NOT FOR USE FOR CURRICULAR COURSE CHANGES
REQUEST FOR PROGRAM IMPROVEMENTS

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  
COLLEGE: CEAS

PROPOSED EFFECTIVE FALL YEAR: 2019

PROPOSED IMPROVEMENTS: Academic Program Proposed Improvements

☐ New degree*  ☑ Revised major  ☐ Deletion (required by others)

☐ New major*  ☐ New minor  ☐ Deletion (not required by others)

☐ New curriculum*  ☐ Revised minor  ☐ Change in Title

☐ New concentration*  ☐ Admission requirements  ☐ Transfer

☐ New certificate  ☐ Graduation requirements

☐ Other (explain**)  ** Other:

Title of degree, curriculum, major, minor, concentration, or certificate: BS in Chemical Engineering (CHGJ) and BS in Paper Engineering (PPRJ)

Chair, Department Curriculum Committee: [Signature]  Date 9/26/18

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.

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1. Explain briefly and clearly the proposed improvement:
   Add to the Pollution Prevention and Sustainability Area of Emphasis in Chemical Engineering and to the Environmental Engineering and Sustainable Processes Area of Emphasis in Paper Engineering programs elective courses:
   CHEG 5200: Renewable Energy and Energy Storage
   and
   CHEG 5250: Sustainable Earth Resources Engineering

2. Rationale. Give your reason(s) for the proposed improvement.
   Undergraduates would be able to enroll in chemical engineering classes from a broader range of areas of impacts in chemical engineering and training from faculty who are specialized in those areas.

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.
   Not Applicable

4. Effect on your department’s programs. Show how the proposed change fits with other departmental offerings.
   No effect

5. Alignment with college’s and department’s strategic plan, mission, and vision.
   Will help to attract student to the accelerated MS program and increase graduate program enrollment

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.
   May increase graduate enrollment

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.)
   No effect

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.
   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.
    As Part of ABET accreditation, the program continue to conduct assessment to improve learning

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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.

No effect

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.

Catalog Descriptions:

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

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

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.
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
      iii. Bioethanol from Lignocellulose Biomass

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iv. Energy Storage
v. Rechargeable Batteries
vi. Lithium-Ion Batteries
vii. Lithium-Sulfur Batteries
viii. Lithium-Air Batteries
Course Syllabus

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

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

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

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

12. 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.

13. 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.

14. 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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Chemical Engineering program catalog:

Emphasis in Pollution Prevention and Sustainability (17 hours minimum)

Required Courses (3 credit hours)

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

Elective Courses (14 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

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

Required Electives (3 hours)

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

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

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