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: ChP
PROPOSED EFFECTIVE FALL YEAR: 2019

PROPOSED IMPROVEMENTS: Academic Program Proposed Improvements

☐ New degree*
☐ New major*
☐ New curriculum*
☐ New concentration*
☐ New certificate
☐ Revised major
☐ New minor
☐ Revised minor
☐ Admission requirements
☐ Graduation requirements
☐ Deletion (required by others)
☐ Deletion (not required by others)
☐ Change in Title
☐ Transfer

☐ Other (explain**)

** Other:

Title of degree, curriculum, major, minor, concentration, or certificate: BS in Chemical Engineering CHEGJ

Chair, Department Curriculum Committee: [Signature] Date 7/21/18

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] Date 9/26/18

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: [Signature] Date 

Revised March 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:
GSC/USC; EPGC, GRADUATE COLLEGE, and/or FACULTY SENATE EXECUTIVE BOARD

☐ Return to Dean
☐ Forward to: Curriculum Manager: Date:

☐ Approve ☐ Disapprove Chair, GSC/USC: Date

☐ Approve ☐ Disapprove Chair, EPGC: Date

☐ Approve ☐ Disapprove Graduate College Dean: Date

☐ Approve ☐ Disapprove Faculty Senate President: Date

☐ Approve ☐ Disapprove Provost: Date

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1. Explain briefly and clearly the proposed improvement:

Modify Energy Management Area of Emphasis of the CHEG program by:

(a) Remove CHEG 4840
(b) Add CHEG 5250: Sustainable Earth Resources Engineering
(c) Add CHEG 5200: Renewable Energy and Energy Storage
(d) Change required courses form 7 to 3 credits and Elective courses from 10 to 14

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

CHEG 4840 have been replaced by CHEG 5250 to cover state of the art energy topics

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

NA

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.

NA

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?

NONE

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

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 as elective courses do not change the assessment outcomes.

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.

NOT APPLICABLE

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.

NOT APPLICABLE

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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 for CHEG 4840:

**CHEG 4840 - Process Control for Energy Management**

The use of instrument systems, digital computers and programmable logic controllers to control process and utility boilers and energy management systems. Design of control systems, principles of analog and digital systems, digital signal processing and architecture of programmable logic controllers.

**Prerequisites & Corequisites:** Prerequisite: CHEG 4830, a minimum grade of "C" is required in CHEG prefixed prerequisites.

**Credits:** 4 hours

**Lecture Hours - Laboratory Hours:** (4 - 0)

Proposed Catalog Description for CHEG 5250: Sustainable Earth Resources Engineering

a. Catalog description: As global population sources, the demand for food, water, and energy will likewise intensify while supplies are becoming increasingly scarce. This course will examine the state of the art and basic scientific and engineering principles that underlie food, energy and water production technologies with emphasis on their interdependence. Potential engineering solutions for enhancing efficiency and sustainability will be discussed. This course is intended for engineering students interested in topics of bioenergy, energy efficiency, and water resources engineering and sustainability.

b. Prerequisites or co-requisites: Prerequisites - CHEG 2611 (Environmental Engineering I) and CHEG 2960 (Material and Energy Balance) and equivalent courses, or instructor’s permission.

Proposed Catalog Description for CHEG 5200: Renewable Energy and Energy Storage

c. Catalog description: This course covers the basic concepts of energy, energy conversion and energy storage with emphasis on renewable energy and rechargeable battery. Fundamentals and state-of-the-art technologies for utilizing renewable resources for energy will be introduced. Theories, processes and applications of energy conversion and storage technologies, including electric capacitors, batteries, rechargeable batteries and fuel cells, will be discussed.

d. Prerequisites or co-requisites: Prerequisites - CHEG 3200 (Chem. Eng. Therm.), PHYS 2070 (Univ. Physics II)

e. Required course: No.

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Emphasis Areas

Emphasis in Energy Management (17 hours minimum)

Required Courses (7 credit hours): CHANGE to 3 hours

- CHEG 4440 - Energy Management Engineering Credits: 3 hours
- REMOVE: CHEG 4840 - Process Control for Energy Management Credits: 4 hours

Elective Courses (choose 10 hours minimum): CHENG 3 to 14 hours

- 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
- EDM 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

ADD: CHEG 5200: Renewable Energy and Energy Storage. Credits: 3 hours

ADD: CHEG 5250: Sustainable Earth Resources Engineering. Credits: 3 hours

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Course Syllabus

2. Course number and name: CHEG 5200 – Renewable Energy and Energy Storage

3. Credits and contact hours: 3 credits, 4 contact hours per week

4. Instructor’s or course coordinator’s name: Dr. Qingliu Wu

5. Text book, title, author, and year: None. Various materials will be used.

6. Specific course information
   a. Catalog description: This course covers the basic concepts of energy, energy conversion and energy storage with emphasis on renewable energy and rechargeable battery. Fundamentals and state-of-the-art technologies for utilizing renewable resources for energy will be introduced. Theories, processes and applications of energy conversion and storage technologies, including electric capacitors, batteries, rechargeable batteries and fuel cells, will be discussed.
   b. Prerequisites or co-requisites: Prerequisites - CHEG 3200 (Chem. Eng. Therm.), PHYS 2070 (Univ. Physics II)
   c. Required course: No.

7. Specific goals for the course
   a. Specific outcomes of instruction: Upon completion of the course, the students should be able to:
      i. Distinguish various sources of energy; Understand energy density, heating value of various fuels.
      ii. Understand biofuel production and fuel cell technologies.
      iii. Understand fundamentals of solar cells, analyze the characteristic curve, calculate the fill factor and efficiency of solar cells.
      iv. Be familiar with technologies of energy storage; Understand terminology in energy storage.
      v. Understand working principle for supercapacitors, fuel cells, lithium-ion, lithium-sulfur and lithium-air batteries.
      vi. Analyze the behaviors of electrical storage with fundamentals of electrochemistry
      vii. Be able to determine the open circuit voltage, rate capability and durability of batteries
      viii. Design batteries with high energy densities
   b. ABET Criterion 3 Outcomes addressed:
      i. (3a) An ability to apply knowledge of mathematics, science, and engineering: Formulate and solve mathematical equations related to solar cell, fuel cell, capacitor and battery.
      ii. (3d) An ability to function on multidisciplinary teams: Perform as a member/leader of a team in conducting research project and writing reports.
      iii. (3e) An ability to identify, formulate and solve engineering problems: Use fundamental knowledge and state-of-art technologies to design batteries with high energy densities for practical applications.
   c. Brief list of topics to be covered:
      i. Introduction to Energy and Energy Forms
      ii. Renewable Energy

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iii. Bioethanol from Lignocellulose Biomass
iv. Energy Storage
v. Rechargeable Batteries
vi. Lithium-Ion Batteries
vii. Lithium-Sulfur Batteries
viii. Lithium-Air Batteries
Course Syllabus

1. Course number and name: CHEG 5250 – Sustainable Earth Resources Engineering

2. Credits and contact hours: 3 credits, 3 contact hours per week

3. Instructor’s or course coordinator’s name: Dr. Andro Mondala

4. Text book, title, author, and year: None. Various materials will be used.

5. Specific course information
   a. Catalog description: As global population sources, the demand for food, water, and energy will likewise intensify while supplies are becoming increasingly scarce. This course will examine the state of the art and basic scientific and engineering principles that underlie food, energy and water production technologies with emphasis on their interdependence. Potential engineering solutions for enhancing efficiency and sustainability will be discussed. This course is intended for engineering students interested in topics of bioenergy, energy efficiency, and water resources engineering and sustainability.
   b. Prerequisites or co-requisites: Prerequisites - CHEG 2611 (Environmental Engineering I) and CHEG 2960 (Material and Energy Balance) and equivalent courses, or instructor’s permission
   c. Required course: No.

6. Specific goals for the course
   a. Specific outcomes of instruction: Upon completion of the course, the students should be able to:
      i. Describe the current issues in food, energy, and water resource sustainability and their interdependence in the technical, geopolitical, and social contexts.
      ii. Describe innovative solutions for solving said issues and explain the underlying theoretical, technical, and economic aspects.
   b. ABET Criterion 3 Outcomes addressed:
      i. (3e) An ability to identify, formulate, and solve engineering problems.
      ii. (3h) Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context.
      iii. (3d) Knowledge of contemporary issues.

7. Brief list of topics to be covered:
   a) Basic principles of food-energy-water nexus sustainability
   b) Water, nutrient, and energy cycles and their interrelationships
   c) Sustainability in water use strategies for energy and food production
   d) Efficient energy use for water production
   e) Energy use and impact on water resources

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