

1. Explain briefly and clearly the proposed improvement.
Replace the word 'Elective' with 'Emphasis Elective' in the 8-semester schedule of Chemical Engineering and Paper Engineering
2. Rationale. Give your reason(s) for the proposed improvement. (If your proposal includes prerequisites, justify those, too.)
This adds clarity to the 8-semester schedule
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.
None
4. Effect on your department's programs. Show how the proposed change fits with other departmental offerings.
None
5. 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. If a required course will be offered during summer only, provide a rationale.
No effect
6. 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?
No change
7. Effects on resources. Explain how your proposal would affect department and University resources, including faculty, equipment, space, technology, and library holdings. Tell how you will staff additions to the program. If more advising will be needed, how will you provide for it? How often will course(s) be offered? What will be the initial one-time costs and the ongoing base-funding costs for the proposed program? (Attach additional pages, as necessary.)
No effect
8. General education criteria. For a general education course, indicate how this course will meet the criteria for the area or proficiency. (See the General Education Policy for descriptions of each area and proficiency and the criteria. Attach additional pages as necessary. Attach a syllabus if (a) proposing a new course, (b) requesting certification for baccalaureate-level writing, or (c) requesting reapproval of an existing course.) Not Applicable
9. List the learning outcomes for the proposed course or the revised or proposed major, minor, or concentration. These are the outcomes that the department will use for future assessments of the course or program.
No change in learning outcomes of the program.
10. Describe how this curriculum change is a response to assessment outcomes that are part of a departmental or college assessment plan or informal assessment activities Result of internal assessment
11. (Undergraduate proposals only) Describe, in detail, how this curriculum change affects transfer articulation for Michigan community colleges. For course changes, include detail on necessary changes to transfer articulation from Michigan community college courses. 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. Not Applicable

Catalog Copy (Cumulative for all the changes)

Chemical Engineering

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Accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

Program Educational Objectives: Our graduates are expected within a few years of graduation to attain the following in the areas of career growth, professional development, innovation, and service:

Career Growth: graduates are expected to attain: proficiency in current position, increasing responsibility, diversity of job functions, recognition, progression or job advancement.

Professional Development: graduates are expected to attain: pursuit of additional educational activities, professional certifications or leadership opportunities.

Service. graduates are expected to have involvement in the local community, professional societies, K-12 education, industry or humanitarian endeavors.

Innovation and entrepreneurship: graduates are expected to attain: expertise in problem solving, new process, or methods development, in device or patent creation or in founding a business.

(For up-to-date educational objectives and learning outcomes, see the program's web page at <http://wmich.edu/pci/academics/chemical.html>)

Admission

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 of this catalog.

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 should 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 Chemical Engineering major will satisfy the Baccalaureate-Level Writing requirement by successfully completing CHEG 4870:Senior Design Project.

Requirements

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

The requirement of departmental prefixed prerequisite will not be fulfilled with a grade less than "C". Requests for exceptions to this policy must follow the departmental appeal policy (available in the department office). If an exception is granted, the policy requires that the less than "C" grade be replaced within two regular semesters.

No more than two grades of "D" or "DC" may be presented for graduation.

The Chemical 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. Chemical Engineering majors are required to take ECON 2010 for Area V.

Students must complete the following program of 135 semester credit hours, which includes the courses in one of the Emphasis Areas presented below at the end of the 8-semester example schedule. One emphasis area must be selected and taken in its entirety. The schedules below are examples leading to graduation in eight semesters, beginning in fall. However, depending on the individual's curricular and scheduling needs, the program can take more than eight semesters.

First Semester (17 hours)

General Education Area I: Fine Arts* **Credits:** 3 hours

The following courses are pre-engineering requirements:

CHEG 1010 - Introduction to Chemical Engineering **Credits:** 3 hours

CHEM 1100 - General Chemistry I **Credits:** 3 hours

CHEM 1110 - General Chemistry Laboratory I **Credits:** 1 hour

IEE 1020 - Technical Communication **Credits:** 3 hours

MATH 1220 - Calculus I **Credits:** 4 hours

or

MATH 1700 - Calculus I, Science and Engineering **Credits:** 4 hours

Second Semester (18 hours)

General Education Area III: United States: Cultures and Issues* **Credits:** 3 hours

The following courses are pre-engineering requirements:

CHEG 1810 - Introduction to Chemical Engineering Computation **Credits:** 2 hours

CHEM 1120 - General Chemistry II **Credits:** 3 hours

CHEM 1130 - General Chemistry Laboratory II **Credits:** 1 hour

MATH 1230 - Calculus II **Credits:** 4 hours

or

MATH 1710 - Calculus II, Science and Engineering **Credits:** 4 hours

PHYS 2050 - University Physics I **Credits:** 4 hours

PHYS 2060 - University Physics I Laboratory Credits: 1 hour

Third Semester (17 hours)

Emphasis Approved Elective Credits: 4 hours

CHEG 2810 - Data Acquisition and Handling Credits: 1 hour

Pre-engineering requirement

IEE 2610 - Engineering Statistics Credits: 3 hours

MATH 2720 - Multivariate Calculus and Matrix Algebra Credits: 4 hours

Pre-engineering requirement

PHYS 2070 - University Physics II Credits: 4 hours

PHYS 2080 - University Physics II Laboratory Credits: 1 hour

Fourth Semester (19 hours)

Emphasis Approved Elective Credits: 4 hours

BIOS 1610 - Molecular and Cellular Biology Credits: 4 hours

CHEG 2611 - Environmental Engineering I Credits: 3 hours

CHEG 2960 - Material and Energy Balance Credits: 4 hours

MATH 3740 - Differential Equations and Linear Algebra Credits: 4 hours

Fifth Semester (15 hours)

General Education Area VIII: Health and Well-being* Credits: 2 hours

CHEG 3110 - Unit Operations in Chemical Engineering I Credits: 3 hours

CHEG 3200 - Chemical Engineering Thermodynamics Credits: 3 hours

CHEG 3810 - Computer Modeling and Simulation - Chemical Processes Credits: 1 hour

CHEM 4300 - Physical Chemistry I Credits: 3 hours

ECON 2010 - Principles of Microeconomics Credits: 3 hours

Sixth Semester (16 hours)

General Education Area III: Humanities* Credits: 3 hours

CHEG 3120 - Unit Operations in Chemical Engineering II Credits: 3 hours

CHEG 3300 - Mass Transfer Credits: 3 hours

CHEG 3550 - Bioprocess Engineering Credits: 3 hours

CHEM 3750 - Organic Chemistry I Credits: 3 hours

CHEM 3760 - Organic Chemistry Lab I Credits: 1 hour

Seventh Semester (17 hours)

Emphasis Approved Elective Credits: 3 hours

CHEG 4100 - Chemical Reaction Engineering Credits: 3 hours

CHEG 4600 - Plant Economics and Project Design Credits: 3 hours

CHEG 4830 - Process Control I Credits: 4 hours

CHEM 3770 - Organic Chemistry II Credits: 3 hours

CHEM 3780 - Organic Chemistry Lab II Credits: 1 hour

Eighth Semester (16 hours)

Emphasis Approved Elective Credits: 6 hours

General Education Area IV: Other Cultures and Civilizations* **Credits: 4 hours**

CHEG 4400 - Safety and Hazards Management in Chemical Processes **Credits: 1 hour**

CHEG 4810 - Unit Operations Lab: Fluid Flow, Heat and Mass

Transfer **Credits: 2 hours**

CHEG 4870 - Senior Design Project **Credits: 3 hours**

Emphasis Areas

Emphasis in Energy Management (17 hours minimum)

Required Courses (7 credit hours):

CHEG 4440 - Energy Management Engineering **Credits: 3 hours**

CHEG 4840 - Process Control for Energy Management **Credits: 4 hours**

Elective Courses (choose 10 hours minimum):

CHEG 5950 - Topics in Chemical Engineering **Credits: 1 to 3 hours**

CHP 3100 - Work Experience/Co-op **Credits: 1 hour**

ECE 2100 - Circuit Analysis **Credits: 4 hours**

ECE 2110 - Machines and Electronic Circuits **Credits: 3 hours**

EDMM 1420 - Engineering Graphics **Credits: 3 hours**

ME 4320 - Thermodynamics II **Credits: 3 hours**

ME 4330 - Environmental Systems Design in Buildings **Credits: 3 hours**

ME 4390 - Design of Thermal Systems **Credits: 3 hours**

Emphasis in Life Sciences (17 hours minimum)

Including at least one 3000-level course (not including CHP 3100):

BIOS 1620 - Ecology and Evolution **Credits: 4 hours**

BIOS 2110 - Human Anatomy **Credits: 4 hours**

BIOS 2320 - Microbiology and Infectious Diseases **Credits: 4 hours**

BIOS 2400 - Human Physiology **Credits: 4 hours**

BIOS 2500 - Genetics **Credits: 4 hours**

BIOS 3500 - Human Physiology for Majors **Credits: 5 hours**

BIOS 5310 - Biology of Aging **Credits: 3 hours**

BIOS 5610 - Pharmacology **Credits: 3 hours**

BIOS 5970 - Topics in Biological Sciences **Credits: 3 to 4 hours**

CHEG 5950 - Topics in Chemical Engineering **Credits: 1 to 3 hours**

CHEM 3550 - Introductory Biochemistry **Credits: 3 hours**

CHP 3100 - Work Experience/Co-op **Credits: 1 hour**

Emphasis in Pollution Prevention and Sustainability (17 hours minimum)

Required Courses (39 credit hours)

CHEG 3611 - Advanced Topics in Environmental Engineering Credits: 3 hours

CHEG 4440 - Energy Management Engineering Credits: 3 hours

CHEG 4611 - Sustainable Chemical Process Development Credits: 3 hours

Elective Courses (148 credit hours minimum)

CHEG 5950 - Topics in Chemical Engineering Credits: 1 to 3 hours

CHP 3100 - Work Experience/Co-op Credits: 1 hour

PAPR 3531 - Wastewater Treatment Systems Credits: 3 hours

ECON 3190 - Environmental Economics Credits: 3 hours

BIOS 2320 - Microbiology and Infectious Diseases Credits: 4 hours

CHEM 2250 - Quantitative Analysis Credits: 3 hours

CHEM 2260 - Quantitative Analysis Laboratory Credits: 1 hour

CHEM 3550 - Introductory Biochemistry Credits: 3 hours

CHEM 3560 - Introductory Biochemistry Laboratory Credits: 1 hour

IEE 3100 - Engineering Economy Credits: 3 hours

Emphasis in Pulp and Paper (17 hours minimum)

CHP 3100 - Work Experience/Co-op Credits: 1 hour

CHEG 5950 - Topics in Chemical Engineering Credits: 1 to 3 hours

• PAPR 10040 - Introduction to Pulp and Paper Paper-Manufacture Industry
and Technology Credits: 31 hour

PAPR 2040 - Stock Preparation and Papermaking Credits: 4 hours

PAPR 2420 - Coating Credits: 4 hours

PAPR 2550 - Paper Physics Fundamentals Credits: 4 hours

PAPR 3030 - Pulping and Bleaching Credits: 4 hours

PAPR 4300 - Surface and Wet End Science Credits: 3 hours

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Catalog Copy for Paper Engineering (cumulative for al the changes)

Paper Engineering

First Semester (17 hours)

- General Education Credits: 3 hours
Pre-engineering requirement
- 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
- MATH 1220 - Calculus I Credits: 4 hours
- or
- MATH 1700 - Calculus I, Science and Engineering Credits: 4 hours
Pre-engineering requirement
- PAPR 1000 - Introduction to Pulp and Paper Manufacture Credits: 3 hours

Second Semester (16 hours)

- General Education Credits: 2 hours
- CHEG 1810 - Introduction to Chemical Engineering Computation Credits: 2 hours
Pre-engineering requirement
- CHEM 1120 - General Chemistry II Credits: 3 hours
Pre-engineering requirement
- CHEM 1130 - General Chemistry Laboratory II Credits: 1 hour
Pre-engineering requirement
- MATH 1230 - Calculus II Credits: 4 hours
- or
- MATH 1710 - Calculus II, Science and Engineering Credits: 4 hours
Pre-engineering requirement
- PAPR 2040 - Stock Preparation and Papermaking Credits: 4 hours
Pre-engineering requirement

Third Semester (19 hours)

- CHEM 3750 - Organic Chemistry I Credits: 3 hours
- CHEM 3760 - Organic Chemistry Lab I Credits: 1 hour
- ECON 2010 - Principles of Microeconomics Credits: 3 hours
- Pre-engineering requirement
- IEE 2610 - Engineering Statistics Credits: 3 hours
- PAPR 2550 - Paper Physics Fundamentals Credits: 4 hours
- PHYS 2050 - University Physics I Credits: 4 hours
- Pre-engineering requirement
- PHYS 2060 - University Physics I Laboratory Credits: 1 hour
- Pre-engineering requirement

Fourth Semester (20 hours)

- Emphasis Elective Credits: 4 hours
- CHEG 2611 - Environmental Engineering I Credits: 3 hours
- Pre-engineering requirement
- CHEG 2960 - Material and Energy Balance Credits: 4 hours
- MATH 2720 - Multivariate Calculus and Matrix Algebra Credits: 4 hours
- Pre-engineering requirement
- PHYS 2070 - University Physics II Credits: 4 hours
- PHYS 2080 - University Physics II Laboratory Credits: 1 hour

Fifth Semester (18 hours)

- General Education Credits: 4 hours
- General Education Credits: 3 hours
- Emphasis Elective Credits: 4 hours
- CHEG 3110 - Unit Operations in Chemical Engineering I Credits: 3 hours
- PAPR 3030 - Pulp and Bleaching Credits: 4 hours

Sixth Semester (16 hours)

- General Education Credits: 3 hours
- Emphasis Elective Credits: 3 hours
- CHEG 3120 - Unit Operations in Chemical Engineering II Credits: 3 hours
- MATH 3740 - Differential Equations and Linear Algebra Credits: 4 hours
- PAPR 3330 - Carbohydrate and Lignin Chemistry Credits: 3 hours

- OR
- CHEM 3770 Organic Chemistry II Credits: 3 hours

Seventh Semester (15 hours)

- CHEG 4830 - Process Control I Credits: 4 hours
- CHEM 4300 - Physical Chemistry I Credits: 3 hours
- CHP 3100 - Work Experience/Co-op Credits: 1 hour
- PAPR 4400 - Seminar Credits: 1 hour
- PAPR 4600 - Plant Economics and Project Design Credits: 3 hours
- PAPR 4850 - Research Design Credits: 3 hours

Eighth Semester (14 hours)

- Emphasis Elective Credits: 3 hours
- Emphasis Elective Credits: 3 hours
- CHEG 4811 - Unit Operations Lab: Fluid Flow and Heat Transfer Credits: 1 hour
- PAPR 4300 - Surface and Wet End Science Credits: 3 hours
- CHEG 4400 or GPS 4400/PAPR 4400 - Seminar Credits: 1 hour
- PAPR 4860 - Independent Research Credits: 3 hours

Areas of Emphasis

Emphasis in Process Paper-Engineering (17 hours minimum)

Required Electives (4 hours)

- PAPR 2420 - Coating Credits: 4 hours

Elective Courses (choose 13 hours minimum):

- CHEG 3200 - Chemical Engineering Thermodynamics Credits: 3 hours
- CHEG 3810 - Computer Modeling and Simulation - Chemical Processes Credits: 1 hour
- Preferred Elective
- CHEG 4100 - Chemical Reaction Engineering Credits: 3 hours
- CHP 3100 - Work Experience/Co-op Credits: 1 hour

- ECE 2100 - Circuit Analysis Credits: 4 hours
- GPS 5100 - Printability Analysis Credits: 3 hours
- IEE 3100 - Engineering Economy Credits: 3 hours
- (Another course in IEE, MGMT, or COM can be substituted for IEE 3100 with approval of the advisor.)
- ME 25630 - Statics and Mechanics of Materials Credits: 3 hours
- Preferred Elective
- CHEGPAPR 4840 - Process Control for Energy Management Credits: 4 hours
- STAT 5670 - Statistical Design and Analysis of Experiments Credits: 4 hours
- Preferred Elective

Emphasis in Environmental Engineering and Sustainable Processes (17 hours minimum)

Required Electives (39 hours)

- CHEG 3611 - Advanced Topics in Environmental Engineering Credits: 3 hours
- CHEG 4440H -- Energy Management Engineering Sustainable Chemical Process Development Credits: 3 hours

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Elective Courses (choose 148 hours minimum):

- CHP 3100 - Work Experience/Co-op Credits: 1 hour
- PAPR 3531 - Wastewater Treatment Systems Credits: 3 hours
- PAPR 2420 - Coating Credits: 4 hours
- ECON 3190 - Environmental Economics Credits: 3 hours
- BIOS 2320 - Microbiology and Infectious Diseases Credits: 4 hours
- CHEG 3200 - Chemical Engineering Thermodynamics Credits: 3 hours
- CHEG 4100 - Chemical Reaction Engineering Credits: 3 hours
- CHEG 4440 - Energy Management Engineering Credits: 3 hours
- sCHEM 2250 - Quantitative Analysis Credits: 3 hours
- CHEM 2260 - Quantitative Analysis Laboratory Credits: 1 hour
- CHEM 3550 - Introductory Biochemistry Credits: 3 hours
- CHEM 3560 - Introductory Biochemistry Laboratory Credits: 1 hour
- IEE 3100 - Engineering Economy Credits: 3 hours