Curriculum Course Request WES Change Course IEE 3100 - A-2018-IEM-118; effective term: 202010

Steven E Butt

Tue 12/18/2018 7:13 PM

To: Raja G Aravamuthan <raja.aravamuthan@wmich.edu>; Said M Abubakr <said.abubakr@wmich.edu>

Cc: Holly Blanks <holly.blanks@wmich.edu>

2 attachments (77 KB)

Spring 2019 ABET Course Outline IEE 3100 with sustainability Rev 3.doc; IEE 3100 Assessing WES SLOs _ Science and Technology.docx;

Please verify your data for New Curriculum Course Request for department: IEM; college: A. Go to the following URL to complete your worklist items: https://bwfp31.cc.wmich.edu:7102/wfbprod

Date of request: 21-NOV-2018

Request ID: A-2018-IEM-118

College: A

Department: IEM

Initiator name: Larry Mallak

Initiator email: Larry.mallak@wmich.edu

Proposed effective term: 202010

Does course need General Education approval?: Y

Will course be used in teacher education?: N

If 5000 level course, prerequisites apply to: U

Proposed course data:

WES Change Course IEE 3100

Specific Course Change type selected: WMU Essential Studies - Level 2: Exploration and Discovery

1. Existing course prefix and number:

IEE 3100

2. Level 2: Exploration and Discovery

Indicate which course category the course should be placed in:

Science and Technology

3. Indicate which ONE additional required student learning outcome the course will assess: (may NOT select category required

https://outlook.office.com/owa/?realm=WMICH.EDU&exsvurl=1&ll=cc=1033&modurl=0
L. 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.)

Two sections each in Fall and Spring semesters with a 24 student capacity. One section in Summer with a 28 student capacity. Not offered online. All sections use the same syllabus and assessments. The course coordinator oversees all instructors and ensures uniform use of the syllabus, content, assignments, and assessments across all sections.

M. With the change from General Education to WMU Essential Studies, this question is no longer used.

For courses requesting approval as a WMU Essential Studies course, a syllabus identifying the student learning outcomes and an action plan for assessing the student learning outcomes must be attached in the Banner Workflow system.

Not Applicable

N. (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.

Initial WMU Essential Studies review and approval.

O. Current catalog copy:

IEE 3100 - Engineering Economy

Application of principles of engineering economy for establishment of equipment and system feasibility. Interest, equivalence, taxes, depreciation, uncertainty and risk, incremental and sunk costs, and replacement models.

Prerequisites & Corequisites: Prerequisites: MATH 1230 and Junior standing.

Credits: 3 hours


Lecture Hours - Laboratory Hours: (3 - 0)

P. Proposed catalog copy:

IEE 3100 - Engineering Economy

This course covers the analysis and design of traditional and sustainable economic systems. Analysis of alternatives is presented by including topics such as time value of money, net present value, internal rate of return, depreciation, taxes, and inflation, with emphasis on planetary sustainability as an essential design and analysis consideration. Integrating economic principles across disciplines is emphasized throughout the course. This course meets the student learning outcomes in the Western Michigan University Essential Studies Level II - Exploration and Discovery, Science and Technology course category and the WES student learning outcome on Planetary Sustainability (S).

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Coordinator: Dr. Bob White, Professor, Industrial and Entrepreneurial Engineering Office Room E-216, Parkview Campus. 276-3379. bob.white@wmich.edu

Prerequisites by topic:
1. Differential and integral calculus. MATH 1230.
2. Understanding and familiarity with computer programming.

<table>
<thead>
<tr>
<th>Course Objectives</th>
<th>Performance Criteria (department)¹</th>
<th>ABET/EAC Outcomes²</th>
<th>WES SLOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Understand professional and ethical responsibility.</td>
<td>Engineering case study assignments.</td>
<td>4</td>
<td>Develop practices for planetary sustainability. (WMU Essential Studies SLO)</td>
</tr>
<tr>
<td>2. Understand how global actions promote or disrupt the human and natural world.</td>
<td>Weekly contemporary issue quizzes.</td>
<td></td>
<td>Demonstrate and apply scientific literacy. (WMU Essential Studies SLO)</td>
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<td>3. Collect experimental data, formulate hypotheses, and use simulation methods to test hypotheses and optimize design.</td>
<td>Case Study 1</td>
<td></td>
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<td>4. Apply science and math to address a common societal problem – planning for a</td>
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Impact of debt financing
Simultaneous variable sensitivity analysis using Monte Carlo simulation

**CASE STUDY #3: Engineering design with variability.**

Weeks 11,12 Recognizing the impact of global actions on economy studies
- Exchange rates and the impact on economy analyses
- Including inflation in economy studies.
- Adjusting cash flows for the impact of inflation
- Modeling unknown inflation and interest rates using Monte Carlo simulation

**CASE STUDY #4: Entrepreneurial Case Study.**

Weeks 13-14 Risk and uncertainty.
- Calculation of expected NPV and IRR
- Determining the distribution of NPV and IRR using Monte Carlo simulation

**Schedule:**

<table>
<thead>
<tr>
<th>Week</th>
<th>TEXT READING</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Chapter 17,1</td>
</tr>
<tr>
<td>2</td>
<td>2,3</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>4 Case Study #1 Due</td>
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<tr>
<td>5</td>
<td>5,6</td>
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<tr>
<td>6</td>
<td>7,8 Exam #1</td>
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<tr>
<td>7</td>
<td>8, Case Study #2 Due</td>
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<td>9</td>
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<td>10</td>
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<tr>
<td>10</td>
<td>11 Case Study #3 Due</td>
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<td>11</td>
<td>12</td>
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<td>12</td>
<td>12, Exam #2</td>
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<tr>
<td>13</td>
<td>13 Case Study #4 Due</td>
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<tr>
<td>14</td>
<td>14 Team Project Due</td>
</tr>
<tr>
<td>15</td>
<td>Final Exam</td>
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</tbody>
</table>

This is an approximate schedule. Actual class assignments may vary from this as the class proceeds throughout the semester. When deviations occur, they will be announced in class.

**Evaluation:**

- 2 Exams, 100 pts each: 200 pts 40%
- Final Exam: 100 pts 30%
- Case Study Assignments/homework: 100 pts 20%
- Weekly Contemporary Issue Quizzes: 50 pts 10%
- Team Project: 50 pts 10%

**Total:** 500 pts 100%
Case Study #2. Sustainable retirement: Construction of a multi objective retirement planner that allows for variability in the assumptions. This case study will require students to apply principles of mathematics and science to address an issue applicable to all members of society – providing for an economically sustainable retirement and provide the first assessment for the apply scientific knowledge to situations common to daily life, and/or societal concerns learning outcome.

Case Study #3. Design with variability. This case study will require students to analyze and determine how to provide a service to society (water delivery, transportation system, delivery of goods, etc.) that efficiently and economically meets its stated objectives. This case study will provide the second assessment for the apply scientific knowledge to situations common to daily life, and/or societal concerns learning outcome. Progress in meeting this objective from case study 2 to 3 will be assessed.

Case Study #4. Entrepreneurial case study. This case study will require students to analyze a start-up or an “intrapreneural” venture. These types of cases operate at higher levels of risk and uncertainty and require proper use of engineering economic models with special regard to assumptions concerning the venture and the models used. This case will require students to use applied mathematics modeling using Monte Carlo simulation and sensitivity analysis.

**Semester Long Team Project:** An interdisciplinary semester long team project is required. Teams will consist of 2-3 students with each student from a different major. The project will focus on a current topic that deals with analysis and design of a system to address an important societal issue from a planetary sustainability perspective. Examples could include:

1. Analysis and design of a sustainable energy generation and distribution system.
2. Analysis and design of sustainable housing that meets the needs of all citizens.
3. Analysis and design of a sustainable healthcare system.
4. Analysis and design of a sustainable Medicare/Medicaid system.
5. Analysis and design of a sustainable education system.
6. Analysis and design of a sustainable transportation system.
7. Analysis and design of a sustainable food production system for a growing population.

These are given as example topics. Each student team will propose its own topic for approval. Topics covered in the class must be applied in this project.

This project must include a thorough analysis of the current system and careful design of proposed alternatives that are sustainable through time and changing economic and political conditions. This project will require you to explore the interconnectedness of the human (political) and natural (science based) world, and to analyze how societal actions can promote or disrupt the human and natural worlds through time. Interim progress reports at approximately weeks 5, 8, and 11 will provide students with guidance and feedback. Formal assessment will take place at the time the final report is submitted.
Assessing WMU Essential Studies Student Learning Outcomes for IEE 3100
(Rev. 12/18/18)

Level II: Exploration and Discovery

Science and Technology

<table>
<thead>
<tr>
<th>WMU Essential Studies Student Learning Outcome</th>
<th>Assignments and/or Learning Activities that meet the criteria within the rubric that is aligned with the SLO</th>
<th>When the SLO assessment will take place</th>
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| Demonstrate and apply scientific literacy     | Case Study #1. Students will design a mathematical model of a physical system and then develop several hypotheses, collect data through experimentation, and use Monte Carlo simulation to test the hypotheses.  
Case Study #2. Students will use science and mathematics to construct a retirement planner to provide for an economically sustainable retirement. This case study will provide the first assessment that requires students to apply scientific knowledge to situations common to daily life.  
Case Study #3. Students will be required to use historical and modern scientific and mathematical approaches to provide a service (such as water delivery, transportation systems, delivery of goods and services, etc.) that most efficiently and economically meets stated objectives. This case study will provide the second assessment that requires students to apply scientific knowledge to situations common to daily life. Progress from case study 2 to case study 3 will be evaluated. | Case study #1 is due in week 4.  
Case study #2 is due in week 8.  
Case study #3 is due in week 11. |
| Develop practices for planetary sustainability | Interdisciplinary team project. Students will be placed in teams of 2-3 and select a topic important to planetary sustainability. Examples might include health care delivery, generation and distribution of energy, global food production, etc. Students will utilize multiple sources of data and information such as academic literature, print/online media, and publicly available sources to analyze the issue, identify sustainability aspects, and propose solutions to address technical, societal, and sustainable elements of the selected topic. Students will be required to explicitly recognize how humans and science are connected and how societal actions can promote or disrupt the human/natural world through the lens of planetary sustainability and engineering economic analyses.  
Quizzes on contemporary issues. Weekly quizzes will be given on contemporary issues as found in the students’ reading of publications such as the New York Times and the Wall Street Journal. Many items on these quizzes are concerned with current news on planetary sustainability. | The team project is due in week 14. Intermediate progress reports are due in weeks 5, 8, and 11 and will provide guidance and feedback.  
Contemporary issues quizzes will be conducted weekly. |
IEE 3100
ENGINEERING ECONOMY
Course Syllabus – Spring 2019 (Rev 12/18/18)

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