REQUEST TO COLLEGE CURRICULUM COMMITTEE FOR CURRICULAR IMPROVEMENTS

DEPARTMENT: CHP  PROPOSED EFFECTIVE SEMESTER: Spring '18  COLLEGE: CEAS

PROPOSED IMPROVEMENTS

- New degree*
- New major*
- New curriculum*
- New concentration*
- New certificate
- New minor
- Revised major
- Revised minor
- Admission requirements
- Graduation requirements
- Deletion  Transfer
- Other (explain**)

Substantive Course Changes
- New course
- Pre or Co-requisites
- Course #, different level
- Credit hours
- Enrollment restriction
- Course-level restriction
- Prefix  Title and description
- General education (select one)
- Not Applicable
- Other (explain**)

Misc. Course Changes
- Title
- Description (attach current & proposed)
- Deletion (not required by others)
- Course #, same level
- Variable credit
- Credit/no credit
- Cross-listing
- COGE reapproval
- Other (explain**)

*Replace the word 'Elective' with 'Emphasis Elective' in the 8-semester schedule of Chemical Engineering and Paper Engineering
Title of degree, curriculum, major, minor, concentration, or certificate: BSE in Chemical Engineering and BSE in Paper Engineering

Existing course prefix and #: Proposed course prefix and #: Credit hours:
Existing course title:
Proposed course title:

Existing course prerequisite & co-requisite(s):
Proposed course prerequisite(s):
If there are multiple prerequisites, connect with "and" or "or". To remove prerequisites, enter "none."
Proposed course co-requisite(s):
If there are multiple corequisites, they are always joined by "and."
Proposed course prerequisite(s) that can also be taken concurrently:
Is there a minimum grade for the prerequisites or corequisites?
The default grades are D for undergraduates and C for graduates.

Major/minor or classification restrictions:
List the Banner 4 character codes and whether they should be included or excluded.
For 5000 level prerequisites & corequisites: Do these apply to: (circle one) undergraduates graduates both

Specifications for University Schedule of Classes:
a. Course title (maximum of 30 spaces):
b. Multi-topic course:  No  Yes
c. Repeatable for credit:  No  Yes
d. Mandatory credit/no credit:  No  Yes
e. Type of class and contact hours per week (check type and indicate hours as appropriate)
   1. Lecture
   2. Lab or discussion
   3. Lecture/lab/discussion
   4. Seminar or studio
   5. Independent study
   6. Supervision or practicum

CIP Code (Registrar's use only):

Chair/Director

Chair, College Curriculum Committee  Date 3/26/17

Dean

Graduate Dean:

Curriculum Manager: Return to dean Date Forward to:

Chair, COGE/ PEB / FS President

FOR PROPOSALS REQUIRING GSC/USC REVIEW:

* Approve  Disapprove  Chair, GSC/USC

* Approve  Disapprove  Provost

Revised May 2007. All previous forms are obsolete and should not be used.
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

Return to: Departments and Programs

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 https://wmich.edu/ecn/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 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 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 Manufacture Industry and Technology Credits: 3 hours
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
Catalog Copy for Paper Engineering (cumulative for all 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
- CHIEG 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
- IE 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 - Pulping 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
• 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

Seventh Semester (15 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 4480 - Seminar Credits: 1 hour
• PAPR 4860 - Independent Research Credits: 3 hours

Eighth Semester (14 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: 34 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 444061 - Energy Management Engineering Sustainable Chemical Process Development Credits: 3 hours

Elective Courses (choose 148 hours minimum):

• CHP 3100 - Work Experience/C-0 Credits: 1 hour
• PAPR 3531 - Wastewater Treatment Systems Credits: 3 hours
• PAPR 3420 - Costing 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