modern Physics Credits: 4 hours
- PHYS 3300 - Thermodynamics Credits: 3 hours
- PHYS 4200 - Analytical Mechanics Credits: 3 hours
- PHYS 4600 - Quantum Mechanics Credits: 3 hours
- STAT 3640 - Foundations of Data Analysis Credits: 4 hours
- ME 2320 - Thermodynamics I Credits: 3 hours
- ME 2560 - Statics Credits: 3 hours
- ME 2570 - Mechanics of Materials Credits: 3 hours
- ME 2580 - Dynamics Credits: 3 hours
- AE 2610 - Introduction to Aerospace Engineering Credits: 3 hours
- AE 3610 - Aerodynamics I Credits: 4 hours

Note:
Other courses may be used in place of these courses if PRIOR approval is obtained from the Electrical and Computer Engineering Advisor and Department Chair.

Computer Science Elective Group

Students must complete one elective course (minimum of 3 credit hours).

- CS 4310 Algorithms
- CS 4540 Operating Systems
- CS 4850 Foundations of Programming Languages
- CS 5541 Computer Systems (will review C programming and basic architecture, plus OS)
- CS 5810 Compiler Construction

Revised Sept. 2018. All previous forms are obsolete and should not be used.