NOTE: Changes to programs may require course changes, which must be processed electronically. Any questions should be directed to Associate Provost David Reinhold at 7-4684 or david.reinhold@wmich.edu

DEPARTMENT: IEE & EM
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
☐ Change in Title
☐ Transfer

☐ Other (explain**)

** Other: Minor revisions to curriculum to accommodate new WES requirements

Title of degree, curriculum, major, minor, concentration, or certificate: B.S.E. in Industrial and Entrepreneurial Engineering

Chair, Department Curriculum Committee: [Signature]

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.
☐ 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 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: [Signature]

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 10/23/18

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.

**Dean:**

**Date**

### FOR PROPOSALS REQUIRING REVIEW BY:

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<th>GSC/USC; EPGC, GRADUATE COLLEGE, and/or FACULTY SENATE EXECUTIVE BOARD</th>
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| *needs review by |
| Provost: |
| Date |

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 Western Essential Studies Program requirements and minor curriculum changes to accommodate WES. Increased credit hours for Health and Wellness WES (formerly Gen Ed Area VIII-Health and Well-Being) from 2 to 3 credits. Split IEE 4910 into two separate courses (IEE 4910 - 3 credits and IEE 4810 - 1 credit). CS 1023 is no longer being offered and was deleted. ECON 2010 was also removed because it is no longer as applicable to the degree. Credit hours required remain the same at 128 credit hours.

2. Rationale. Give your reason(s) for the proposed improvement.

Required to remove references to general education requirements and update with Western Essential Studies Program requirements.

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.

4. Effect on your department’s programs. Show how the proposed change fits with other departmental offerings.

None.

5. Alignment with college’s and department’s strategic plan, mission, and vision.

Provides broad-based liberal arts education for engineering technology students and supports both ABET requirements to ensure we graduate well-rounded engineering technologists ready to lead challenges facing our society.

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 issues that arise for current 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 engineering technology program in response to the new Western Essential Studies Program were coordinated across the college and university through the Western Essential Studies Program design.

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.

The Industrial and Entrepreneurial Engineering Educational Objectives are:

1) Plan, design, analyze, Implement and Improve cost effective manufacturing service systems.
2) Build and use management tools to analyze and solve problems effectively and make decisions from a systems perspective.
3) Communicate effectively in verbal, written and graphic forms.
4) Pursue professional growth and interact effectively in work environments.

Revised Sept. 2018. All previous forms are obsolete and should not be used.
The Industrial and Entrepreneurial Engineering Student Outcomes are:

1) An ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, or technology to solve broadly-defined engineering problems
2) An ability to design systems, components or processes for broadly-defined engineering technology problems appropriate to program educational objectives
3) An ability to apply written, oral and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature
4) An ability to conduct standard tests and measurements; to conduct, analyze and interpret experiments; and to apply experimental results to improve processes
5) An ability to function effectively as a member or leader on a technical team

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.

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 Western 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
Put in current curriculum here)

Industrial and Entrepreneurial Engineering

Return to: Departments and Programs


The Industrial and Entrepreneurial Engineering curriculum provides the essential foundation, experience, and understanding in science, mathematics, entrepreneurship, humanities, and engineering so that graduates may find employment in a wide variety of industries. The program allows students to obtain a minor of their choice and receive credit for internships or international study as part of the 128 credit hour, four year curriculum. The program also provides a solid foundation for future graduate study. Industrial and entrepreneurial engineering involves traditional IE functions such as the design, installation, and improvement of systems integrating people, materials, and equipment. The program also provides substantial work in entrepreneurial engineering, including product innovation and design and financial aspects of starting new companies. Graduates are typically employed in startup as well as traditional companies in industries such as hotels, banks, food, transportation, and hospitals.

Industrial and Entrepreneurial Engineering Program Educational Objectives (PEOs)
Within a few years after graduation, IEE alumni are expected to be immersed in:

1. Practice: Performing Industrial Engineering functions in public, private or academic sectors.

Revised Sept. 2018. All previous forms are obsolete and should not be used.
2. Innovation: Engaging in intra/entrepreneurial activities leading to product, process, and/or system innovation.
3. Knowledge: Continuing formal and/or informal education, applying lessons learned, and leading or mentoring others.

(For up-to-date educational objectives and learning outcomes, see department web page at www.wmich.edu/ieecm)

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 Engineering and Applied Sciences' section. The pre-engineering course requirements for this curriculum are indicated below.
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 Industrial and Entrepreneurial Engineering curriculum will satisfy the Baccalaureate Writing Requirement by successfully completing IEE 3160 - Report Preparation Credits: 3 hours.

Requirements

Candidates for the Bachelor of Science in Engineering (Industrial and Entrepreneurial) 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 IEE, ECE, and ME prefixes.
2. No more than two grades of "D" or "DC" in courses presented for graduation may be counted for graduation.

1. Complete the following program of 128 semester credit hours. The schedule below is an example of one leading to graduation in eight semesters, beginning in fall. Pre-engineering requirements are indicated.

First Semester (17 hours)

- General Education Credits: 3 hours
- CHEM 1100 - General Chemistry I Credits: 3 hours
- (Satisfies General Education Area VI)
- Pre-engineering requirement
- CHEM 1110 - General Chemistry Laboratory I Credits: 1 hour

Revised Sept. 2018. All previous forms are obsolete and should not be used.
(Satisfies General Education Area VI)
- Pre-engineering requirement
- IEE 1020 - Technical Communication Credits: 3 hours
- Pre-engineering requirement
- EDMM 1420 - Engineering Graphics Credits: 3 hours
- MATH 1220 - Calculus I Credits: 4 hours
- Pre-engineering Requirement
- or
- MATH 1700 - Calculus I, Science and Engineering Credits: 4 hours
- Pre-engineering requirement

Second Semester (15 hours)

- General Education Credits: 3 hours
- IEE 2010 - Entrepreneurial Engineering I: Cost and Financial Analysis Credits: 3 hours
- 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
- (Satisfies General Education Area VI)
- Pre-engineering requirement
- PHYS 2060 - University Physics I Laboratory Credits: 1 hour
- (Satisfies General Education Area VI)
- Pre-engineering requirement

Third Semester (15 hours)

- IEE 2610 - Engineering Statistics Credits: 3 hours
- Pre-engineering requirement
- MATH 2720 - Multivariate Calculus and Matrix Algebra Credits: 4 hours
- Pre-engineering requirement
- ME 2560 - Statics Credits: 3 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 (15 hours)

Revised Sept. 2018. All previous forms are obsolete and should not be used.
- Minor Elective  Credits: 3 hours
- **ECON 2010 - Principles of Microeconomics**  Credits: 3 hours
  (Satisfies General Education Area V)
- Pre-engineering Requirement
- **IEE 2050 - Work Design**  Credits: 4 hours
- Pre-engineering requirement
- **IEE 2621 - Probability for Engineers**  Credits: 3 hours
- **IEE 2622 - Statistical Quality Control**  Credits: 2 hours

**Fifth Semester (16 hours)**

- Minor Elective  Credits: 3 hours
- **IEE 3010 - Entrepreneurial Engineering II: Product and Service Design**  Credits: 3 hours
- **IEE 3100 - Engineering Economy**  Credits: 3 hours
- **IEE 3160 - Report Preparation**  Credits: 3 hours
  (Satisfies General Education Proficiency 2)
- **MATH 3740 - Differential Equations and Linear Algebra**  Credits: 4 hours

**Sixth Semester (16 hours)**

- Minor Elective  Credits: 3 hours
- **IEE 3110 - Introduction to Operations Research**  Credits: 3 hours
- **IEE 3300 - Simulation Modeling and Analysis**  Credits: 3 hours
- **IEE 3420 - Ergonomics and Design**  Credits: 3 hours
- **ECE 2100 - Circuit Analysis**  Credits: 4 hours

**Seventh Semester (17 hours)**

- General Education  Credits: 3 hours
- Minor Elective  Credits: 3 hours
- Approved Technical Elective  Credits: 3 hours
- **IEE 4010 - Entrepreneurial Engineering III: Facilities Planning and Logistics**  Credits: 3 hours
- **IEE 4160 - Operations Control in Industry**  Credits: 4 hours
- **IEE 4190 - IE Senior Design**  Credits: 1 - 4 hours

**Eighth Semester (17 hours)**
• General Education Area IV: Other Cultures and Civilizations Credits: 3 hours
• General Education Area VIII: Health and Well-Being Credits: 2 hours
• Minor Elective Credits: 3 hours
• Approved Technical Elective Credits: 3 hours
• Internship/International Studies Credits: 3 hours

• IEE 4190 - IE Senior Design Credits: 1 - 4 hours

Approved Technical Electives

Please see an advisor prior to taking any course not on this list.

• ECE 2110 - Machines and Electronic Circuits Credits: 3 hours
• ECE 2120 - Electronic Circuits and Systems Credits: 3 hours
• ECE 2210 - Electronics I Credits: 4 hours
• ECE 2500 - Digital Logic Credits: 3 hours
• ME 2320 - Thermodynamics I Credits: 3 hours
• ME 2500 - Materials Science for Engineers Credits: 3 hours
• ME 2570 - Mechanics of Materials Credits: 3 hours
• ME 2580 - Dynamics Credits: 3 hours
• CHEG 2611 - Environmental Engineering I Credits: 3 hours
• IEE 2990 - Cooperative Education Credits: 1 to 3 hours
• OR
• IEE 5200 - Modern Industrial Practices Credits: 3 hours

(not both)
Industrial and Entrepreneurial Engineering

Accredited by the Engineering Accreditation Commission EAC of ABET, [www.abet.org](http://www.abet.org).

The Industrial and Entrepreneurial Engineering curriculum provides the essential foundation, experience, and understanding in science, mathematics, entrepreneurship, humanities, and engineering so that graduates may find employment in a wide variety of industries. The program allows students to obtain a minor of their choice and receive credit for internships or international study as part of the 128 credit hour, four-year curriculum. The program also provides a solid foundation for future graduate study. Industrial and entrepreneurial engineering involves traditional IE functions such as the design, installation, and improvement of systems integrating people, materials, and equipment. The program also provides substantial work in entrepreneurial engineering, including product innovation and design and financial aspects of starting new companies. Graduates are typically employed in startup as well as traditional companies in industries such as hotels, banks, food, transportation, and hospitals.

The Industrial and Entrepreneurial Engineering Program Educational Objectives are:

1. Practice: Performing Industrial Engineering functions in public, private or academic sectors.
2. Innovation: Engaging in intra/entrepreneurial activities leading to product, process, and/or system innovation.
3. Knowledge: Continuing formal and/or informal education, applying lessons learned, and leading or mentoring others.

The Industrial and Entrepreneurial Engineering Student Learning Outcomes are:

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 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 context
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 judgement to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies
8. An understanding of the entrepreneurial process including how to design, develop and bring new products and processes to market

(For up-to-date Educational Objectives and Student Learning Outcomes, see department web page at [www.wmich.edu/ieeem](http://www.wmich.edu/ieeem))
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 Engineering and Applied Sciences’ section. The pre-engineering course requirements for this curriculum are indicated below.

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.

Requirements

Candidates for the Bachelor of Science in Engineering (Industrial and Entrepreneurial) 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 IEE, ECE, and ME prefixes.
2. No more than two grades of “D” or “DC” in courses presented for graduation may be counted for graduation.
3. Complete the following program of 128 semester credit hours. The schedule below is an example of one leading to graduation in eight semesters, beginning in fall. Pre-engineering requirements are indicated.

First Semester (17 hours)

- MATH 1220 - Calculus I Credits: 4 hours (pre-engineering requirement)
  (Satisfies Western Essential Studies (WES) Level 1: Quantitative Reasoning)

OR

- MATH 1700 - Calculus I, Science and Engineering Credits: 4 hours (pre-engineering requirement)
  (Satisfies Western Essential Studies (WES) Level 1: Quantitative Reasoning)
- CHEM 1100 - General Chemistry I Credits: 3 hours (pre-engineering requirement)
- CHEM 1110 - General Chemistry Laboratory I Credits: 1 hour (pre-engineering requirement)
- IEE 1020 - Technical Communication Credits: 3 hours (pre-engineering requirement)
- (Satisfies Western Essential Studies (WES) Level 1: Writing)
- BDMM 1420 - Engineering Graphics Credits: 3 hours
- Western Essential Studies (WES) Level 1: Inquiry and Engagement: Critical Thinking in the Arts and Humanities* Credits: 3 hours

Second Semester (15 hours)

- 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 Western Essential Studies (WES) Level 2: Laboratory Science)
- PHYS 2060 - University Physics I Laboratory Credits: 1 hour (pre-engineering requirement)
  (Satisfies Western Essential Studies (WES) Level 2: Laboratory Science)

Revised Sept. 2018. All previous forms are obsolete and should not be used.
- **IEE 2010 - Entrepreneurial Engineering I: Cost and Financial Analysis**  Credits: 3 hours
- **Western Essential Studies (WES) Level 2: Personal Wellness**  Credits: 3 hours

**Third Semester (15 hours)**

- **MATH 2720 - Multivariate Calculus and Matrix Algebra**  Credits: 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)
- **IEE 2610 - Engineering Statistics**  Credits: 3 hours (pre-engineering requirement)
(Satisfies Western Essential Studies (WES) Level 1: Communications)
- **ME 2560 - Statics**  Credits: 3 hours (pre-engineering requirement)

**Fourth Semester (15 hours)**

- **IEE 2650 - Work Design**  Credits: 4 hours (pre-engineering requirement)
- **IEE 2621 - Probability for Engineers**  Credits: 3 hours
- **IEE 2622 - Statistical Quality Control**  Credits: 2 hours
- **Western Essential Studies (WES) Level 2: World Language and Cultures**  Credits: 3 hours
- Minor Elective  Credits: 3 hours

**Fifth Semester (16 hours)**

- **IEE 3010 - Entrepreneurial Engineering II: Product and Service Design**  Credits: 3 hours
- **IEE 3100 - Engineering Economy**  Credits: 3 hours
(Satisfies Western Essential Studies (WES) Level 2: Science and Technology)
- **IEE 3160 - Report Preparation**  Credits: 3 hours
- **MATH 3740 - Differential Equations and Linear Algebra**  Credits: 4 hours
- Minor Elective  Credits: 3 hours

**Sixth Semester (16 hours)**

- **IEE 3110 - Introduction to Operations Research**  Credits: 3 hours
- **IEE 3300 - Simulation Modeling and Analysis**  Credits: 3 hours
- **IEE 3420 - Ergonomics and Design**  Credits: 3 hours
- **ECE 2100 - Circuit Analysis**  Credits: 4 hours
- Minor Elective  Credits: 3 hours

**Seventh Semester (17 hours)**

- **IEE 4010 - Entrepreneurial Engineering III: Facilities Planning and Logistics**  Credits: 3 hours
- **IEE 4160 - Operations Control in Industry**  Credits: 4 hours
- **IEE 4180 - IEE Senior Design Proposal**  Credits: 1 hour
- Minor Elective  Credits: 3 hours
- Approved Technical Elective  Credits: 3 hours
- Western Essential Studies (WES) Level 2: Artistic Theory and Practice  Credits: 3 hours

**Eighth Semester (18 hours)**

Revised Sept. 2018. All previous forms are obsolete and should not be used.
- IEE 4190 - IEE Senior Design Credits: 3 hours
  (Satisfies Western Essential Studies (WES) Level 3: Local and National Perspectives)
- Approved Technical Elective Credits: 3 hours
- Approved Technical Elective or Approved Internship Credits: 3 hours
- Minor Elective Credits: 3 hours
- Western Essential Studies (WES) Level 3: Global Perspectives* Credits: 3 hours
- Western Essential Studies (WES) Level 2: Societies and Culture* Credits: 3 hours

NOTE:

*At least one of these Western Essential Studies (WES) course must fulfill the Diversity and Inclusion requirement.

Approved Technical Electives

Please see an advisor prior to taking any course not on this list.

- BEE 2110 - Machines and Electronic Circuits Credits: 3 hours
- BEE 2120 - Electronic Circuits and Systems Credits: 3 hours
- BEE 2210 - Electronics I Credits: 4 hours
- BEE 2500 - Digital Logic Credits: 3 hours
- ME 2320 - Thermodynamics I Credits: 3 hours
- ME 2500 - Materials Science for Engineers Credits: 3 hours
- ME 2570 - Mechanics of Materials Credits: 3 hours
- ME 2580 - Dynamics Credits: 3 hours
- CHEG 2611 - Environmental Engineering I Credits: 3 hours
- IEE 2990 - Cooperative Education Credits: 3 hours

OR

- IEE 5200 - Modern Industrial Practices Credits: 3 hours

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