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

COLLEGE: CEAS

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: MS in Chemical Engineering (CHGM)

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.

Chair, College Curriculum Committee: Date

Revised March 2018. All previous forms are obsolete and should not be used.
NOT FOR USE FOR CURRICULAR COURSE CHANGES
REQUEST FOR PROGRAM IMPROVEMENTS

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

Revised March 2018. All previous forms are obsolete and should not be used.
1. Explain briefly and clearly the proposed improvement:
   Add the following courses to Electives Course:
   CHEG 5100: Medical and biomolecular Engineering Concepts
   CHEG 5250: Sustainable Earth Resource Engineering
   CHEG 5200: Renewable Energy and Energy Storage

2. Rationale. Give your reason(s) for the proposed improvement.
   All new courses that have been previously offered as chemical engineering topics (CHEG 5950) to reflect new faculty expertise. Undergraduates would be able to also take these classes from a broader range of areas 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.
   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.
   NOT APPLICABLE

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.

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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 5100:

**CHEG 5100 - Medical and Biomolecular Engineering Concepts**

A course focused on molecular biotechnology, bioprocessing, and pharmacology concepts related to engineering. Topics may include but are not limited to molecular biology and biochemical techniques, PCR and primer design, chromatography, gel electrophoresis and Western blotting, mass spectrometry, advanced bioprocessing, pharmacokinetics, and pharmacodynamics.

**Prerequisites & Corequisites:** Prerequisites: BIOS 1610, CHEM 3750, and MATH 2720, or by instructor approval.

**Credits:** 3 hours

**Notes:** Open to upper class and graduate students.

**Lecture Hours - Laboratory Hours:** (3 - 0)

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
      iv. Energy Storage

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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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2018-19 Graduate Catalog copy:

Elective Courses Thesis option students will select a minimum of six credit hours of Electives from the list below. Non-thesis option students will select a minimum of nine credit hours of Elective courses (including CHEG 6500) from the list below.

CHEG 6400 - Pollution Prevention Engineering Credits: 3 hours
CHEG 6500 - Chemical Process Design and Analysis I Credits: 3 hours
CHEG 6510 - Chemical Process Design and Analysis II Credits: 3 hours
CHEG 6600 - Methods of Research and Engineering Communication Credits: 3 hours
CHEG 6950 - Graduate Topics in Chemical Engineering Credits: 3 hours OR ECE 6720 - Fuzzy Control Systems Credits: 3 hours

Add the following courses to Electives Course:

CHEG 5100: Medical and biomolecular Engineering Concepts
CHEG 5250: Sustainable Earth Resource Engineering
CHEG 5200: Renewable Energy and Energy Storage

Revised March 2018. All previous forms are obsolete and should not be used.
Course Description (registrar): A course focused on molecular biotechnology, bioprocessing, and pharmacology concepts related to engineering. Topics may include but are not limited to molecular biology and biochemical techniques, PCR and primer design, chromatography, gel electrophoresis and Western blotting, mass spectrometry, advanced bioprocessing, pharmacokinetics, and pharmacodynamics.

Instructor:

Professor James R. Springstead; Office A-222 Floyd Hall
Phone: 269-276-3513; Email: james.springstead@wmich.edu
Office hours: to be determined
Possible Recitation/Discussion section: Time and place to be discussed

Course Objectives:

1) To gain and an understanding of the analytical molecular and cell biology techniques involved in the characterization of novel pathways involved in disease and drug discovery.
2) To gain an understanding of the underlying chemistry of how drugs work on a molecular basis.
3) To gain an understanding of drug transport and the biochemical effects of a drug on the human body.

Prerequisites: BIOS 1610, CHEM 3750, and MATH 2720, or by instructor approval.

Learning outcomes:

1) Students gain an understanding of molecular biology techniques that are fundamental in the biotechnology and biochemical industries today. Students should be able to have some understanding of how to design experiments in molecular biology to test hypotheses involved in biological pathways.
2) Students will gain an understanding of analytical chemistry techniques and methods involved in the characterization of novel pathways involved in disease. Students should understanding how experiments using liquid chromatography, mass spectrometry, western blotting, and tagged ligands may be used in order to demonstrate biomolecular interactions.
3) Students should learn about how genomics, metabolomics, proteomics, and lipidomics are used in drug discovery and development, and a further understanding of the biological and pathological bases of disease. To this end, students should gain an understanding of how microarrays, mass spectrometry, and NMR, among other methods are used in experiments.
4) Students will be introduced to concepts in drug delivery and molecular pharmacology. In this section students should understand the mechanisms of how drugs are transported within and how they affect the human body.

This course provides support for ABET Criterion 3 outcomes a, b, c, e, h, and j;
Required Text:


Supplemental texts (not required):


Tentative Evaluation breakdown (undergraduate students):

First midterm 25%
Second midterm 25%
Final Exam 25%
Homework, Papers/Projects, Quizzes 25%

Grading Scale (tentative; grades may be higher according to professor’s discretion)

A≥93%  93>AB≥87%  87>B≥83%  83>BC≥77%
77>C≥70%  70>CD≥67%  67>D≥60%  E<60%

Tentative Course Outline (May change as time allots and at professor’s discretion)

• Various topics in Biochemistry, Molecular and Cell Biology
• Chapter 1: Molecular Biotechnology
• Chapter 2: Tools in the Analysis of Biological Compounds
• Chapter 3: Production and Processing of Biotech Compounds
• Midterm #1
• Chapter 4: Formulation of Biotech Products
• Chapter 5: Pharmacokinetics
• Chapter 7: Pharmacodynamics
• Midterm #2
• Various topics (Drug trial considerations, commercialization, ethics), Review for Final Exam
• Final Exam