UNIVERSITY OF MICHIGAN
College of Engineering
Curriculum Committee Meeting
Tuesday, March 31, 2015 – 1:30-3:00pm
Room 1180 Duderstadt Center

PAGE #s

AGENDA

1. Proposal for revision of NAME Undergraduate Degree Program (second presentation) – Prof. Armin Troesch and Prof. Marc Perlin

2. CARF Summaries

	SUBJECT	COURSE#	ACTION	SUMMARY	EFFECTIVE TERM	MINIMUM GRADE REQUIRED FOR ENFORCED PREPREQ
7	BIOMEDE (MICROBIOLOGY)	504 (504)	Modification	Change to home unit, course description, prereqs, class type. Question: Level of Credit?	FT 2015	
12	CEE	370	Modification	Change to course number to 375, course title, level of credit, class type	WT 2016	
17	CEE(ENSCEN)	428(428)	Modification	Change to prereqs	FT 2015	
19	CEE	543	Deletion	Last taught in 2000	FT 2015	
21	CEE	543	New Course		FT 2015	
28	CEE	555	New course		FT 2015	
37	CEE	572	New course		FT 2015	
43	CHE	290	Modification	CARF marked as new crse, but really modification. Change to course description, prepreqs, and class type	FT 2015	Enforced prereq
45	CHE	460	Modification	Change to prereqs	FT 2015	Enforced prereq
47	CHE	490	Modification	Change to course description and prereqs	FT 2015	Enforced prereq
49	CHE	496	Modification	Change to level of credit	FT 2015	
51	IOE(MATH)	552(542)	Modification	Deletion of cross-listing, change to prereqs	FT 2015	Enforced prereq
53	IOE(MATH)	553(543)	Modification	Deletion of cross-listing, change to prereq	FT 2015	Enforced prereq
55	NAVARCH	260	Modification	Course description, credit hours	WT 2016	
59	NAVARCH	280	New course		WT 2016	
61	NAVARCH	370	Deletion			
63	NAVARCH	391	Modification	Course title, description, prereqs, credit hours Question: verify course is not repeatable	WT 2017	Enforced prereq
65	NAVARCH (MGF)	410(410)	Modification	Course description	FT 2015	Enforced prereq stays the same
67	NAVARCH	461	New course		WT 2018	Enforced prereq
71	NAVARCH	513	New course		FT 2015	
79	NAVARCH (MFG)	514 (515)	Modifications	Cross-listing of course with MFG, credits	FT 2015	
81	NAVARCH	551	New course		FT 2015	
83	NERS	671	Modification	Change to course title	FT 2015	
85	NERS	672	Deletion		FT 2015	

MICHIGAN ENGINEERING
UNIVERSITY of MICHIGAN ■ COLLEGE of ENGINEERING

NAVAL ARCHITECTURE AND MARINE ENGINEERING
2600 DRAPER DR. ANN ARBOR, MICHIGAN 48109-2145
734 764-6470 FAX: 734 936-8820
http://www.engin.umich.edu/dept/name

March 24, 2015

From: Steve Ceccio, Chair
To: COE Curriculum Committee
Re: NA&ME Curriculum Revision Proposal

Dear Committee Members:

The faculty of the Department of Naval Architecture and Marine Engineering are pleased to submit to the COE Curriculum Committee a proposal to revise the undergraduate program curriculum.

1. Description of Current Curriculum

   - Sophomore, Junior and Senior years descriptive summaries:

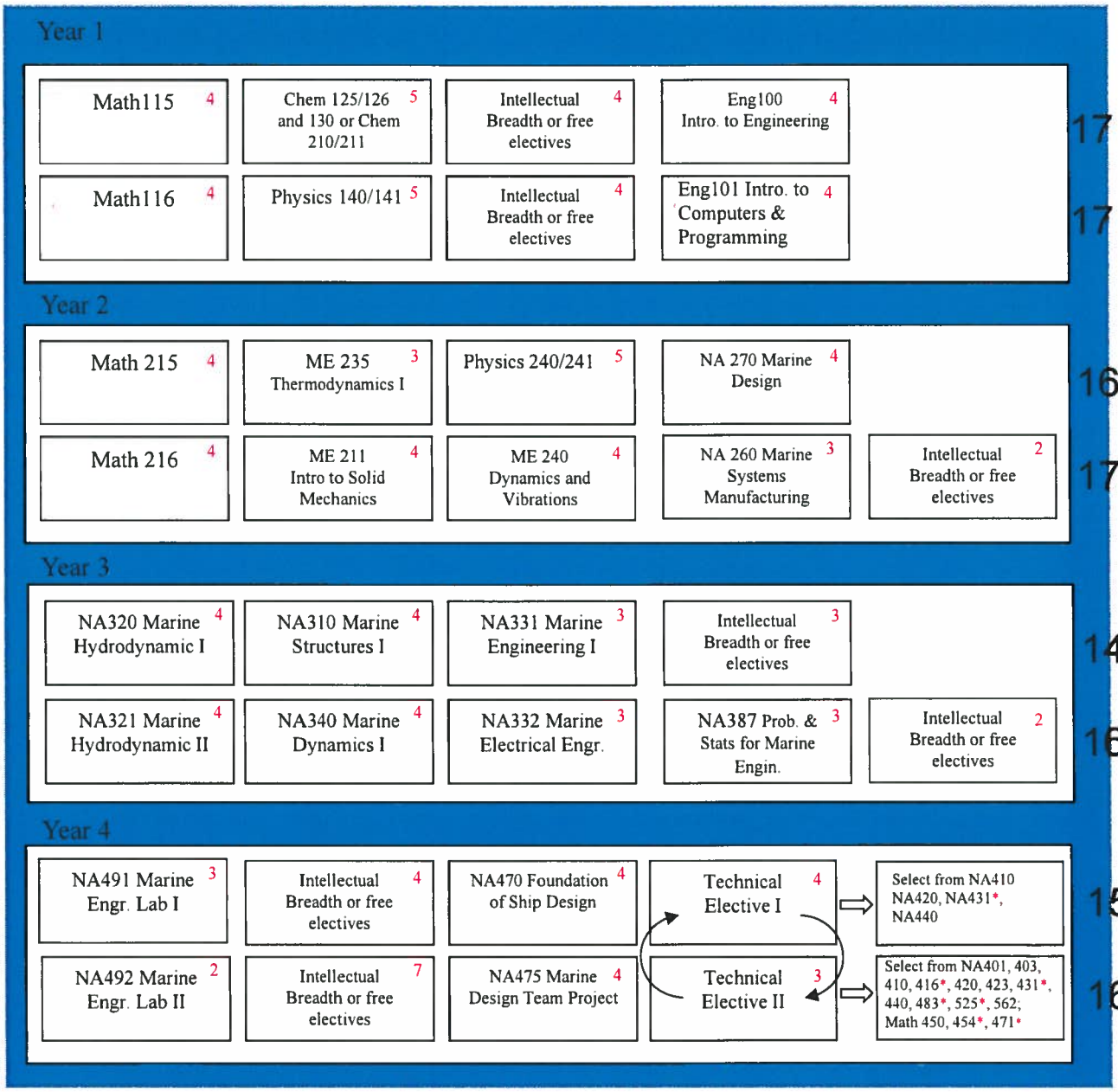
     Year 2 - Currently the curriculum in Naval Architecture and Marine Engineering begins with an introduction to the design process (NA 270) in the Sophomore year. While NA 270 is offered both terms of Year 2, 90% of new NAME students elect NA 270 in the fall term. As a follow-up, in the Winter semester of Year 2, NA 260 provides the student with an introduction to the manufacturing process, paving the way for Year 3.

     Year 3 – The Junior year features specific instruction in the areas that contribute to the foundations of Naval Architecture and Marine Engineering. A solid engineering mechanics background is provided including courses in Marine Hydrodynamics, Marine Structures, Marine Engineering, Marine Electrical Engineering, Marine Dynamics and in Probability and Statistics for Marine Engineers. These classes prepare the students for their technical electives that follow, and the laboratory and capstone design courses in the Senior year.

     Year 4 – The Senior year is comprised of two required laboratory classes (NA 491 and NA 492) with the opportunity to conduct experiments, analyze data including error analysis, and produce professional-level technical reports. In addition, the Seniors have an individual ship design course, NA 470, as well as their team design capstone project, NA 475. These lab and design courses allow the students to integrate their education over the course of their study into two design projects.

Naval Architecture and Marine Engineering Curriculum - Current Version

A typical study plan for a Naval Architecture and Marine Engineering student at the University of Michigan.



* - 3 credit Tech Elective

- College/Program Requirements = 128
- Intellectual/Breadth = 16
- Free Electives = 9-11

Sample Schedule 2013-2014

Naval Architecture and Marine Engineering

	Total Credit Hours	Terms: 1	2	3	4	5	6	7	8
Subjects Required by All Programs (52 - 55 hours)									
Mathematics 115, 116, 215, and 216	16	4	4	4	4	-	-	-	-
Engineering 100, Introduction to Engineering	4	4	-	-	-	-	-	-	-
Engineering 101, Introduction to Computers	4	-	4	-	-	-	-	-	-
Chemistry 125/126 and 130 or,Chemistry 210 and 211 [1]	5	5	-	-	-	-	-	-	-
Physics 140 with lab 141[2]	5	-	5	-	-	-	-	-	-
Physics 240 with lab 241[2]	5	-	-	5	-	-	-	-	-
Humanities and Social Science	16	4	4	-	-	-	-	4	4
Related Technical Core Subjects (11 hours)									
ME 211, Introduction to Solid Mechanics	4	-	-	-	4	-	-	-	-
ME 240, Introduction to Dynamics	4	-	-	-	4	-	-	-	-
ME 235, Thermodynamics I	3	-	-	3	-	-	-	-	-
Program Subjects (45 hours)									
NA 270, Marine Design	4	-	-	4	-	-	-	-	-
NA 260, Marine Systems Manufacturing	3	-	-	-	3	-	-	-	-
NA 310, Marine Structures I	4	-	-	-	-	4	-	-	-
NA 320, Marine Hydrodynamics I	4	-	-	-	-	4	-	-	-
NA 321, Marine Hydrodynamics II	4	-	-	-	-	-	4	-	-
NA 331, Marine Engineering I	3	-	-	-	-	3	-	-	-
NA 332, Marine Electrical Engineering	3	-	-	-	-	-	3	-	-
NA 340, Marine Dynamics I	4	-	-	-	-	-	4	-	-
NA 387, Probability and Statistics for Marine Engineers	3	-	-	-	-	-	3	-	-
NA 470, Foundations of Ship Design	4	-	-	-	-	-	-	4	-
NA 475, Marine Design Team Project	4	-	-	-	-	-	-	-	4
NA 491, Marine Engineering Laboratory I	3	-	-	-	-	-	-	3	-
NA 492, Marine Engineering Laboratory II	2	-	-	-	-	-	-	-	2
Electives (16 - 18 hours)									
Technical Electives[3]	7-8	-	-	-	-	-	-	4	3
General Electives	9 - 10	-	-	-	2	3	2	-	3
Total	128	17	17	16	17	14	16	15	16

Notes:

[1] If you have a satisfactory score or grade in Chemistry AP, A-Level, IB Exams or transfer credit from another institution for Chemistry 125/126/130 you will have met the Chemistry Core Requirement for the College of Engineering

[2] If you have a satisfactory score or grade in Physics AP, A-Level, IB Exams or transfer credit from another institution for Physics 140/141 and Physics 240/241 you will have met the Physics Core Requirement for the College of Engineering.

[3] Technical Electives:
Choose 2 from the following list. At least one must come from the first four on the list:
NA 410, Marine Structure II
NA 420, Environmental Ocean Dynamics
NA 431, Marine Engineering II
NA 440, Marine Dynamics II
NA 401, Small Craft Design
NA 403, Sailing Craft Design Principles
NA 416, Theory of Plates and Shells
NA 455, Nearshore Environmental Dynamics
NA 562, Marine Systems Production Strategy Operations Management
Advanced Mathematics: Math 450, Math 454, or Math 471
Other courses as approved by the department

2. Description of the New Curriculum

- Major drivers for curricular change:

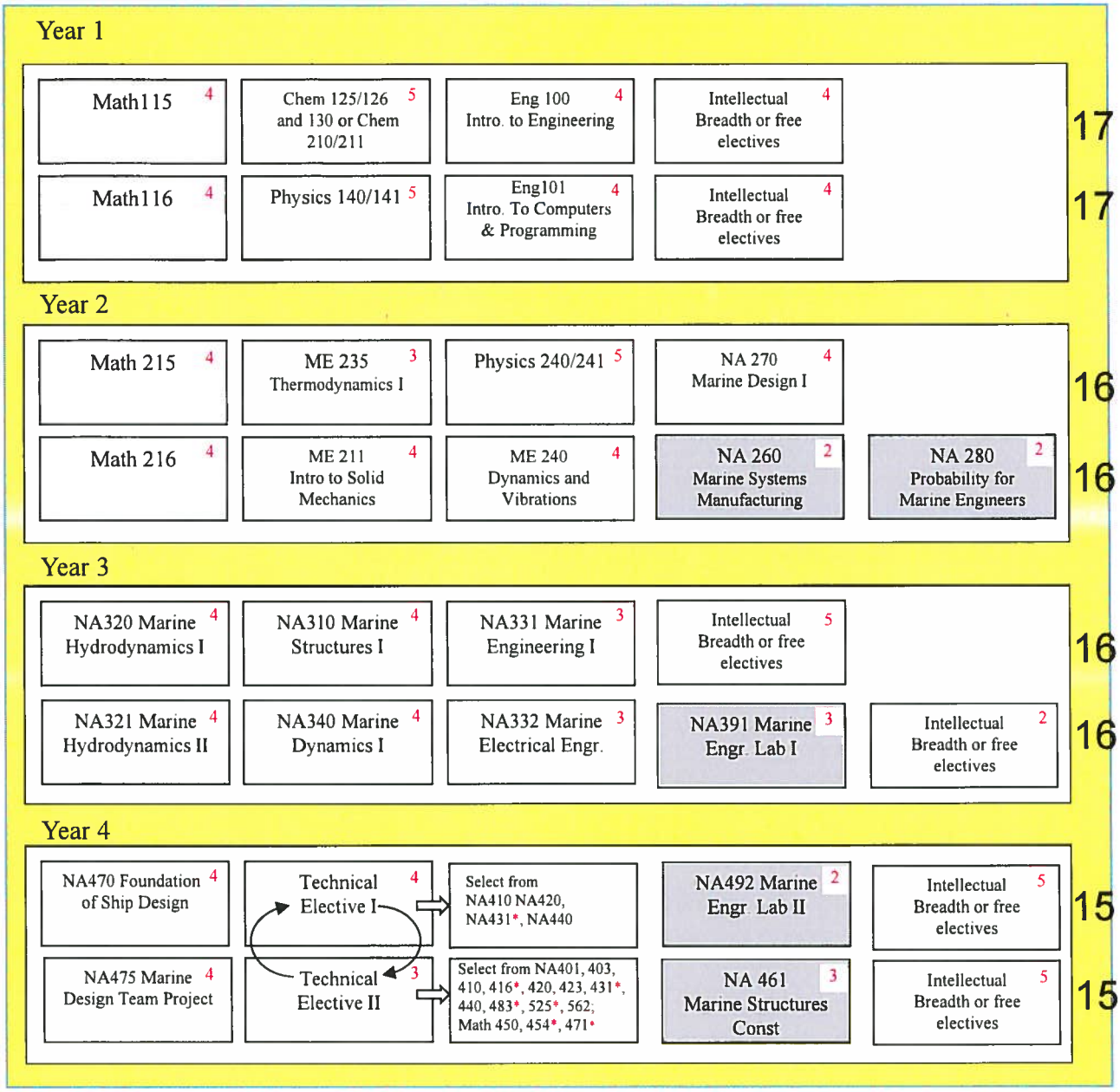
  - Laboratory work and design projects are very time intensive
  - Some laboratory experience in the Junior year would reinforce the engineering mechanics learned then. Students would benefit from timely exposure to technical content covered in non-laboratory classes by bringing hands-on experience to supplement the text-book material
  - Junior level courses would benefit from earlier introduction of probability and statistics. In particular, NA387 is currently a prerequisite for NA340 but students sometimes delay taking NA387 due to scheduling conflicts. Having relevant materials covered in the Sophomore year would reduce this problem substantially

- **Proposed changes to enhance student experience and learning**

  - Move (revise and re-number) NA 491 lab to the Junior year as NA 391
  - Move NA 492 to the fall semester of the Senior year , which frees the students from a lab during the course of their capstone Senior Design project
  - Move and revise NA 387 to NA 280 and reduce material in NA 260 from three credits to two credits
  - Introduce NA 461 as a required course in the Senior year. The course provides students with emphasis on manufacturing and production including some material that was eliminated from NA 387 and NA 260 in those course credit reductions

NA&ME Curriculum Modification 2015

Proposed study plan for a Naval Architecture and Marine Engineering student at the University of Michigan.



* - 3 credit Tech Elective

- College/Program Requirements = 128
- Intellectual/Breadth = 16
- Free Electives = 8-10

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Revised Curriculum

Naval Architecture and Marine Engineering

	Total Credit Hours	Terms: 1	2	3	4	5	6	7	8
Subjects Required by All Programs (52 - 55 hours)									
Mathematics 115, 116, 215, and 216	16	4	4	4	4	-	-	-	-
Engineering 100, Introduction to Engineering	4	4	-	-	-	-	-	-	-
Engineering 101, Introduction to Computers	4	-	4	-	-	-	-	-	-
Chemistry 125/126 and 130 or Chemistry 210 and 211 [1]	5	5	-	-	-	-	-	-	-
Physics 140 with lab 141[2]	5	-	5	-	-	-	-	-	-
Physics 240 with lab 241[2]	5	-	-	5	-	-	-	-	-
Intellectual Breadth	16	4	4	-	-	-	-	4	4
Related Technical Core Subjects (11 hours)									
ME 211, Introduction to Solid Mechanics	4	-	-	-	4	-	-	-	-
ME 240, Introduction to Dynamics	4	-	-	-	4	-	-	-	-
ME 235, Thermodynamics I	3	-	-	3	-	-	-	-	-
Program Subjects (46 hours)									
NA 270, Marine Design	4	-	-	4	-	-	-	-	-
NA 260, Marine Systems Manufacturing	2	-	-	-	2	-	-	-	-
NA 280, Probability for Marine Engineers	2	-	-	-	2	-	-	-	
NA 310, Marine Structures I	4	-	-	-	-	4	-	-	-
NA 320, Marine Hydrodynamics I	4	-	-	-	-	4	-	-	-
NA 321, Marine Hydrodynamics II	4	-	-	-	-	-	4	-	-
NA 331, Marine Engineering I	3	-	-	-	-	3	-	-	-
NA 332, Marine Electrical Engineering	3	-	-	-	-	-	3	-	-
NA 340, Marine Dynamics I	4	-	-	-	-	-	4	-	-
NA 391, Marine Engineering Laboratory I	3	-	-	-	-	-	3	-	-
NA 461, Marine Structures Construction	3	-	-	-	-	-	-	-	3
NA 470, Foundations of Ship Design	4	-	-	-	-	-	-	4	-
NA 475, Marine Design Team Project	4	-	-	-	-	-	-	-	4
NA 492, Marine Engineering Laboratory II	2	-	-	-	-	-	-	2	-
Electives (15 - 18 hours)									
Technical Electives[3]	7-8	-	-	-	-	-	-	4	3
General Electives	8-10	-	-	-	-	5	2	1	1
Total	128	17	17	16	16	16	16	15	15

Notes:

[1] If you have a satisfactory score or grade in Chemistry AP, A-Level, IB Exams or transfer credit from another institution for Chemistry 125/126/130 you will have met the Chemistry Core Requirement for the College of Engineering

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NA 455, Nearshore Environmental Dynamics
NA 562, Marine Systems Production Strategy Operations Management
Advanced Mathematics: Math 450, Math 454, or Math 471
Other courses as approved by the department

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number 2562
Date 1/19/2015
Effective Term Fall 2015
Course Offer Freq ☒ Indefinitely ☐ One term only

Action Requested
○ New Course
◉ Modification of Existing Course
○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

	A. CURRENT LISTING	B. REQUESTED LISTING
	Home Department: Microbiology; Course Number: 504	Home Department: BIOMEDE Biomedical Engineering; Course Number: 504
X	Cross Listed Course Information: BIOMEDE Biomedical Engineering 504	Cross Listed Course Information: Microbiology 504
	Course Title	Course Title: Cellular Biotechnology
	TITLE ABBREVIATION — Time Sched Max = 19 Spaces:	TITLE ABBREVIATION — Time Sched Max = 19 Spaces: Cell Biotech
	TITLE ABBREVIATION — Transcript Max = 20 Spaces:	TITLE ABBREVIATION — Transcript Max = 20 Spaces: Cell Biotech
X	Course Description: Modern biotechnology is transforming the ways in which we detect and treat human disease. Biotechnology companies combine knowledge in science, business, management, and intellectual property to accomplish these goals. Emphasis will be placed on: basic biological/engineering principles, translating lab discovery to biotechnology industry, and scientific and translational innovation.	Course Description for Official Publication (Max = 50 words): Biotechnology is a rapidly evolving, multi-disciplinary field that impacts nearly every aspect of our daily lives from the food we eat to the medicine we take. This course covers basic scientific and engineering principles behind this growing field, along with entrepreneurial aspects of translating innovative biotechnological solutions into new products.
	PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j	PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j
	Degree Requirements: ○ Degree Requirement ○ Tech Elective ○ Core Course ○ Other ○ Free Elective	Degree Requirements: ○ Degree Requirement ◉ Tech Elective ○ Other ○ Core Course ○ Free Elective
X	Prereq: ○ Enforced ○ Advised	Prereq: Graduate student standing or consent of the instructor. ○ Enforced ◉ Advised
	Credit Restrictions	Credit Restrictions
	Level of Credit: ☐ Undergrad only ☐ Ugrad or Non-Rckhm Grad ☐ Rackham Grad ☐ All Credit types ☐ Non-Rckhm Grad ☐ Rckhm Grad w/add'l Work ☐ Ugrad or Rckhm Grad; Credit Hours Min 3 Max 3; Contact Hrs/Wk 3; Number of Wks 14	Level of Credit: ☐ Undergrad only ☐ Ugrad or Non-Rckhm Grad ☐ Rackham Grad ☐ All Credit types ☐ Non-Rckhm Grad ☐ Rckhm Grad w/add'l Work ☒ Ugrad or Rckhm Grad; Credit Hours Min 3 Max 3; Contact Hrs/Wk 3; Number of Wks 14

C.

Repeatability (Indi Research, Dir. Study, Dissertation): Is this course repeatable? ○ Yes ◉ No Max Hours? ____ Max Times? ____ Can it be repeated in the same term? ○ Yes ○ No

X
Class Type(s): ☒ Lec ☐ Sem ☐ Dis ☐ Other ____ ☐ Rec ☐ Lab ☐ Ind
Graded Section: ☒ Lec ☐ Sem ☐ Dis ☐ Other ____ ☐ Rec ☐ Lab ☐ Ind
Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U
Course Is Y Graded ☐
Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Cognizant Faculty Member: Andrew Putnam — Title: Associate Professor
Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info — **Approved by Name** — **Approved Date**
☐ Curriculum Comm.
☐ Faculty
☐ Cross listed Unit 1
☐ Cross listed Unit 2

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

	Department Chair Name	Chair Signature
Home Dept.	Biomedical Engineering 3/10/14	Theresa Kramer for Jennifer Linderman
Cross-listed	Microbiology 3/23/15	Mary Maddox

7

Dept(s).

Form Number

2562

SUPPORTING STATEMENT

This Cellular Biotechnology course was originally developed as a core course required for all trainees appointed to the NIH-funded Cellular Biotechnology Training Program (T32) here at UM. In July 2014, Dr. Andrew Putnam (BME) took over from Dr. Joel Swanson (Microbiology and Immunology) as the Director of this training grant, and moved the grant to BME. As a result, Dr. Putnam thereby became responsible for this course as well. Given that his home department is BME, we request that the course be officially moved to the BME department for administrative purposes (scheduling, classroom assignment, enrollment, etc.) and to ensure that Dr. Putnam receives credit for teaching this course. The course has a long history of being cross-listed with multiple departments, and that feature will be retained moving forward. Students from the Medical School, LSA, College of Pharmacy, and the CoE will continue to be welcome in the class.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

Cellular Biotechnology 504
Winter 2015

Course overview/description:
Biotechnology is a rapidly evolving and highly multi-disciplinary field that impacts nearly every aspect of our daily lives from the food we eat to the medicine we take. This one-semester, 3-credit course provides an overview and integration of several disparate disciplines that together define the field of cellular biotechnology. Topics this year will include: (1) commercialization strategies and technology evaluation, (2) microtechnologies, (3) fluorescence and FRET, (4) DNA repair and control of gene expression, (5), protein engineering, (6) translational control mechanisms and assay development, (7) stem cells, tissue engineering, and regenerative medicine, (8) gene editing technologies, (9) immune-bioengineering, and (10) drug delivery, and (11) regulatory affairs.

Emphasis will be placed not only on the basic scientific and engineering principles behind the growing field of biotechnology, but also on the entrepreneurial aspects of translating innovative solutions into new commercial products.

This course is cross-listed with the Departments of Anatomy; Biological Chemistry; Microbiology & Immunology; and Biomedical Engineering.

Grading criteria:
Student performance will be evaluated in three ways:

- *Homework:* Brief homework assignments (4) based on lecture content and supplemental readings will be given out throughout the semester. **25% of the grade**
- *Class Participation:* Attendance, questions asked, and comments made in class will be tallied by the instructor. **25% of the grade**
- *Projects:* The main assignment of this course is a team-based project consisting of formulating, writing, and presenting an innovative biotechnological solution to a problem that is related to, or incorporates, some of the topics discussed in class. Students will be assigned to small groups (~5/group). Proposals must be cross-disciplinary in approach, include both business motivation and overview as well as scientific innovation in an NIH SBIR format. Various milestones will be met through the term to keep groups on track (more details forthcoming). **50% of the final grade**

Time: Tuesdays and Thursdays from 2:30-4:00 p.m.
Place: 3427 EECS

Course Director:
Andy Putnam, PhD
Associate Professor, Biomedical Engineering
Director, Cellular Biotechnology Training Program
2204 Lurie Biomedical Engineering
Phone: (734) 615-1398
Email: putnam@umich.edu
Website: http://www.csetlab.org/

Course Instructors:

Lola Eniola-Adefeso, Ph.D.
Associate Professor, Chemical Engineering
Miller Faculty Scholar
B28-G046W NCRC
(734) 936-0856
Email: lolaa@umich.edu
Web: http://cheresearch.engin.umich.edu/eniola/

Amanda Garner, Ph.D.
Assistant Professor, Medicinal Chemistry
College of Pharmacy
4565 CC Little
(734) 763-2654
Email: algarner@umich.edu
Web: http://www.garnerlaboratory.com/

James Moon, Ph.D.
John Gideon Searle Assistant Professor
Pharmaceutical Sciences and Biomedical Engineering
B10-A190 NCRC
(734) 936-2570
Email: moonjj@umich.edu
Web: http://www.umich.edu/~moonlab/James_Moon_Lab/Home.html

Patrick O'Brien, Ph.D.
Associate Professor, Biological Chemistry
4220B MSRB3, Box 5606
(734) 647-5821
Email: pjobrien@umich.edu

David C. Olson, Ph.D.
CEO Swift Biosciences
(734) 678-7689
Email: dolson@alumni.princeton.edu
Email: olsonphd@gmail.com
Web: http://www.swiftbiosci.com/

Gene Parunak, Managing Director
in2being, LLC
100 E Michigan Ave, Suite 208
Saline, MI 48176
Phone: 734-681-0031
Email: gparunak@in2being.com
Web: http://in2being.com/

Other instructors may be added throughout the semester as the course evolves.

Cellular Biotechnology Syllabus 2015
Tuesday/Thursday 2:30-4 pm (EECS 3427)
Course Director: **Dr. Andy Putnam (*putnam@umich.edu*)**
Biomedical Engineering

January 8	Introduction: What is Cellular Biotechnology? – Dr. Andy Putnam
January 13	Examples of Commercial Success in Biotechnology – Dr. Andy Putnam
January 15	Examples of Commercial Success in Biotechnology – Dr. Andy Putnam
January 20	A Case Study in Biotechnology Commercialization – Dr. David Olson
January 22	Career Paths in Biotechnology - Dr. David Olson
January 27	Microtechnologies in Biotechnology – Dr. Andy Putnam
January 29	Microtechnologies in Biotechnology – Dr. Andy Putnam
February 3	Fluorescence and FRET – Dr. Andy Putnam *(HW #1 DUE)*
February 5	Fluorescence and FRET – Dr. Andy Putnam
February 10	DNA Repair Mechanisms and Control of Gene Expression - Dr. Patrick O'Brien
February 12	DNA Repair Mechanisms and Control of Gene Expression - Dr. Patrick O'Brien
February 17	Protein Engineering - TBD
February 19	Protein Engineering - TBD
February 24	Translation (mRNA, miRNA) and Assay Development - Dr. Amanda Garner
February 26	Translation (mRNA, miRNA) and Assay Development - Dr. Amanda Garner *(HW #2 DUE)*
March 3	*UM Break*
March 5	*UM Break*
March 10	Stem Cells, Tissue Engineering, Regenerative Medicine – Dr. Andy Putnam
March 12	Stem Cells, Tissue Engineering, Regenerative Medicine – Dr. Andy Putnam
March 17	Engineering the immune system – Dr. James Moon
March 19	Engineering the immune system – Dr. James Moon *(HW #3 DUE on Friday, 3/20 – Specific Aims page for Group Project)*
March 24	Gene Editing, CRISPR/Cas9 technologies - Dr. Andy Putnam
March 26	Gene Editing, CRISPR/Cas9 technologies - Dr. Andy Putnam
March 31	Drug delivery - Dr. Lola Eniola-Adefeso
April 2	Drug delivery - Dr. Lola Eniola-Adefeso
April 7	Regulatory Affairs – Gene Parunak
April 9	TBD *(HW #4 DUE)*
April 14	Proposal Presentations
April 16	Proposal Presentations
April 21	Proposal Presentations

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number 2537
Date 11/10/2014
Effective Term Winter 2016
Course Offer Freq ☒ Indefinitely ☐ One term only

Action Requested
○ New Course
◉ Modification of Existing Course
○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING		B. REQUESTED LISTING	
Home Department	Course Number	Home Department	Course Number
CEE Civil & Environmental Engin	370	CEE Civil & Environmental Engin	375
☐ Cross Listed Course Information		Cross Listed Course Information	
☒ Course Title	Sensors, Electrical Circuits, and Signal Processing	Course Title	Sensors, Circuits, and Signals
TITLE ABBREVIATION — Time Sched Max = 19 Spaces		TITLE ABBREVIATION — Time Sched Max = 19 Spaces	Sensors and Circuits
TITLE ABBREVIATION — Transcript Max = 20 Spaces		TITLE ABBREVIATION — Transcript Max = 20 Spaces	Sensors and Circuits
☐ Course Description		Course Description for Official Publication (Max = 50 words)	This course introduces students to the fundamentals of collecting and processing experimental data. The course begins with an introduction to DC and AC circuits. The design and operation of sensors are then introduced followed by an introduction to digital signal processing.
PROGRAM OUTCOMES:	☐ a ☐ c ☐ e ☐ g ☐ i ☐ k ☐ b ☐ d ☐ f ☐ h ☐ j	PROGRAM OUTCOMES:	☒ a ☒ c ☒ e ☐ g ☐ i ☒ k ☒ b ☒ d ☐ f ☐ h ☐ j
Degree Requirements	○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ○ Tech Elective	Degree Requirements	◉ Degree Requirement ○ Free Elective ○ Other ○ Core Course ○ Tech Elective
☐ Prereq	○ Enforced ○ Advised	Prereq	Physics 240. ○ Enforced ◉ Advised
☐ Credit Restrictions		Credit Restrictions	
☒ Level of Credit	☐ Undergrad only ☐ Ugrad or Non-Rckhm Grad ☐ Rackham Grad ☒ All Credit types ☐ Non-Rckhm Grad ☐ Rckhm Grad w/add'l Work ☐ Ugrad or Rckhm Grad	Level of Credit	☒ Undergrad only ☐ Ugrad or Non-Rckhm Grad ☐ Rackham Grad ☐ All Credit types ☐ Non-Rckhm Grad ☐ Rckhm Grad w/add'l Work ☐ Ugrad or Rckhm Grad
Credit Hours Min Max		Credit Hours Min Max	3 3
Contact Hrs/Wk	3	Contact Hrs/Wk	4
Number of Wks	14	Number of Wks	14

C.
Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ○ Yes ◉ No Max Hours? 3 Max Times? 1 Can it be repeated in the same term? ○ Yes ◉ No

☒ **Class Type(s)**: ☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☒ Lab ☐ Ind
Graded Section: ☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☐ Lab ☐ Ind
Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U
Course Is Y Graded ☐
Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Cognizant Faculty Member: Jerome P. Lynch — Title: Professor
Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

	Department Chair Name	Chair Signature
Home Dept.	Kim F. Hayes, Chair & Professor	
Cross-listed Dept(s).	Civil & Environmental Engin	

12

Form Number

2537

SUPPORTING STATEMENT

First, we are proposing a slight change in course title - we wish to be more concise in the description of the course with the minor name change. The course description and course content remains unchanged. Second, we are formally changing the course to be listed as a lab course. For the past two offerings we have run a lab with the course with extremely enthusiastic student feedback (citing the lab as the best part of the course). The lab was established as part of a grant from the Provost Third Century program to convert the course from a lecture style to one anchored by a lab to provide hands-on learning experiences for students. The Provost funding allow us to build a state-of-the-art electronics and sensing lab in GG Brown which is now used in CEE370 and CEE575. The course will go from 3 hours of classical lecture to 2 hours lecture and 2 hours lab each week.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

CEE370 – Sensors, Electrical Circuits, and Signal Processing (3 Credits)
Winter Semester 2015-2016
Course Description

Instructor: Jerome P. Lynch
2380 G. G. Brown
jerlynch@umich.edu

Assistant: TBD (Instructional Aid)

Lectures: Mondays and Wednesdays
11:30 -12:30 pm
1200 EECS Building

Lab: Fridays
1:30 – 3:30 pm
1000 G. G. Brown

Office Hours: *Prof. Lynch*: Monday and Wednesday 10:30 – 11:30 am, 2380 G. G. Brown

Website: http://www-personal.umich.edu/~jerlynch/cee370/

Catalog Description:

This course introduces students to the fundamentals of collecting and processing experimental data for civil and environmental applications. The course begins with an introduction to DC and AC circuits followed by the coverage of sensors used in the civil and environmental field. Examples and hands-on demonstrations will be presented relevant to seismic, environmental, structural and hydraulic monitoring.

Textbook:

- Introduction to Electric Circuits, R. C. Dorf and J. A. Svoboda (Wiley, 2010) – 9th Edition
- Handbook of Modern Sensors, J. Fraden (Springer, 2010) – 4th Edition (available online) http://link.springer.com/book/10.1007/978-1-4419-6466-3/page/1

Course Presentation Strategy:

The majority of lectures pertinent to circuit analysis are viewed outside of class time. Specifically, Lecture #1 through #23 are archived and posted to the course website. It is imperative students watch these lectures when assigned to ensure they progress with the course material. Classroom time is reserved for a mixture of problem solving sessions and a number of in-class lectures on sensors (Class #1 through #7). On occasion, a quiz will be provided in class to ensure students are watching the lecture videos. Every Friday, the class will engage in a lab activity. Lab reports are expected of students conducting the laboratory.

Course Requirements:

- In-class quizzes
- Weekly homework assignments
- Midterm exam
- Laboratory projects

Homework:

Homework will normally be assigned each Monday and due the following Monday *in class*. **Late homework will not be accepted.** You are allowed to discuss the homework problems with peers, but you must write up your own homework to hand in. Please

submit homework assignments in a neat and presentable manner with all calculations shown. **Submission of homework on engineering pad paper is required.** Homework will be graded on a scale of 100. Please abide by the University of Michigan Honor Code – it will be strictly enforced, including on homework.

Grading:

Homework 30%, midterms 40%, labs 30%. These weights are approximate; the instructor reserves the right to change later (normally to the students' advantage).

Prerequisites:

- Physics 240 – General Physics II (strongly recommended)

CEE370 – Sensors, Electrical Circuits, and Signal Processing
Winter Semester 2015-2016

Course Outline

Date	Pre-Lecture Video	In-Class	Laboratory
Wed, 1/6		Introduction to CEE370	
Fri, 1/8	Lecture #1: Definition of Circuits	-	Introduction to Lab
Mon, 1/11	Lecture #2: Circuit Elements	Circuit Basics -Problems	
Wed, 1/13	Lecture #3: Power Sources	Circuit Basics - Problems	
Fri, 1/15	Lecture #4: Analyzing Resistive Circuits	-	Lab #1
Wed, 1/20	Lecture #5: Analyzing Res Circuits Cont.	Power Sources - Problems	
Fri, 1/22	-	-	Lab #1
Mon, 1/25	Lecture #6: Source Transformations	Resistive Circuits - Problems	
Wed, 1/27	Lecture #7: Introduction to Op-Amps	Class #1: Resistivity-Based Sensing: Strain, Temperature and Cracks	
Fri, 1/29	-	-	Lab #2
Mon, 2/1	Lecture #8: Op-Amp Circuits	Op-Amp - Problems	
Wed, 2/3	Lecture #9: Energy Storage Elements	Op-Amps - Problems	
Fri, 2/5	-	-	Lab #2
Mon, 2/8	Lecture #10: C & L Elements in Circuits	Energy Storage – Problems	
Wed, 2/10	Lecture #11: LC Op-Amp Circuits	LC- Op Amp - Problems	
Fri, 2/12	-		Lab #3
Mon, 2/15	Lecture #12: Response of RCL Circuits	Class #2: Position and Displacement by Resistive and Cap. Sensing	
Wed, 2/17	Lecture #13: Stability and Differential Operators via RC and RL Circuits	**Midterm #1**	
Fri, 2/19	-		Lab #3
Mon, 2/23	Lecture #14: Intro 2nd Ord RCL Circuits	RCL Circuits – Problems	
Wed, 2/25	Lecture #15: Natural Res of RCL Circuits	RCL Circuits – Problems	
Fri, 2/27	-		Lab #4
Mon, 3/7	Lecture #16: Forced Res of RCL Circuits	Class #3: Position and Displacement by Inductive Sensing	
Wed, 3/9	Lecture #17: Introduction to AC Circuits	AC Circuits - Problems	
Fri, 3/11	-		Lab #4
Mon, 3/14	Lecture #18: Phasors and Complex Num.	AC Circuits - Problems	
Wed, 3/16	Lecture #19: Impedance RCL Elements	AC Circuits – Problems	
Fri, 3/18	-		Lab #5
Mon, 3/21	Lecture #20: AC Circuit Analysis	AC Circuits – Problems	
Wed, 3/23	Lecture #21: Data Acq. and Sensors	AC Circuits – Problems	
Fri, 3/25	-		Lab #5
Mon, 3/28	Lecture #22: Sensor Interfaces	**Midterm #2**	
Wed, 3/30	Lecture #23: Analog to Digital Conv.	Class #4: Acceleration and Velocity Sensors	
Fri, 4/1	-		Lab #6
Mon, 4/4	-	Class #5: MEMS Sensors	
Wed, 4/6	-	Class #6: Pressure Sensors	
Fri, 4/8	-		Lab #6
Mon, 4/11	-	Class #7: Flow Sensors	

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number 2580
Date 2/10/2015
Effective Term Fall 2015
Course Offer Freq ☒ Indefinitely ☐ One term only

Action Requested
○ New Course
◉ Modification of Existing Course
○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING	B. REQUESTED LISTING
Home Department / Course Number	Home Department: CEE Civil & Environmental Engin / Course Number: 428
☐ Cross Listed Course Information	Cross Listed Course Information: ENSCEN Environmental Sciences & Engin 428
☐ Course Title	Course Title: Groundwater Hydrology
TITLE ABBREVIATION — Time Sched Max = 19 Spaces / Transcript Max = 20 Spaces	Time Sched: Groundwater Hydrol / Transcript: Groundwater Hydrol
☐ Course Description	Course Description for Official Publication (Max = 50 words): Basic principles which govern the flow of water in the subsurface. Development and solution of groundwater flow and contaminant transport equations, in presence and absence of pumping wells, for both confined and phreatic aquifers. Measurement and estimation of parameters governing flow and transport. Use of computer software for the simulation of flow.
PROGRAM OUTCOMES: ☐ a ☐ c ☐ e ☐ g ☐ i ☐ k ☐ b ☐ d ☐ f ☐ h ☐ j	PROGRAM OUTCOMES: ☒ a ☒ c ☒ e ☐ g ☐ i ☒ k ☒ b ☐ d ☐ f ☒ h ☒ j
Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ○ Tech Elective	Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ◉ Tech Elective
Prereq: CEE 265 and CEE 325 or equivalent. ☒ ○ Enforced ◉ Advised	Prereq: CEE 325 and (CEE 345 or CEE 366). ○ Enforced ◉ Advised
☐ Credit Restrictions	Credit Restrictions
Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work; Credit Hours Min ___ Max ___; Contact Hrs/Wk ___; Number of Wks ___	Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☒ All Credit types ☐ Rckhm Grad w/add'l Work; Credit Hours Min 3 Max 3; Contact Hrs/Wk 5; Number of Wks 14

C.

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ○ Yes ◉ No Max Hours? 3 Max Times? 1 Can it be repeated in the same term? ○ Yes ◉ No

Class Type(s): ☒ Lec ☐ Sem ☐ Dis ☐ Other ___ ☐ Rec ☒ Lab ☐ Ind
Graded Section: ☒ Lec ☐ Sem ☐ Dis ☐ Other ___ ☐ Rec ☐ Lab ☐ Ind
Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U
Course Is Y Graded ☐
Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Cognizant Faculty Member: Avery H. Demond — Title: Professor
Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

	Department Chair Name	Chair Signature
Home Dept.	Kim F. Hayes, Chair & Professor	
Cross-listed Dept(s).	Civil & Environmental Engin	
	Environmental Sciences & Engin	

17

Form Number

2580

SUPPORTING STATEMENT

The change that is being requested is to the listed prerequisites. The class enrolls both undergraduate and graduate students. With the implementation of the new BSE in Environmental Engineering, more undergraduates are electing the course. The course includes a semester-long team design project, culminating with the writing of a consulting engineering report. Based on my experience in Fall 2014, the undergraduate students need some basic soil property knowledge and to have had technical communication training for them to really benefit from the design experience the class offers. This background is provided in both CEE 345 and CEE 366. So the request is to add (CEE 345 or CEE 366) to the prerequisites.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number 2595
Date 2/23/2015
Effective Term Fall 2015
Course Offer Freq ☒ Indefinitely ☐ One term only

Action Requested
- ○ New Course
- ○ Modification of Existing Course
- ◉ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING

Home Department: CEE Civil & Environmental Engin
Course Number: 543

Cross Listed Course Information:

Course Title: Geosynthetics

TITLE ABBREVIATION
- Time Sched Max = 19 Spaces: Geosynthetics
- Transcript Max = 20 Spaces: Geosynthetics

Course Description:
Physical, mechanical, chemical, biological and endurance properties of geosynthetics (including geotextiles, geogrids, geonets, geomembranes, geopipes and geocomposites). Standard testing methods for geosynthetics. Application and design procedures for geosynthetics in Civil and Environmental Engineering: separation, reinforcement, stabilization, filtration, drainage and containment of solids and liquids.

PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k

Degree Requirements ○ Degree Requirement ○ Core Course ○ Free Elective ○ Tech Elective ○ Other

Prereq: CEE 345.
◉ Enforced ○ Advised

Credit Restrictions:

Level of Credit
☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad
☐ Ugrad or Non-Rckhm Grad ☒ All Credit types ☐ Rckhm Grad w/add'l Work

Credit Hours Min: 3 Max: 3
Contact Hrs/Wk: 3
Number of Wks: 14

B. REQUESTED LISTING

Home Department:
Course Number:

Cross Listed Course Information:

Course Title:

TITLE ABBREVIATION
- Time Sched Max = 19 Spaces:
- Transcript Max = 20 Spaces:

Course Description for Official Publication (Max = 50 words):

PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k

Degree Requirements ○ Degree Requirement ○ Core Course ○ Free Elective ○ Tech Elective ○ Other

Prereq:
○ Enforced ○ Advised

Credit Restrictions:

Level of Credit
☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad
☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work

Credit Hours Min: Max:
Contact Hrs/Wk:
Number of Wks:

C.

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ○ Yes ◉ No Max Hours? 3 Max Times? 1 Can it be repeated in the same term? ○ Yes ◉ No

Class Type(s)
☒ Lec ☐ Sem ☐ Dis ☐ Other
☐ Rec ☐ Lab ☐ Ind

Graded Section
☒ Lec ☐ Sem ☐ Dis ☐ Other
☐ Rec ☐ Lab ☐ Ind

Grading
☒ A-E
☐ CR/NC
☐ P/F
☐ S/U

Course Is Y Graded ☐

Location
☒ Ann Arbor
☐ Biological Station
☐ Camp Davis
☐ Extension

Cognizant Faculty Member: Roman D. Hryciw
Title: Professor

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

	Department Chair Name	Chair Signature
Home Dept.	Kim F. Hayes, Chair & Professor	
Cross-listed Dept(s).	Civil & Environmental Engin	

Form Number

2595

SUPPORTING STATEMENT

The CEE 543 Geosynthetics course was last taught in 2000. Since then, most of the material covered by this course has been moved to CEE 542 and CEE 549 taught by Dimitrios Zekkos. The course therefore is considered redundant and needs to be removed from the course listings.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number 2596
Date 2/23/2015
Effective Term Fall 2015
Course Offer Freq ☒ Indefinitely ☐ One term only

Action Requested
◉ New Course
○ Modification of Existing Course
○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING	B. REQUESTED LISTING
Home Department / Course Number	Home Department: CEE Civil & Environmental Engin / Course Number: 543
Cross Listed Course Information	Cross Listed Course Information
Course Title	Course Title: Numerical Modeling in Geotechnical Engineering
TITLE ABBREVIATION — Time Sched Max = 19 Spaces / Transcript Max = 20 Spaces	TITLE ABBREVIATION — Time Sched Max = 19 Spaces: Num Mod Geotech Engr / Transcript Max = 20 Spaces: Num Mod Geotech Engr
Course Description	Course Description for Official Publication (Max = 50 words): Finite element method formulation, constitutive laws for geotechnical materials including linear elastic, nonlinear elastic, linear elastic-perfectly plastic and nonlinear elasto-plastic. Critical state framework for modeling soil behavior. Finite element program PLAXIS for performing static analyses of earth structures. Soil-structure interaction. Finite difference method and discrete element method. Advanced soil models.
PROGRAM OUTCOMES: ☐ a ☐ c ☐ e ☐ g ☐ i ☐ k ☐ b ☐ d ☐ f ☐ h ☐ j	PROGRAM OUTCOMES: ☐ a ☐ c ☐ e ☐ g ☐ i ☐ k ☐ b ☐ d ☐ f ☐ h ☐ j
Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ○ Tech Elective	Degree Requirements: ○ Degree Requirement ○ Free Elective ◉ Other ○ Core Course ○ Tech Elective
Prereq: ○ Enforced ○ Advised	Prereq: CEE 345 or equivalent. ○ Enforced ◉ Advised
Credit Restrictions	Credit Restrictions
Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work; Credit Hours Min Max; Contact Hrs/Wk; Number of Wks	Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☒ All Credit types ☐ Rckhm Grad w/add'l Work; Credit Hours Min 3 Max 3; Contact Hrs/Wk 3; Number of Wks 14

C.

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ○ Yes ◉ No Max Hours? 3 Max Times? 1 Can it be repeated in the same term? ○ Yes ◉ No

Class Type(s)
☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☐ Lab ☐ Ind

Graded Section
☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☐ Lab ☐ Ind

Grading
☒ A-E ☐ CR/NC ☐ P/F ☐ S/U
Course is Y Graded ☐

Location
☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Cognizant Faculty Member: Adda Athanasopoulos-Zekkos — Title: Assistant Professor

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

	Department Chair Name	Chair Signature
Home Dept.	Kim F. Hayes, Chair & Professor	
Cross-listed Dept(s).	Civil & Environmental Engin	

Form Number

2596

SUPPORTING STATEMENT

The course will discuss the application of numerical methods and geotechnical constitutive laws to analyze problems in geotechnical engineering. The emphasis will be on the use of the Finite Element Method (FEM) in Geomechanics, but will also present the Finite Difference Method and the Discrete Element Model (DEM) and some new developments in numerical modeling.

Specifically the course will examine the importance of adequately modeling soil behavior. The finite element method will be presented and constitutive laws for geotechnical materials will be developed including linear elastic, nonlinear elastic, linear elastic-perfectly plastic and nonlinear elasto-plastic. The critical state soil mechanics (CSSM) framework for modeling soil behavior will be studied.

Students will be introduced to and will use the finite element program PLAXIS to perform static analyses of earth structures and develop recommendations regarding realistic consulting projects.

Numerical modeling of Soil-structure Interaction will be presented, as well as various Advanced Soil Models.

A course focusing on numerical modeling in geotechnical engineering is very important and was missing from our curriculum. Currently, students in the Civil MSE program with a focus on geotechnical engineering had to take a finite element course in Mechanical Engineering or AOSS. This is not appropriate since soil materials are very different from other materials and require different considerations when developing constitutive models to be used in numerical analyses.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

Department of Civil and Environmental Engineering

CEE 501.043 – Special Topics: Numerical Modeling in Geotechnical Engineering (3) Fall 2014

Time: MWF 11:30 (11:40 start) – 12:30 pm
Place: 1363 GG Brown

Instructor: Prof. Adda Athanasopoulos-Zekkos
2362 G.G. Brown Building
phone: 764-0057 (office)
addazekk@umich.edu

Office Hours: MW 10:30am to 11:30am;
or by appointment

Textbook: No textbook is required for class, however reading materials will be provided in class.

Grading:

Homework	40%
Midterm	25%
Final Exam	35%

Midterm Exam: Monday, October 20, 11:30am–12:30pm 1363 GG Brown

Final Exam: Wednesday, December 17, 10:30am – 12:30pm 1363 GG Brown

23

Course Outline

I. Introduction to Numerical Modeling in Geotechnical Engineering
- Modeling of Soil response to Loadings
- Introduction to PLAXIS – A finite element program

II. The Finite Element Method
- The Finite Element "Approximation"
- Finite Element Formulation
- Numerical Procedures
- Incremental Finite Element Analysis
- Development of Finite Element Model

III. Soil Constitutive Models
- Linear Elasticity
  - Theory
  - Application to Shallow Foundations
- Linear Elastic – Perfectly Plastic
  - Theory
  - Application to Shallow Foundation
- Non-Linear Stress Dependent Elastic Model
  - Incremental Duncan Hyperbolic Soil Model
  - Application to Shallow Foundation and Earth Embankment
- Non-Linear Elasto-Plastic Strain Hardening Model
  - Critical State Soil mechanics
  - Incremental Cam-Clay and modified Cam-Clay models
  - Application to Shallow Foundation and Earth Embankment

IV. Soil-Structure Interaction and Advanced Analysis
- Interface element
- Reinforced soil systems and soil-culvert systems
- Boundary deformation problems and slope stability
- Excavations

V. Recent Developments and Summary
- Finite difference method with dynamic relaxation
- Discrete Element Method
- Advanced Soil Models

Policy and Guidelines on Homework and Project Report Preparation

Assignments are typically due one week after they were assigned, unless otherwise specified. Late homework grades will be reduced by 25%. Homework submitted after the solutions have been posted or discussed in class will not be accepted.

You are allowed to consult with other students in the class during the conceptualization of a problem but all written work (calculations, figures, tables, graphs, etc.) is to be generated by you working alone. Violation of this policy will be considered a violation of the College of Engineering's Honor Code. If you have any questions about this policy, please do not hesitate to contact the instructor.

Guidelines for Submission

- Print neatly and in order.
- Name, date, and number every page. Staple pages together. Landscape pages should be inserted such that the top of the landscape page corresponds to the left edge of the portrait pages.
- If including a graph is required, print the graph on official logarithmic paper or use a computer program for printing graphs. Label all graph axes.
- Give the units for all answers (unless they are dimensionless) and do not use an excessive number of significant digits in your final answer.
- When using equations, always first write the complete equation in variable form. Never just write numbers without explaining what equation you have inserted them into.
- Use spreadsheets whenever repetitive calculations are to be performed. However, always provide a hand-written sample calculation. Spreadsheets are also excellent for preparing graphs.

University of Michigan
Office of the Registrar - Evaluations
ro.umich.edu/evals/

Fall 2014 Final
5 students responded out of the total enrolled 6

Instructor with Comments Report

2014-11-26 - 2014-12-11 Report ID: MSR04734

Instructor: Athanasopoulos-Zekkos,Adda
CEE 501 043

		Responses from your Students**							Other Users of This Item*					
									University Wide			School/College		
		5 SA	4 A	3 N	2 D	1 SD	NA	Your Median	75% Above	50% Above	25% Above	75% Above	50% Above	25% Above
1	Overall, this was an excellent course.	4	1	0	0	0	0	4.88	3.95	4.33	4.72	4.25	4.50	4.70
2	Overall, the instructor was an excellent teacher.	3	2	0	0	0	0	4.67	4.15	4.61	4.85	4.39	4.65	4.85
3	I learned a great deal from this course.	5	0	0	0	0	0	5.00	4.00	4.40	4.75	4.33	4.60	4.78
4	I had a strong desire to take this course.	3	2	0	0	0	0	4.67	3.64	4.17	4.63	4.25	4.56	4.75
15	I increased my ability to apply math and science knowledge to engineering problems.	2	3	0	0	0	0	4.33	4.06	4.28	4.55			
17	I increased my ability to analyze and interpret data.	4	1	0	0	0	0	4.88	4.03	4.27	4.50			
20	My confidence in my design abilities increased because of this course.	3	2	0	0	0	0	4.67	4.00	4.25	4.67			
21	I gained valuable experience working in teams in this course.	3	2	0	0	0	0	4.67	3.94	4.19	4.50			
23	I increased my ability to formulate, and solve engineering problems.	3	2	0	0	0	0	4.67	4.05	4.26	4.54			
25	I developed a greater understanding of my responsibilities as a professional.	2	3	0	0	0	0	4.33	4.00	4.33	4.75			
28	Course improved my ability to communicate technical information, designs, and analyses.	3	2	0	0	0	0	4.67	4.00	4.25	4.50			
30	I developed a greater understanding of the impact of engineering on the environment.	3	0	2	0	0	0	4.67	3.79	4.10	4.44			
32	This course increased my desire to learn more about this subject in the future.	3	2	0	0	0	0	4.67	4.00	4.30	4.58			
34	I have a greater understanding of how course concepts apply to contemporary problems.	3	2	0	0	0	0	4.67	4.13	4.32	4.63			
35	I increased my ability to apply engineering tools and methods.	5	0	0	0	0	0	5.00	4.08	4.32	4.57			
121	I gained a good understanding of concepts/principles in this field.	2	3	0	0	0	0	4.33	3.96	4.22	4.57			
125	I developed the ability to solve real problems in this field.	4	1	0	0	0	0	4.88	4.00	4.25	4.61			
201	The instructor gave clear explanations.	4	1	0	0	0	0	4.88	4.00	4.50	4.79			
203	The instructor stressed important points in lectures/discussions.	3	2	0	0	0	0	4.67	4.22	4.58	4.82			
207	The instructor appeared to have a thorough knowledge of the subject.	5	0	0	0	0	0	5.00	4.50	4.80	4.92			
216	The instructor acknowledged all questions insofar as possible.	3	2	0	0	0	0	4.67	4.33	4.67	4.83			
229	The instructor used class time well.	4	1	0	0	0	0	4.88	4.13	4.50	4.79			
230	The instructor seemed well prepared for each class.	4	1	0	0	0	0	4.88	4.33	4.69	4.86			
232	Work requirements and grading system were clear from the beginning.	1	3	0	1	0	0	4.00	4.06	4.38	4.67			
239	The amount of work required was appropriate for the credit received.	2	2	1	0	0	0	4.25	4.00	4.25	4.63			
356	Examinations covered the important aspects of the course.	1	2	0	0	0	2	4.25	4.10	4.38	4.67			
360	Exams were reasonable in length and difficulty.	1	2	0	0	0	2	4.25	3.87	4.14	4.50			
366	The grading system was clearly explained.	3	1	1	0	0	0	4.67	4.00	4.39	4.67			

Written Comments

900 Comment on the quality of instruction in this course.

Student 1
Professor Athanasopoulos-Zekkos provided very good course notes that I believe will be practical and useful in my future career. The class lectures were interesting and Professor Athanasopoulos-Zekkos did a very good job delivering the information. My favorite lecture was the lecture on the failure of levees during Hurricane Katrina. I thought that this lecture really showed the ability of numerical modeling to model failures that occurred in the field, and the lessons that one can learn from numerical modeling.

University of Michigan
Office of the Registrar - Evaluations
ro.umich.edu/evals/

Fall 2014 Final
5 students responded out of the total enrolled 6

Instructor with Comments Report

2014-11-26 - 2014-12-11 Report ID: MSR04734

Instructor: Athanasopoulos-Zekkos,Adda
CEE 501 043

Student 2
NA

Student 3
NA

Student 4
Course allowed lab test results to be used in implementing design models. Increased confidence in ability to apply and think critically about various numerical models. This class was a good follow up to Advanced Soil Mechanics in actually applying concepts developed in that class.

Student 5
This course is the first time that I had been exposed to numerical modeling specific to geotechnical engineering problems, and I feel at the end of this course that I have a much greater understanding of how models are applied, and their usefulness in geotechnical engineering problems. The assignments were challenging and required time to first fully understand the model you were applying, its limitations, the testing required to develop the parameters you needed, and what the expected outcome is and how to validate your model based on the test data. Taking the time to go through the models in the assignments really helped them sink in. Also through the class I feel that I have developed a good amount of skill in using PLAXIS 2D, both developing the problems accurately and understanding and interpreting the results. Overall I feel that this course is very practical and beneficial.

* The quartiles are calculated from Fall 2014 data. The university-wide quartiles are based on all UM classes in which an item was used. The school/college quartiles in this report are based on graduate level students in College of Engineering.
** SA - Strongly Agree, A - Agree, N - Neutral, D - Disagree, SD - Strongly Disagree, NA - Not Applicable

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number 2583
Date 2/10/2015
Effective Term ~~Winter 2015~~ FT 2015
Course Offer Freq ☒ Indefinitely ☐ One term only

Action Requested
◉ New Course
○ Modification of Existing Course
○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING	B. REQUESTED LISTING
Home Department / Course Number	Home Department: CEE Civil & Environmental Engin / Course Number: 555
☐ Cross Listed Course Information	Cross Listed Course Information
☐ Course Title	Course Title: Sustainability of Civil Infrastructure Systems
TITLE ABBREVIATION — Time Sched Max = 19 Spaces	Sus Civ Infr Sys
TITLE ABBREVIATION — Transcript Max = 20 Spaces	Sus Civ Infr Sys
☐ Course Description	Course Description for Official Publication (Max = 50 words): Life Cycle Cost Analysis and Life Cycle Analysis - Methods and Applications in Civil Infrastructure Systems; Building Energy Modeling and Simulation; Energy Management in Buildings; Impact of Building Occupants and Behavioral Challenges; Renewable Energy and Efficiency in Buildings; Existing Buildings and Technical/Social Challenges of Energy Retrofits; and Building Certifications (e.g., LEED).
PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k	PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k
Degree Requirements: ○ Degree Requirement ○ Core Course ○ Free Elective ○ Tech Elective ○ Other	Degree Requirements: ○ Degree Requirement ○ Core Course ○ Free Elective ○ Tech Elective ◉ Other
Prereq: ○ Enforced ○ Advised	Prereq: ○ Enforced ○ Advised
☐ Credit Restrictions	Credit Restrictions
Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work	Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☒ All Credit types ☐ Rckhm Grad w/add'l Work
Credit Hours Min Max: ___ ___ ; Contact Hrs/Wk: ___ ; Number of Wks: ___	Credit Hours Min Max: 3 3 ; Contact Hrs/Wk: 3 ; Number of Wks: 14

Repeatability (Indi Research, Dir. Study, Dissertation): Is this course repeatable? ○ Yes ◉ No Max Hours? 3 Max Times? 1 Can it be repeated in the same term? ○ Yes ◉ No

C.

Class Type(s)
☒ Lec ☐ Sem ☐ Dis ☐ Other ___
☐ Rec ☐ Lab ☐ Ind

Graded Section
☒ Lec ☐ Sem ☐ Dis ☐ Other ___
☐ Rec ☐ Lab ☐ Ind

Grading
☒ A-E
☐ CR/NC
☐ P/F
☐ S/U
Course Is Y Graded ☐

Location
☒ Ann Arbor
☐ Biological Station
☐ Camp Davis
☐ Extension

Cognizant Faculty Member: Carol Menassa — Title: Assistant Professor

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info | **Approved by Name** | **Approved Date**

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

	Department Chair Name	Chair Signature
Home Dept.	Kim F. Hayes, Chair & Professor	
Cross-listed Dept(s).	Civil & Environmental Engin	

28

Form Number

2583

SUPPORTING STATEMENT

High oil prices, diminishing natural resources, and global warming are causing developed countries to investigate ways to reduce their energy consumption. In the United States (US), the civil infrastructure and building sector represents an excellent opportunity to achieve large-scale energy use reductions through efficiency and conservation.

The objective of the class is to provide the students with the opportunity to explore the different challenges associated with making civil infrastructure systems and buildings sustainable, by exploring fundamental concepts, practical applications and academic research in this field. The class will teach the students tools to evaluate different aspects of civil infrastructure and building sustainability (i.e., economic, environmental and social). A set of general questions will be used as guiding principles throughout the course, these include:

- What are the available methods and approaches that can effectively assist in achieving sustainability in civil infrastructure systems and buildings with specific emphasis on energy consumption?
- What elements of the design and decision making process related to making new and existing civil infrastructure systems and buildings sustainable need to be revisited or improved to ensure effective results?
- To what extent do these elements represent the interests of those affected by the decisions (e.g., building owners, buildings occupants/tenants, building operators)?
- And vice versa, how the interests of those affected influence the design and outcome during the civil infrastructure systems or building operation phases?

Students will be able to achieve the following outcomes:

- Understand why civil infrastructure systems and buildings play a central role in reducing demand for energy and subsequently reduce greenhouse gas emissions.
- Understand the challenges associated with making new and existing civil infrastructure systems and buildings sustainable.
- Explore why addressing economic, environmental and social issues is integral to achieving energy reduction from civil infrastructure systems and building operations.
- Learn tools and techniques to evaluate civil infrastructure systems and civil infrastructure systems building performance from economic, environmental and social perspectives.
- Identify opportunities that leverage tools and techniques learned in the class to achieve sustainable buildings and infrastructure systems.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

CEE 501 - 059
SUSTAINABILITY OF CIVIL INFRASTRUCTURE SYSTEMS
WINTER 2015 – 3 Credits

Lectures: Monday/Wednesday 2:30 – 4:00 PM
2305 GGBL

Contact: Carol Menassa, Assistant Professor
2322 G. G. Brown
Phone: (734) 764-7525
Email: menassa@umich.edu
Office Hours: by appointment

Credits: 3 hours

Required Text: Material for this class is drawn from several different books and resources. There is no single required text book. All required course materials and notes will be posted on the course website.

Recommended text books:

1) Sustainable Construction: Green Building Design and Delivery, 3rd Edition by Charles J. Kilbert. Publisher: John Wiley & Sons, Inc.
2) The Integrative Design Guide to Green Building – Redefining the Practice of Sustainability by 7 Group and Bill G. Reed. Publisher: John Wiley & Sons, Inc.

Prerequisites: A prior course in engineering economics will be beneficial but it not required. Fundamental skills in math, physics and computer-based problem solving are necessary. A desire to actively participate in a learning environment is required.

Course Website: https://ctools.umich.edu

Once you register with the course, you will be able to use the course resources on C-Tools. Please take some time to familiarize yourself with the system.

30

COURSE DESCRIPTION

High oil prices, diminishing natural resources, and global warming are causing developed countries to investigate ways to reduce their energy consumption. In the United States (US), the building sector represents an excellent opportunity to achieve large-scale energy use reductions through efficiency and conservation. Residential and commercial buildings account for 40 percent of the total energy consumption by the built environment with an estimated 3 percent increase per year (http://www.eia.gov/ 2014).

The objective of the class is to provide the students with the opportunity to explore the different challenges associated with making buildings sustainable, by exploring fundamental concepts, practical applications and academic research in this field. The class will teach the students tools to evaluate different aspects of building sustainability (i.e., economic, environmental and social). A set of general questions will be used as guiding principles throughout the course, these include:

- What are the available methods and approaches that can effectively assist in achieving sustainability in buildings with specific emphasis on energy consumption?
- What elements of the design and decision making process related to making new and existing buildings sustainable need to be revisited or improved to ensure effective results?
- To what extent do these elements represent the interests of those affected by the decisions (e.g., building owners, buildings occupants/tenants, building operators)?
- And vice versa, how the interests of those affected influence the design and outcome during the building operation phases?

COURSE OUTCOMES

Students will be able to achieve the following outcomes:

- Understand why buildings we live and work in are going to play a central role in reducing demand for energy and subsequently reduce greenhouse gas emissions.
- Understand the challenges associated with making new and existing buildings sustainable.
- Explore why addressing economic, environmental and social issues is integral to achieving energy reduction from building operations.
- Learn tools and techniques to evaluate building performance from economic, environmental and social perspectives.
- Identify opportunities that leverage tools and techniques learned in the class to achieve sustainable buildings and infrastructure systems.

COURSE OUTLINE

The following is a list of planned topics that we will cover in the class.

Topic 1: Sustainability and Buildings – A General Overview
The class will start with an introduction to sustainability framework in buildings that will cover principles, phases and resources. The discussion will focus on new concepts related to achieving sustainable buildings such as Integrated Building Design (IBD) and Net Zero Buildings (NZB). Other issues related to site analysis, solar orientation and regulatory zoning factors will be introduced.

Topic 2: Life Cycle Cost Analysis - Methods and Applications in Buildings
The class will introduce the life cycle cost analysis (LCCA) by providing a comprehensive definition and discussing how and why it can be applied to buildings. In addition, several methods from engineering economics will be presented to teach students to perform LCCA using traditional present value approaches. This will be complimented with an introduction to real options and discussing how it can be used to overcome some of the technical limitations on applying the traditional LCCA to evaluate sustainable buildings.

Topic 3: Life Cycle Analysis - Methods and Applications in Buildings
This class will introduce the life cycle analysis (LCA) by providing a comprehensive definition and discussing how and why it can be applied to buildings. A contrast between LCA and LCCA will be provided. The students will be introduced to economic input-output (EIO-LCA), process models and hybrid models of performing LCA. The limitations of these methods to analyzing buildings will also be discussed and opportunities explored.

Topic 4: Building Energy Modeling and Simulation
This class will introduce the energy simulation and modeling in buildings. It will discuss applications, teach common software (e.g. eQuest and EnergyPlus), and discuss the advantages and disadvantages of some of the existing software. The students will perform analysis on typical buildings and couple that with sensitivity analysis to identify important input parameters for proper conceptual design and analysis of buildings.

Topic 5: Energy Management in Buildings
This class will introduce the principles of managing the consumption and conservation of energy in buildings. It will discuss the management cycle and introduce available energy management tools like Energy Star.

Topic 6: Impact of Building Occupants and Behavioral Challenges
This class will introduce the important topic of occupancy and their impact on energy use. The students will learn how this impact differs between residential and commercial buildings. Approaches to reduce occupancy impact in building energy use will also be introduced and evaluated. Technical approaches (e.g. occupancy sensors and building automation systems) will be contrasted with behavioral approaches (e.g. information sharing and feedback). In addition, different occupancy intervention strategies will be discussed, and their advantages/disadvantages highlighted.

Topic 7: Renewable Energy and Efficiency in Buildings
This class will build on the idea of net zero energy buildings (NZE) to introduce the students to renewable energy applications in buildings. The students will learn the different types of on-site and off-site renewable energy options. An important aspect of this class will to be to contrast efficiency and renewable energy application and discuss how a hybrid of these methods will be required to achieve NZE buildings of the future.

Topic 8: Existing Buildings and Challenges of Energy Retrofits - Technical/Social
This class will discuss the challenges of sustainably retrofitting existing buildings. The students will explore the difference between general maintenance and sustainable retrofits in existing buildings. The technical and social challenges to sustainably retrofitting existing buildings will be discussed.

Topic 9: Building Certifications - Truths and Myths
This class will discuss drivers for building certifications and introduce some of the existing methods such as: New Building Certification Standards, International Federation of Consulting Engineers (FIDIC), Green Building Institute (GBI), Build It Green, KB Homes; Energy Performance Guide, U.S. Green Building Council (USGBC). Students will explore the opportunities and challenges in pursuing these certifications.

GRADING POLICY

Homework: 40%
Assignments will be given throughout the semester reflecting the lessons learned in the class. Students should keep their assignments neat and organized. Any further grading criteria will be provided with the homework, as it is assigned.

Semester Project: 30%
At the beginning of the semester, the students will organize in teams to work on a project. Each team will propose a project that interests them. It is required that students work on the project progressively through the semester. The project will require the students to analyze a sustainable concept or application, and defend it using the fundamentals and tools learned in this course.

The final project product will consist of the following parts:

- An oral presentation given in class at the end of the semester to present findings to the class. This presentation is worth **40** percent of the total project grade.
- A technical report, providing the details of the study, collected at the end of the semester and worth **60** percent of the score.

Further grading criteria will be provided in the detailed instructions to the project.

Quizzes: 30%
There will be two quizzes for this class. Quizzes will be offered during the regular class time on the assigned dates given below. The format of each quiz will be discussed in class.

Quiz 1: Wednesday February 25, 2015

Quiz 2: Wednesday April 15, 2015

ACADEMIC INTEGRITY AND ACADEMIC MISCONDUCT – HONOR CODE

The Department of Civil and Environmental Engineering at the University of Michigan adheres to the strictest standards of academic honesty. An important aspect of achieving these standards is to be sure that students are aware of faculty expectations regarding academic honesty. This statement clarifies these expectations as they apply to this course.

Assignments and semester projects performed by students for submission serve the following two purposes:

- Assignments and term project are seen as educational devices to help students master the course material. This includes the concepts, theories, methodologies, and tools presented in class and recitation; as well as, such skills as working in teams.
- Assignments and term project help the faculty evaluate how well each student has mastered the course material.

Students currently taking this class can work together to conceptualize general approaches to assignments. However, unless otherwise specified for a particular assignment, the work you submit must be done completely on your own. This includes text, numerical calculations, mathematical derivations, diagrams, graphs, computer programs and output. You are also expected to properly reference the source of any information used in a submission that is not your own. This includes any book, article, web page, MS PowerPoint presentation or personal correspondence from someone else that you used to create your work. It is recommended to use the American Society of Civil Engineers (ASCE) publications guidelines available at the link below to properly reference all types of sources.
http://www.asce.org/Audience/Authors,--Editors/Books/General-Book-Information/Quick-Guide-to-Common-Types-of-Referenced-Material/

It is also inappropriate to use assignments or projects submitted in previous years as a source. Academic honesty rules will be strictly implemented in this case.

If you have any questions about how these policies relate to a specific situation, please speak to the professor of this course for clarification. Just remember, when you have doubts, ask the professor for assistance.

Please refer to University policy regarding academic misconduct. Academic misconduct (cheating, plagiarism, etc.) on homework assignments, projects, etc. will not be accepted and such works will be given a score of zero, and reported to the Honor Council in the College of Engineering. More information can be found at the following link: http://honorcode.engin.umich.edu/.

University of Michigan
Office of the Registrar - Evaluations
ro.umich.edu/evals/

Winter 2014 Final
25 students responded out of the total enrolled 35

Instructor Report

2014-04-10 - 2014-04-24 Report ID: MSR04732

Instructor: Menassa,Carol C
CEE 501 059

		Responses from your Students**							Other Users of This Item*					
									University Wide			School/College		
		5 SA	4 A	3 N	2 D	1 SD	NA	Your Median	75% Above	50% Above	25% Above	75% Above	50% Above	25% Above
1	Overall, this was an excellent course.	9	12	3	1	0	0	4.21	3.95	4.33	4.73	4.17	4.50	4.75
2	Overall, the instructor was an excellent teacher.	14	8	3	0	0	0	4.61	4.16	4.60	4.85	4.27	4.69	4.83
3	I learned a great deal from this course.	12	10	3	0	0	0	4.45	4.00	4.38	4.72	4.30	4.58	4.79
4	I had a strong desire to take this course.	17	5	2	0	1	0	4.76	3.67	4.17	4.63	4.17	4.50	4.75
15	I increased my ability to apply math and science knowledge to engineering problems.	9	10	4	2	0	0	4.15	4.04	4.27	4.57			
17	I increased my ability to analyze and interpret data.	10	9	5	1	0	0	4.22	4.00	4.33	4.60			
20	My confidence in my design abilities increased because of this course.	8	10	4	1	0	2	4.15	4.04	4.47	4.63			
21	I gained valuable experience working in teams in this course.	12	10	2	1	0	0	4.45	3.86	4.20	4.58			
23	I increased my ability to formulate, and solve engineering problems.	7	8	8	2	0	0	3.81	4.04	4.29	4.53			
25	I developed a greater understanding of my responsibilities as a professional.	13	9	1	2	0	0	4.54	4.00	4.33	4.75			
28	Course improved my ability to communicate technical information, designs, and analyses.	10	11	2	2	0	0	4.27	4.05	4.22	4.50			
30	I developed a greater understanding of the impact of engineering on the environment.	16	8	0	0	0	0	4.75	3.75	4.17	4.58			
32	This course increased my desire to learn more about this subject in the future.	12	9	3	1	0	0	4.44	3.94	4.17	4.58			
34	I have a greater understanding of how course concepts apply to contemporary problems.	13	11	1	0	0	0	4.54	4.13	4.34	4.64			
35	I increased my ability to apply engineering tools and methods.	13	9	2	1	0	0	4.54	4.10	4.28	4.56			
121	I gained a good understanding of concepts/principles in this field.	13	11	1	0	0	0	4.54	3.98	4.21	4.55			
125	I developed the ability to solve real problems in this field.	13	5	6	1	0	0	4.54	3.93	4.25	4.64			
201	The instructor gave clear explanations.	15	8	2	0	0	0	4.67	4.08	4.50	4.79			
203	The instructor stressed important points in lectures/discussions.	13	10	2	0	0	0	4.54	4.17	4.56	4.80			
207	The instructor appeared to have a thorough knowledge of the subject.	18	6	1	0	0	0	4.81	4.50	4.80	4.92			
216	The instructor acknowledged all questions insofar as possible.	18	5	1	0	0	0	4.83	4.33	4.67	4.83			
229	The instructor used class time well.	15	6	4	0	0	0	4.67	4.14	4.50	4.80			
230	The instructor seemed well prepared for each class.	18	7	0	0	0	0	4.81	4.33	4.69	4.86			
232	Work requirements and grading system were clear from the beginning.	18	6	1	0	0	0	4.81	4.07	4.39	4.68			
239	The amount of work required was appropriate for the credit received.	13	11	1	0	0	0	4.54	4.00	4.26	4.57			
356	Examinations covered the important aspects of the course.	8	3	3	0	0	11	4.63	4.00	4.29	4.63			
360	Exams were reasonable in length and difficulty.	6	2	3	0	0	14	4.58	3.83	4.09	4.46			
366	The grading system was clearly explained.	14	10	0	0	0	1	4.64	4.00	4.33	4.64			

* The quartiles are calculated from Winter 2014 data. The university-wide quartiles are based on all UM classes in which an item was used. The school/college quartiles in this report are based on graduate level students in College of Engineering.

** SA - Strongly Agree, A - Agree, N - Neutral, D - Disagree, SD - Strongly Disagree, NA - Not Applicable.

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number 2540
Date 11/12/2014
Effective Term Fall 2015
Course Offer Freq ☒ Indefinitely ☐ One term only

Action Requested
- ◉ New Course
- ○ Modification of Existing Course
- ○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING	B. REQUESTED LISTING
Home Department / Course Number	Home Department: CEE Civil & Environmental Engin / Course Number: 572
Cross Listed Course Information	Cross Listed Course Information
Course Title	Course Title: Dynamic Infrastructure Systems
TITLE ABBREVIATION — Time Sched Max = 19 Spaces	Dynamic Infr Sys
TITLE ABBREVIATION — Transcript Max = 20 Spaces	Dynamic Infr Sys
Course Description	Course Description for Official Publication (Max = 50 words): Introduction to the fundamentals of dynamics system theory applied to infrastructure systems including system modeling as well as monitoring and controlling structural, transportation, hydraulic, and electrical grid systems. Continuous-time and discrete-time linear systems are emphasized but elementary concepts in nonlinear systems are also presented.
PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k	PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k
Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ○ Tech Elective	Degree Requirements: ◉ Degree Requirement ○ Free Elective ○ Other ○ Core Course ○ Tech Elective
Prereq: ○ Enforced ○ Advised	Prereq: ○ Enforced ○ Advised
Credit Restrictions	Credit Restrictions
Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work; Credit Hours Min Max; Contact Hrs/Wk; Number of Wks	Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☒ Ugrad or Non-Rckhm Grad ☒ All Credit types ☐ Rckhm Grad w/add'l Work; Credit Hours Min 3 Max 3; Contact Hrs/Wk 3; Number of Wks 14

C.

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ○ Yes ◉ No Max Hours? 3 Max Times? 1 Can it be repeated in the same term? ○ Yes ◉ No

Class Type(s): ☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☐ Lab ☐ Ind
Graded Section: ☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☐ Lab ☐ Ind
Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U — Course Is Y Graded ☐
Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Cognizant Faculty Member: Jerome P. Lynch — Title: Professor

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

	Department Chair Name	Chair Signature
Home Dept.	Kim F. Hayes, Chair & Professor	
Cross-listed Dept(s).	Civil & Environmental Engin	

Form Number

2540

SUPPORTING STATEMENT

This course is a required core course of the MS degree concentration in Infrastructure Systems. It is intended to be a survey of dynamic system theory applied to problems in infrastructure systems. The course has been offered in Fall 2014 for the first time under CEE501 (Section 16 – Lynch) and will be offered every year henceforth. Attached is an overview of the course.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

CEE572 – Dynamical Infrastructure Systems (3 Credits)
Fall Semester 2014-2015
Course Description

Instructor: Jerome P. Lynch
jerlynch@umich.edu.

Lectures: Mondays and Wednesdays, 4:00 - 5:30 pm
G. G. Brown 2305

Office Hours: Friday, 10:00 – 11:00 am
2380 G. G. Brown

Website: http://www-personal.umich.edu/~jerlynch/cee572/

Catalog Description:

This course is an introductory course in the fundamentals of dynamics system theory applied to infrastructure systems including applications in modeling, motoring and controlling structural, transportation, hydraulic, and electrical grid systems. Linear systems are emphasized including continuous-time and discrete-time systems but elementary concepts in nonlinear systems are also presented. Additional topics include feedback control theory, system identification, and cyber-physical system architectures.

Textbook:

- None required

Optional References (currently on reserve at the AAE Library):

- *Introduction to Dynamic Systems: Theory, Models, and Applications*, David G. Luenberger, Wiley, 1979
- *Linear Dynamical Systems*, John L. Casti, Academic Press, 1987
- *Filtering and System Identification: A Least Squares Approach*, Michel Verhaegen and Vincent Verdult, Cambridge Press, 2007

Course Requirements:

- Regular attendance
- Weekly homework assignments
- Midterm exams (2 exams)

Homework:

Homework will normally be assigned each Monday and due the following Monday in class (unless otherwise noted). **Please note, late homework will not be accepted.** You are allowed to work on the homework in small groups, but you must write up your own homework to hand in. Homework will often involve MATLAB programming. Homework will be graded on a scale of 100.

Grading:

Homework 30%, Midterm #1 35%, Midterm #2 35%.
These weights are approximate; the right to change them later is reserved.

Prerequisites:

Exposure to linear algebra and matrices. You should have seen the following topics: matrices and vectors, (introductory) linear algebra and differential equations. Deeper appreciation for the course would be derived from having taken CEE571: Linear System Theory

Course Outline:

Lectures:

Class 1 - Introduction to Dynamical Systems
Class 2 - Introduction to System Types
Class 3 - Single Variable Differential Equations for Continuous Time Systems
Class 4 - Difference Equation Models for Discrete Time Systems
Class 5 - Realization of Dynamical Systems
Class 6 - Convolution and the Laplace Transform
Class 7 - Dynamic Response Analysis of SISO Systems by Laplace Transforms
Class 8 - Complex Plane and Dynamic System Behavior
Class 9 - Block Diagrams for Dynamical Systems
Class10 – Control of SISO Dynamical Systems
Class 11 - Introduction to Signals
Class 12- Correlation Analysis of Random Signals
Class 13 – Fourier Series, Integral and Transforms
Class 14 – Applications of the Continuous-Time Fourier Transforms
Class 15 – Introduction to Random Vibrations and Spectral Analysis
Class 16 – Discrete-time SISO Systems and the Z-Transform
Class 17 – Properties of the Discrete-Time Complex Plane
Class 18 – Discrete-time System Examples
Class 19 – Discrete Fourier Transform
Class 20 – Applications of DFT in System Analysis
Class 21 – Aliasing
Class 22 – State-Space System Models
Class 23 – Review of Linear Algebra
Class 24 - State Evolution Equations
Class 24 – Observability and Controllability
Class 25 – Linear Quadratic Regulation (LQR) Control
Class 26 - Nonlinear Systems – Linearization and Phase Diagrams

University of Michigan
Office of the Registrar - Evaluations
ro.umich.edu/evals/

Fall 2014 Final
5 students responded out of the total enrolled 8

Instructor with Comments Report

2014-11-26 - 2014-12-11 Report ID: MSR04734

Instructor: Lynch,Jerome P
CEE 501 016

		Responses from your Students**							Other Users of This Item*					
									University Wide			School/College		
		5 SA	4 A	3 N	2 D	1 SD	NA	Your Median	75% Above	50% Above	25% Above	75% Above	50% Above	25% Above
1	Overall, this was an excellent course.	5	0	0	0	0	0	5.00	3.95	4.33	4.72	4.25	4.50	4.70
2	Overall, the instructor was an excellent teacher.	5	0	0	0	0	0	5.00	4.15	4.61	4.85	4.39	4.65	4.85
3	I learned a great deal from this course.	5	0	0	0	0	0	5.00	4.00	4.40	4.75	4.33	4.60	4.78
4	I had a strong desire to take this course.	4	1	0	0	0	0	4.88	3.64	4.17	4.63	4.25	4.56	4.75
15	I increased my ability to apply math and science knowledge to engineering problems.	5	0	0	0	0	0	5.00	4.06	4.28	4.55			
17	I increased my ability to analyze and interpret data.	5	0	0	0	0	0	5.00	4.03	4.27	4.50			
20	My confidence in my design abilities increased because of this course.	5	0	0	0	0	0	5.00	4.00	4.25	4.67			
21	I gained valuable experience working in teams in this course.	3	0	1	0	0	1	4.83	3.94	4.19	4.50			
23	I increased my ability to formulate, and solve engineering problems.	4	1	0	0	0	0	4.88	4.05	4.26	4.54			
25	I developed a greater understanding of my responsibilities as a professional.	2	1	1	0	0	1	4.50	4.00	4.33	4.75			
28	Course improved my ability to communicate technical information, designs, and analyses.	3	2	0	0	0	0	4.67	4.00	4.25	4.50			
30	I developed a greater understanding of the impact of engineering on the environment.	3	2	0	0	0	0	4.67	3.79	4.10	4.44			
32	This course increased my desire to learn more about this subject in the future.	5	0	0	0	0	0	5.00	4.00	4.30	4.58			
34	I have a greater understanding of how course concepts apply to contemporary problems.	5	0	0	0	0	0	5.00	4.13	4.32	4.63			
35	I increased my ability to apply engineering tools and methods.	5	0	0	0	0	0	5.00	4.08	4.32	4.57			
121	I gained a good understanding of concepts/principles in this field.	5	0	0	0	0	0	5.00	3.96	4.22	4.57			
125	I developed the ability to solve real problems in this field.	5	0	0	0	0	0	5.00	4.00	4.25	4.61			
201	The instructor gave clear explanations.	5	0	0	0	0	0	5.00	4.00	4.50	4.79			
203	The instructor stressed important points in lectures/discussions.	5	0	0	0	0	0	5.00	4.22	4.58	4.82			
207	The instructor appeared to have a thorough knowledge of the subject.	5	0	0	0	0	0	5.00	4.50	4.80	4.92			
216	The instructor acknowledged all questions insofar as possible.	5	0	0	0	0	0	5.00	4.33	4.67	4.83			
229	The instructor used class time well.	5	0	0	0	0	0	5.00	4.13	4.50	4.79			
230	The instructor seemed well prepared for each class.	5	0	0	0	0	0	5.00	4.33	4.69	4.86			
232	Work requirements and grading system were clear from the beginning.	4	1	0	0	0	0	4.88	4.06	4.38	4.67			
239	The amount of work required was appropriate for the credit received.	5	0	0	0	0	0	5.00	4.00	4.25	4.63			
356	Examinations covered the important aspects of the course.	4	1	0	0	0	0	4.88	4.10	4.38	4.67			
360	Exams were reasonable in length and difficulty.	4	1	0	0	0	0	4.88	3.87	4.14	4.50			
366	The grading system was clearly explained.	4	1	0	0	0	0	4.88	4.00	4.39	4.67			

Written Comments

900 Comment on the quality of instruction in this course.

Student 1
NA

Student 2

Fall 2014 Final
5 students responded out of the total enrolled 8

Instructor with Comments Report

2014-11-26 - 2014-12-11 Report ID: MSR04734

Instructor: Lynch,Jerome P

CEE 501 016

I really appreciated the amount of effort that went into preparing (and launching) this course. The copies of lecture notes that were posted online were very helpful, and even more helpful were the recorded lectures. (I wish that we could have had more of the lectures recorded, since being able to pause/go back/etc. made it much easier to process the lecture material.) I think I gained a strong understanding of how systems operate, and how the dynamics of these systems can be easily represented and understood in the Laplace and Fourier domains. The part of the course that covered statistical representations of random signals was a bit more difficult for me to grasp, and having some homework problems on this would probably have helped. On the whole, though, I think I learned a lot, and concepts that seemed intimidating and difficult at the beginning of the course became much more obvious and tangible towards the end of it. Thanks for a great class, I really enjoyed it.

Student 3
NA

Student 4
Great!
1. Some knowledge needs to be made clearer at the beginning of the semester, e.g. clarifying a system is linear or nonlinear.
2. It is better if the notes can be uploaded to the website earlier.
3. It is easier to understand the lecture if there are more examples problem.
4. Handing out some materials like old textbooks is very helpful.
5. There are some mistakes of the question statement or solutions on the homework

Student 5
NA

* The quartiles are calculated from Fall 2014 data. The university-wide quartiles are based on all UM classes in which an item was used. The school/college quartiles in this report are based on graduate level students in College of Engineering.
** SA - Strongly Agree, A - Agree, N - Neutral, D - Disagree, SD - Strongly Disagree, NA - Not Applicable.

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number: 2582
Date: 2/10/2015
Effective Term: Fall 2015
Course Offer Freq: ☒ Indefinitely ☐ One term only

Action Requested
- ◉ ~~New Course~~
- ○ Modification of Existing Course
- ○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING

Home Department	Course Number
CHE Chemical Engineering	290

Cross Listed Course Information:

Course Title: Directed Study, Research, and Special Problems

TITLE ABBREVIATION		
	Time Sched Max = 19 Spaces	Res & Spec Problems
	Transcript Max = 20 Spaces	Res & Spec Problems

Course Description:
Provides an opportunity for undergraduate students to work in chemical engineering research or in areas of special interest such as design problems. For each hour of credit, it is expected that the student will work three or four hours per week. Oral presentation and/or written report due at end of term.

PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j

Degree Requirements: ○ Degree Requirement ◉ Tech Elective ○ Core Course ○ Other ~~○ Free Elective~~

Prereq: First or second year standing, and permission of instructor
○ Enforced ◉ Advised

Credit Restrictions:

Level of Credit: ☒ Undergrad only ☐ Ugrad or Non-Rckhm Grad ☐ Rackham Grad ☐ All Credit types ☐ Non-Rckhm Grad ☐ Rckhm Grad w/add'l Work ☐ Ugrad or Rckhm Grad

Credit Hours: Min 1, Max 16
Contact Hrs/Wk: Arr
Number of Wks: 15

B. REQUESTED LISTING

Home Department	Course Number
CHE Chemical Engineering	290

Cross Listed Course Information:

Course Title: Directed Study, Research, and Special Problems

TITLE ABBREVIATION		
	Time Sched Max = 19 Spaces	Res & Spec Problems
	Transcript Max = 20 Spaces	Res & Spec Problems

Course Description for Official Publication (Max = 50 words):
Provides an opportunity for undergraduate students to work in chemical engineering research or design problems. For each hour of credit, it is expected that the student will work four hours per week in a full term. Oral presentation and/or written report due at end of term. Not open to graduate students.

PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j

Degree Requirements: ○ Degree Requirement ◉ Tech Elective ○ Core Course ○ Other ~~○ Free Elective~~

Prereq: First or second year standing, and permission of instructor
◉ Enforced ○ Advised

Credit Restrictions:

Level of Credit: ☒ Undergrad only ☐ Ugrad or Non-Rckhm Grad ☐ Rackham Grad ☐ All Credit types ☐ Non-Rckhm Grad ☐ Rckhm Grad w/add'l Work ☐ Ugrad or Rckhm Grad

Credit Hours: Min 1, Max 16
Contact Hrs/Wk: Arr
Number of Wks: 15

C.

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ◉ Yes ○ No Max Hours? ____ Max Times? ____ Can it be repeated in the same term? ○ Yes ◉ No

Class Type(s): ☐ Lec ☐ Sem ☐ Dis ☐ Other ____ ☐ Rec ☐ Lab ☒ Ind

Graded Section: ☐ Lec ☐ Sem ☐ Dis ☐ Other ____ ☐ Rec ☐ Lab ☒ Ind

Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U

Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Course is Y Graded ☐

Cognizant Faculty Member: Susan Montgomery — Title: Lecturer

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

Department Chair Name	Chair Signature
Home Dept. Mark Burns, Chemical Engineering	
Cross-listed	

43

Dept(s).

Form Number

2582

SUPPORTING STATEMENT

Change to course description to "four hours" instead of "three to four hours." This change was approved to have more uniform expectations of our students working in research labs. A student in a lecture class is expected to work at least 3 hours outside of class for each lecture hours, so a four hour per week per credit standard matches this expectation.

Prerequisite should be enforced.

Class type should be Independent instead of Lecture.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number 2585
Date 2/11/2015
Effective Term Fall 2015
Course Offer Freq ☒ Indefinitely ☐ One term only

Action Requested
○ New Course
◉ Modification of Existing Course
○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING	B. REQUESTED LISTING
Home Department: CHE Chemical Engineering	Home Department: CHE Chemical Engineering
Course Number: 460	Course Number: 460
Cross Listed Course Information:	Cross Listed Course Information:
Course Title: Chemical Engineering Laboratory II	Course Title: Chemical Engineering Laboratory II
TITLE ABBREVIATION — Time Sched Max = 19 Spaces: Chem Eng Lab II	TITLE ABBREVIATION — Time Sched Max = 19 Spaces: Chem Eng Lab II
TITLE ABBREVIATION — Transcript Max = 20 Spaces: CHEM ENG LAB II	TITLE ABBREVIATION — Transcript Max = 20 Spaces: CHEM ENG LAB II
Course Description: Experimentation in rate and separation processes on a scale which tests process models. Introduction to the use of instrumental analysis and process control. Laboratory, conferences, reports. Technology communications.	Course Description for Official Publication (Max = 50 words): Experimentation in rate and separation processes on a scale which tests process models. Introduction to the use of instrumental analysis and process control. Laboratory, conferences, reports. Technology communications.
PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j	PROGRAM OUTCOMES: ☐a ☐c ☐e ☒g ☒i ☐k ☒b ☒d ☐f ☐h ☐j
Degree Requirements: ◉ Degree Requirement ○ Tech Elective ○ Core Course ○ Other ○ Free Elective	Degree Requirements: ◉ Degree Requirement ○ Tech Elective ○ Core Course ○ Other ○ Free Elective
Prereq: ChE 343, 360	Prereq: ChE 344, ChE 360
X ◉ Enforced ○ Advised	◉ Enforced ○ Advised
Credit Restrictions:	Credit Restrictions:
Level of Credit: ☒ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work	Level of Credit: ☒ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work
Credit Hours Min 4 Max 4; Contact Hrs/Wk 6; Number of Wks 14	Credit Hours Min 4 Max 4; Contact Hrs/Wk 6; Number of Wks 14

C.

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ○ Yes ◉ No Max Hours? ____ Max Times? ____ Can it be repeated in the same term? ○ Yes ○ No

Class Type(s)
☒ Lec ☐ Sem ☐ Dis ☐ Other ____
☐ Rec ☒ Lab ☐ Ind

Graded Section
☐ Lec ☐ Sem ☐ Dis ☐ Other ____
☐ Rec ☒ Lab ☐ Ind

Grading
☒ A-E
☐ CR/NC
☐ P/F
☐ S/U
Course is Y Graded ☐

Location
☒ Ann Arbor
☐ Biological Station
☐ Camp Davis
☐ Extension

Cognizant Faculty Member: Erdogan Gulari
Title: Professor

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info | **Approved by Name** | **Approved Date**
☐ Curriculum Comm.
☐ Faculty
☐ Cross listed Unit 1
☐ Cross listed Unit 2

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

Department Chair Name | **Chair Signature**
Home Dept. Mark Burns, Chemical Engineering
Cross-listed

45

Dept(s).

Form Number

2585

SUPPORTING STATEMENT

Changing prerequisites from ChE 343 and 360 to now be ChE 344 and 360.

Reasoning:

We seek to update the prerequisites for ChE 460, our senior lab, to include ChE 344, reactor engineering and design, to reflect the fact that the lab includes a reactor experiment. We seek to remove ChE 343 as a prerequisite because it's already a prerequisite for ChE 360 so that by having ChE 360 as a prereq for ChE 460 the ChE 343 prerequisite is taken care of.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN – COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number: 2581
Date: 2/10/2015
Effective Term: Fall 2015
Course Offer Freq: ☒ Indefinitely ☐ One term only

Action Requested
○ New Course
◉ Modification of Existing Course
○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING	B. REQUESTED LISTING
Home Department: CHE Chemical Engineering	Home Department: CHE Chemical Engineering
Course Number: 490	Course Number: 490
☐ Cross Listed Course Information:	Cross Listed Course Information:
☐ Course Title: Advanced Directed Study, Research and Special Problems	Course Title: Advanced Directed Study, Research and Special Problems
TITLE ABBREVIATION — Time Sched Max = 19 Spaces: Adv Res & Spec Problem	TITLE ABBREVIATION — Time Sched Max = 19 Spaces: Adv Res & Spec Problem
TITLE ABBREVIATION — Transcript Max = 20 Spaces: Adv Res & Spec Problem	TITLE ABBREVIATION — Transcript Max = 20 Spaces: Adv Res & Spec Problem
☒ Course Description: Provides an opportunity for undergraduate students to work in chemical engineering research or in areas of special interest such as design problems. For each hour of credit, it is expected that the student will work three or four hours per week. Oral presentation and/or written report due at end of term. Not open to graduate students.	Course Description for Official Publication (Max = 50 words): Provides an opportunity for undergraduate students to work in chemical engineering research or design problems. For each hour of credit, it is expected that the student will work four hours per week in a full term. Oral presentation and/or written report due at end of term. Not open to graduate students.
PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j	PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j
Degree Requirements: ○ Degree Requirement ◉ Tech Elective ○ Core Course ○ Other ○ Free Elective	Degree Requirements: ○ Degree Requirement ◉ Tech Elective ○ Core Course ○ Other ○ Free Elective
Prereq: ChE 230 & ChE 341 or ChE 290 or equivalent	Prereq: ChE 230 & ChE 341 or ChE 290 or equivalent and permission of instructor
☒ ○ Enforced ◉ Advised	◉ Enforced ○ Advised
☐ Credit Restrictions:	Credit Restrictions:
Level of Credit: ☒ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work	Level of Credit: ☒ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work
Credit Hours Min 1 Max 16; Contact Hrs/Wk ARR; Number of Wks ARR	Credit Hours Min 1 Max 16; Contact Hrs/Wk ARR; Number of Wks ARR

C.

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ◉ Yes ○ No Max Hours? ____ Max Times? ____ Can it be repeated in the same term? ○ Yes ◉ No

Class Type(s): ☐ Lec ☐ Sem ☐ Dis ☐ Other ____ ☐ Rec ☐ Lab ☒ Ind
Graded Section: ☐ Lec ☐ Sem ☐ Dis ☐ Other ____ ☐ Rec ☐ Lab ☒ Ind
Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U
Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension
Course is Y Graded ☐

Cognizant Faculty Member: Susan Montgomery, ChE — Title: Lecturer

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

Department Chair Name	Chair Signature
Home Dept. Mark Burns, Chair, Chemical Engineering	
Cross-listed	

47

Dept(s).

Form Number

2581

SUPPORTING STATEMENT

Change to course description making it "four hours" instead of "three to four hours". This change was approved to have more uniform expectations of our students working in research labs. A student in a lecture class is expected to work at least 3 hours outside of class for each lecture hours, so a four hour per week per credit standard matches this expectation.

Prerequisites should be enforced.

Are any special resources or facilities required for this course? ☐ Yes ☐ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number 2584
Date 2/11/2015
Effective Term Fall 2015
Course Offer Freq ☒ Indefinitely ☐ One term only

Action Requested
○ New Course
◉ Modification of Existing Course
○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING

Home Department	Course Number
CHE Chemical Engineering	496

Cross Listed Course Information:

Course Title: Special Topics in Chemical Engineering

TITLE ABBREVIATION		
	Time Sched Max = 19 Spaces	Special Topics in ChE
	Transcript Max = 20 Spaces	SP TOPIC CHE

Course Description: Selected topics pertinent to chemical engineering.

PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j

Degree Requirements: ○ Degree Requirement ◉ Tech Elective ○ Other ○ Core Course ○ Free Elective

Prereq: Permission of Instructor
○ Enforced
◉ Advised

Credit Restrictions:

Level of Credit: ☐ Undergrad only ☐ Ugrad or Non-Rckhm Grad ☐ Rackham Grad ☒ All Credit types ☐ Non-Rckhm Grad ☐ Rckhm Grad w/add'l Work ☐ Ugrad or Rckhm Grad

Credit Hours: Min 1 Max 16
Contact Hrs/Wk 1-16
Number of Wks 14

B. REQUESTED LISTING

Home Department	Course Number
CHE Chemical Engineering	496

Cross Listed Course Information:

Course Title: Special Topics in Chemical Engineering

TITLE ABBREVIATION		
	Time Sched Max = 19 Spaces	Special Topics ChE
	Transcript Max = 20 Spaces	SP TOPIC CHE

Course Description for Official Publication (Max = 50 words): Selected topics pertinent to chemical engineering.

PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j

Degree Requirements: ○ Degree Requirement ◉ Tech Elective ○ Other ○ Core Course ○ Free Elective

Prereq: Permission of Instructor
○ Enforced
◉ Advised

Credit Restrictions:

Level of Credit: ☒ Undergrad only ☐ Ugrad or Non-Rckhm Grad ☐ Rackham Grad ☐ All Credit types ☐ Non-Rckhm Grad ☐ Rckhm Grad w/add'l Work ☐ Ugrad or Rckhm Grad

Credit Hours: Min 1 Max 16
Contact Hrs/Wk 1-16
Number of Wks 14

C.

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ◉ Yes ○ No Max Hours? 16 Max Times? ____ Can it be repeated in the same term? ◉ Yes ○ No

Class Type(s): ☒ Lec ☐ Sem ☐ Dis ☐ Other ____ ☐ Rec ☐ Lab ☐ Ind

Graded Section: ☒ Lec ☐ Sem ☐ Dis ☐ Other ____ ☐ Rec ☐ Lab ☐ Ind

Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U

Course is Y Graded ☐

Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Cognizant Faculty Member: Susan Montgomery — Title: Lecturer

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info | **Approved by Name** | **Approved Date**

☐ Curriculum Comm.
☐ Faculty
☐ Cross listed Unit 1
☐ Cross listed Unit 2

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

Department Chair Name | **Chair Signature**

Home Dept. Mark Burns, Chemical Engineering

Cross-listed ____

49

Dept(s).

Form Number

2584

SUPPORTING STATEMENT

Changing Level of credit from "All Credit Types" to "Undergrad only"

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number: 2603
Date: 3/17/2015

Action Requested
- ○ New Course
- ◉ Modification of Existing Course
- ○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

Effective Term: Fall 2015
Course Offer Freq: ☒ Indefinitely ☐ One term only

A. CURRENT LISTING		B. REQUESTED LISTING	
Home Department	Course Number	Home Department	Course Number
IOE Industrial & Operations Engin	552	IOE Industrial & Operations Engin	552
☒ Cross Listed Course Information		Cross Listed Course Information	
Mathematics	542		
☐ Course Title		Course Title	
		FINANCIAL ENGINEERING I	
TITLE ABBREVIATION — Time Sched Max = 19 Spaces		TITLE ABBREVIATION — Time Sched Max = 19 Spaces	FINANCIAL ENGINEERING I
TITLE ABBREVIATION — Transcript Max = 20 Spaces		TITLE ABBREVIATION — Transcript Max = 20 Spaces	FINANCIAL ENGINEERING I
☐ Course Description		Course Description for Official Publication (Max = 50 words)	
		Theory and applications to financial engineering. Designing, structuring and pricing financial engineering products (including options, future, swaps and other derivative securities) and their applications to financial and investment risk management. Mathematical methodology that forms the basis of financial engineering, applied stochastic processes and numerical methods in particular.	
PROGRAM OUTCOMES: ☐a ☐b ☐c ☐d ☐e ☐f ☐g ☐h ☐i ☐j ☐k		PROGRAM OUTCOMES: ☐a ☐b ☐c ☐d ☐e ☐f ☐g ☐h ☐i ☐j ☐k	
Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ○ Tech Elective		Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ○ Tech Elective	
☐ Prereq: IOE 452 and 453 or Math 423 ◉ Enforced ○ Advised		Prereq: IOE 453 or Math 423. Business School students: Fin 580 or Fin 618 or BA 855 ◉ Enforced ○ Advised	
☐ Credit Restrictions		Credit Restrictions	
☐ Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/addl Work; Credit Hours Min Max; Contact Hrs/Wk; Number of Wks		Level of Credit: ☐ Undergrad only ◉ Rackham Grad ◉ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/addl Work; Credit Hours Min 3 Max 3; Contact Hrs/Wk 3; Number of Wks 14	

C.

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ○ Yes ◉ No Max Hours? 3 Max Times? 1 Can it be repeated in the same term? ○ Yes ◉ No

Class Type(s): ☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☐ Lab ☐ Ind
Graded Section: ☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☐ Lab ☐ Ind
Grading: ☐ A-E ☐ CR/NC ☐ P/F ☐ S/U
Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension
Course is Y Graded ☐

Cognizant Faculty Member: Romesh Saigal — Title: Professor, IOE
Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

Department Chair Name	Chair Signature
Home Dept. [IOE] Mark S. Daskin	
Cross-listed Dept(s). [Math] Mel Hochster	

Form Number

2603

SUPPORTING STATEMENT

Remove cross-list with Math 542 per Mathematics department request.

Are any special resources or facilities required for this course? ☐ Yes ☐ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN – COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number: 2604
Date: 3/17/2015
Effective Term: Fall 2015
Course Offer Freq: ☒ Indefinitely ☐ One term only

Action Requested
○ New Course
◉ Modification of Existing Course
○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

	A. CURRENT LISTING	B. REQUESTED LISTING
	Home Department: IOE Industrial & Operations Engin	Home Department: IOE Industrial & Operations Engin
	Course Number: 553	Course Number: 553
☒	Cross Listed Course Information: Mathematics 543	Cross Listed Course Information:
☐	Course Title:	Course Title: FINANCIAL ENGINEERING II
	TITLE ABBREVIATION — Time Sched Max = 19 Spaces:	TITLE ABBREVIATION — Time Sched Max = 19 Spaces: FINANCIAL ENGINEERING II
	TITLE ABBREVIATION — Transcript Max = 20 Spaces:	TITLE ABBREVIATION — Transcript Max = 20 Spaces: FINANCIAL ENGINEERING II
☐	Course Description:	Course Description for Official Publication (Max = 50 words): Advanced issues in financial engineering: stochastic interest rate modeling and fixed income markets, derivatives trading and arbitrage, international finance, risk management methodologies including Value-at-Risk and credit risk. Multivariate stochastic calculus methodology in fiance: multivariate Ito's lemma, Ito's stochastic integrals, the Feynman-Kac theorem and Girsanov's theorem.
	PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j	PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j
	Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ○ Tech Elective	Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ○ Tech Elective
☒	Prereq: IOE 552 ○ Enforced ◉ Advised	Prereq: IOE 552 or Math 542 ◉ Enforced ○ Advised
☐	Credit Restrictions:	Credit Restrictions:
☐	Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad; ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/addl Work. Credit Hours Min Max: ___ ___. Contact Hrs/Wk: ___. Number of Wks: ___	Level of Credit: ☐ Undergrad only ☒ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad; ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/addl Work. Credit Hours Min Max: 3 3. Contact Hrs/Wk: 3. Number of Wks: 14

C.

Repeatability (Indl Research, Dir. Study, Dissertation): Is this course repeatable? ○ Yes ◉ No. Max Hours? ___ Max Times? ___. Can it be repeated in the same term? ○ Yes ◉ No

Class Type(s): ☒ Lec ☐ Sem ☐ Dis ☐ Other ___ ☐ Rec ☐ Lab ☐ Ind
Graded Section: ☒ Lec ☐ Sem ☐ Dis ☐ Other ___ ☐ Rec ☐ Lab ☐ Ind
Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U
Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension
Course Is Y Graded ☐

Cognizant Faculty Member: Romesh Saigal
Title: Professor, IOE
Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

	Department Chair Name	Chair Signature
Home Dept.	[IOE] Mark S. Daskin	
Cross-listed Dept(s).	[MATH] Mel Hochster	

53

Form Number

2604

SUPPORTING STATEMENT

Remove cross-list with Math 543 per Mathematics department request.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN – COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number: 2573
Date: 2/3/2015
Effective Term: Winter 2016
Course Offer Freq: ☒ Indefinitely ☐ One term only

Action Requested
○ New Course
◉ Modification of Existing Course
○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING	B. REQUESTED LISTING
Home Department / Course Number	Home Department: NAVARCH Naval Arch & Marine Engin / Course Number: 260
☐ Cross Listed Course Information	Cross Listed Course Information
☐ Course Title	Course Title: Marine Systems Manufacturing
TITLE ABBREVIATION — Time Sched Max = 19 Spaces	MarineSysManuf
TITLE ABBREVIATION — Transcript Max = 20 Spaces	MarineSysManuf
☒ Course Description: Overview of the marine industry and its environment as it relates to all aspects of naval architecture and marine engineering, including industry characteristics; organization; product types and components; materials used, joining methods, shipbuilding, boat building and offshore equipment manufacturing methods; design; production engineering; planning; contracts and specifications; cost estimating; production and material control.	Course Description for Official Publication (Max = 50 words): The marine industry and its environment as it relates to all aspects that impact the production and operations of maritime products. Industrial and operations aspects of shipping/shipbuilding. Topics include industry characteristics; product types/components; shipbuilding, boatbuilding, offshore equipment manufacturing methods; design; production engineering; planning; contracts/specifications; cost estimating; production and material control.
PROGRAM OUTCOMES: ☐a ☐b ☐c ☐d ☐e ☐f ☐g ☐h ☐i ☐j ☐k	PROGRAM OUTCOMES: ☐a ☐b ☐c ☐d ☐e ☐f ☐g ☐h ☐i ☐j ☐k
Degree Requirements: ○ Degree Requirement ○ Core Course ○ Free Elective ○ Tech Elective ○ Other	Degree Requirements: ○ Degree Requirement ◉ Core Course ○ Free Elective ○ Tech Elective ○ Other
☐ Prereq: ○ Enforced ○ Advised	Prereq: NA 270 or NA 270 concurrent enrollment ○ Enforced ◉ Advised
☐ Credit Restrictions	Credit Restrictions: none
☐ Level of Credit: ☒ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work	Credit Hours Min 3 Max ___ Contact Hrs/Wk 3 Number of Wks 14
☒ Level of Credit: ☒ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work	Credit Hours Min 2 Max 2 Contact Hrs/Wk 2 Number of Wks 14

C.

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ○ Yes ○ No Max Hours? ____ Max Times? ____ Can it be repeated in the same term? ○ Yes ○ No

☐ Class Type(s): ☒ Lec ☐ Rec ☒ Lab ☐ Sem ☐ Ind ☐ Dis ☐ Other ___
Graded Section: ☒ Lec ☐ Rec ☐ Lab ☐ Sem ☐ Ind ☐ Dis ☐ Other ___
Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U
Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension
Course is Y Graded ☐

Cognizant Faculty Member: Singer — Title: Asst Professor

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info / Approved by Name / Approved Date
☐ Curriculum Comm.
☐ Faculty
☐ Cross listed Unit 1
☐ Cross listed Unit 2

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

Department	Chair Name	Chair Signature
Home Dept.	NA&ME	
Cross-listed Dept(s).		

55

Form Number

2573

SUPPORTING STATEMENT

The reduction of NA 260 from 3 to 2 credits is justified by the creation of the 3 credit hour NA 460. In the original 3 credit version of NA 260 the course covered all the topics listed above but also included material preservation and corrosion, general discussion of materials and their properties, and material joining. With the creation of NA 460 the one credit hour of material that was originally in NA 260 will now be expanded into a full 3 credit hours course. With the removal of this material NA 260 can be reduced to two credit hours.

Are any special resources or facilities required for this course? ☐ Yes ☐ No

Detail the Special requirements

COURSE DESCRIPTION:

Overview of the marine industry and its environment as it relates to all aspects that impact the production and operations of maritime products. The course is specifically focused on industrial and operations aspects of shipping and shipbuilding. The topics covered include industry characteristics; product types and components; shipbuilding, boatbuilding and offshore equipment manufacturing methods; design; production engineering; planning; contracts and specifications; cost estimating; production and material control.

COURSE TOPICS:

1. Introduction to Marine Industry
    a. Introduction to Shipbuilding Industry
    b. Introduction to the Military Shipbuilding Industry
    c. Introduction to Offshore Industry
    d. Introduction to Pleasure Boat Industry
        i. Composites Design and Technology
2. Ship and Boat Types and Components
    a. Overview of ship types focusing on ship production issues
    b. Overview of major ship components with focus on ship production
3. Modern Shipbuilding Practice
    a. Block Construction
    b. Advanced Outfitting
    c. Accuracy Control
    d. Shipyard Business strategy
    e. Shipyard Organization & Management
    f. Productivity
4. Shipyard Layout & Equipment
    a. Introduction of Welding processes
    b. Shipyard Design
    c. Productivity as a function of design
5. Global Shipbuilding Markets, Demand and Supply
    a. Global shipbuilding drivers and trends
6. Lean Manufacturing and Lean Shipbuilding
7. Six Sigma
    a. Overview of how to use basic statistics
8. Design for Production
9. Specifications and Contracts
10. Economics
    a. General overview of engineering economics
    b. General overview of how to read a balance sheet
11. Planning and Scheduling

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number 2569
Date 3/2/2015
Effective Term Winter 2016
Course Offer Freq ☒ Indefinitely ☐ One term only

Action Requested
◉ New Course
○ Modification of Existing Course
○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING		B. REQUESTED LISTING	
Home Department	Course Number	Home Department	Course Number
		NAVARCH Naval Arch & Marine Engin	280
Cross Listed Course Information		Cross Listed Course Information	
Course Title		Course Title	
		Introduction to Probability for Marine Engineers	
TITLE ABBREVIATION: Time Sched Max = 19 Spaces		TITLE ABBREVIATION: Time Sched Max = 19 Spaces	Prob Marine Eng
TITLE ABBREVIATION: Transcript Max = 20 Spaces		TITLE ABBREVIATION: Transcript Max = 20 Spaces	Prob Marine Eng
Course Description		Course Description for Official Publication (Max = 50 words)	
		Introduction to the fundamentals of probability theory, with marine applications. Events, Probabilities, Combinatorics, Independence, Bayes Theorem; Discrete and Continuous Random Variables, Central Limit Theorem, Elements of Engineering Statistics, goodness of fit, regression, correlation.	
PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j		PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j	
Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ○ Tech Elective		Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ◉ Core Course ○ Tech Elective	
Prereq		Prereq Math 116	
○ Enforced ○ Advised		◉ Enforced ○ Advised	
Credit Restrictions		Credit Restrictions	
Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work		Level of Credit: ☒ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work	
Credit Hours Min ___ Max ___	Contact Hrs/Wk ___ Number of Wks ___	Credit Hours Min 2 Max 2	Contact Hrs/Wk 2 Number of Wks 14

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ◉ Yes ○ No Max Hours? ___ Max Times? ___ Can it be repeated in the same term? ○ Yes ◉ No

C.

Class Type(s): ☒ Lec ☐ Sem ☐ Dis ☐ Other ___ ☐ Rec ☐ Lab ☐ Ind
Graded Section: ☒ Lec ☐ Sem ☐ Dis ☐ Other ___ ☐ Rec ☐ Lab ☐ Ind
Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U
Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension
Course is Y Graded ☐

Cognizant Faculty Member: Perakis
Title: Assoc Professor
Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

	Department Chair Name	Chair Signature
Home Dept.	Naval Arch & Marine Engin	
Cross-listed Dept(s).		

58

Form Number

2569

SUPPORTING STATEMENT

Recent Curriculum changes regarding modifications and additions to the lab courses, bringing them to the Junior from the Senior year, necessitated that we cancel NA387, our probability and statistics course, and move most of its statistics material to other courses (such as NA460), with its remaining material (2 credits) to be taught in the Sophomore year, to be called NA280 (2).

Are any special resources or facilities required for this course? ☐ Yes ☐ No

Detail the Special requirements

Course Title:	NA 280 Introduction to Probability for Marine Engineers
Course Function:	Required course; third year
Cognizant Faculty:	A.N. Perakis
Credit Hours:	2 credits
Schedule:	Fall and Winter Term
Prerequisites:	Prerequisite: Math 116
Short Description:	Introduction to the fundamentals of probability theory, with engineering applications. Engineering Statistics, goodness of fit, regression, correlation.
Text:	Textbook, Devore, Probability And Statistics for Engineering and the Sciences,

Outline and Time Allocation		hours
I.	Intro. to Probability and Statistics, Mechanics of NA280	1
II.	Introduction to Probability Theory	15
	Introduction - definitions	2
	Conditional prob., independence, Bayes theorem	2
	Random variables, discrete and continuous; PMF's and PDF's	3
	Mean, variance, moments and central moments of Random Variables.	2
	Examples-uniform, Poisson-exponential Gaussian; the Central Limit theorem.	3
	Functions of several random variables; joint PDF-PMF's	2
	Linear and statistical independence of RV's; correlation	1
III.	Introduction to Statistics	5
	Introduction to statistics-sampling	1
	Curve fitting, regression, correlation	2
	Goodness of fit tests, Chi2, K-S	2
IV.	Marine Applications of Probability and Statistics	5
	one Midterm and one Final Examinations	3
	Total	28

ABET Categories:	Engineering Science (0. 5), Mathematics (1. 5)
Threads Served:	Dealing with Uncertainty, Computing
Computing:	Use of educational probability and statistics software available on CAEN computers; use of spreadsheets throughout the course.

THE UNIVERSITY OF MICHIGAN – COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number: 2568
Date: 1/30/2015
Effective Term: Fall 2015
Course Offer Freq: ☐ Indefinitely ☐ One term only

Action Requested
○ New Course
○ Modification of Existing Course
◉ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING

Home Department	Course Number
NAVARCH Naval Arch & Marine Engin	370

X Cross Listed Course Information:

X Course Title: Computer Techniques

TITLE ABBREVIATION	Time Sched Max = 19 Spaces	Computer Tech
	Transcript Max = 20 Spaces	Computer Tech

☐ Course Description: Course description not available

PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k

Degree Requirements: ○ Degree Requirement ○ Core Course ○ Free Elective ○ Tech Elective ○ Other

☐ Prereq: ○ Enforced ○ Advised

☐ Credit Restrictions

☐ Level of Credit: ☒ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work

Credit Hours Min 2 Max 2; Contact Hrs/Wk 2; Number of Wks 14

B. REQUESTED LISTING

Home Department	Course Number

Cross Listed Course Information:

Course Title:

TITLE ABBREVIATION	Time Sched Max = 19 Spaces	
	Transcript Max = 20 Spaces	

Course Description for Official Publication (Max = 50 words)

PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k

Degree Requirements: ○ Degree Requirement ○ Core Course ○ Free Elective ○ Tech Elective ○ Other

Prereq: ○ Enforced ○ Advised

Credit Restrictions

Level of Credit: ☒ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work

Credit Hours Min 3 Max 3; Contact Hrs/Wk 3; Number of Wks 14

C.

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ○ Yes ○ No Max Hours? ____ Max Times? ____ Can it be repeated in the same term? ○ Yes ○ No

Class Type(s): ☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☒ Lab ☐ Ind

Graded Section: ☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☐ Lab ☐ Ind

Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U

Course Is Y Graded ☐

Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Cognizant Faculty Member: Ceccio — Title: Professor

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

Department Chair Name: Home Dept. Naval Arch & Marine Engin

Chair Signature

Cross-listed Dept(s).

61

Form Number

2568

SUPPORTING STATEMENT

Course approval form to delete NA 370 submitted at the request of the University Registrars Office.

Are any special resources or facilities required for this course? ☐ Yes ☐ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number: 2570
Date: 1/30/2015
Effective Term: Winter 2017
Course Offer Freq: ☒ Indefinitely ☐ One term only

Action Requested
○ New Course
◉ Modification of Existing Course
○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING	B. REQUESTED LISTING
Home Department: NAVARCH Naval Arch & Marine Engin	Home Department: NAVARCH Naval Arch & Marine Engin
Course Number: 391	Course Number: 391
☐ Cross Listed Course Information	Cross Listed Course Information
☒ Course Title: Marine Engineering Laboratory	Course Title: Marine Engineering Laboratory I
TITLE ABBREVIATION — Time Sched Max = 19 Spaces: Marine Engin Lab	TITLE ABBREVIATION — Time Sched Max = 19 Spaces: Marine Engin Lab I
TITLE ABBREVIATION — Transcript Max = 20 Spaces: Mar Eng Lab	TITLE ABBREVIATION — Transcript Max = 20 Spaces: Mar Eng Lab I
☒ Course Description: Instruction in laboratory techniques and instrumentation. Use of computers in data analysis. Technical report writing. Investigation of fluid concepts, hydro-elasticity, marine dynamics, propeller forces, wave mechanics, ship hydrodynamics, and extrapolation of model tests to full scale.	Course Description for Official Publication (Max = 50 words): This course is the first in a two-part capstone laboratory class. It provides experimental foundation for the Engineering Mechanics part of the curriculum. Instruction includes laboratory techniques and instrumentation, as well as error analysis. Investigations include fluid dynamics and structural mechanics. Technical report writing is stressed.
PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j	PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j
Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ○ Tech Elective	Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ◉ Core Course ○ Tech Elective
☒ Prereq: NA 321, NA 340 — ○ Enforced ◉ Advised	Prereq: NA 320, NA 310, NA 331; Concurrent enrollment with NA 321, NA 340, NA 332 — ◉ Enforced ○ Advised
☐ Credit Restrictions	Credit Restrictions: none
☒ Level of Credit: ☒ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad; ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work	Level of Credit: ☒ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad; ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work
Credit Hours Min 4 Max 4; Contact Hrs/Wk 5.5; Number of Wks 14	Credit Hours Min 3 Max 3; Contact Hrs/Wk 5; Number of Wks 14

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ○ Yes ◉ No Max Hours? ____ Max Times? ____ Can it be repeated in the same term? ○ Yes ○ No

C.

Class Type(s): ☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☒ Lab ☐ Ind
Graded Section: ☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☐ Lab ☐ Ind
Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U
Course Is Y Graded ☐
Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Cognizant Faculty Member: Perlin — Title: Professor

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Department Chair Name: Home Dept. Naval Arch & Marine Engin
Chair Signature:
Cross-listed Dept(s).:

63

Form Number

2570

SUPPORTING STATEMENT

This course will replace the former, three-credit class, NA 491, which was scheduled for the first semester senior year. As it appears that our students have less hands-on experience every year, the faculty decided to offer the class during the second semester junior year. This serves two purposes: (1) the students get the laboratory experience (that reinforces the theory they learn) in closer proximity to when they are presented with that material and (2) the students obtain hands-on experience earlier in their education. (In addition, the second part of the sequence, NA 492 will be moved from the second semester senior year to the first semester senior year so that it does not conflict with the senior capstone design class, NA 475 and for that class, the students will have then experienced all the naval architecture and marine engineering laboratories.)

As an additional note, to place this course in perspective its history is important. When this class was originally taught as 391, it had 11 labs and was four credits. Students complained of the workload and that the four credits were insufficient for the effort involved. Hence, the department decided to divide the class into two courses taught over two semesters, call the courses 491 and 492, and to allot three credits and two credits for the two classes, respectively for six labs and for four labs in each course.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number: 2597
Date: 3/4/2015
Effective Term: Fall 2015
Course Offer Freq: ☒ Indefinitely ☐ One term only

Action Requested
○ New Course
◉ Modification of Existing Course
○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING	B. REQUESTED LISTING
Home Department / Course Number	Home Department: NAVARCH Naval Arch & Marine Engin / Course Number: 514
☒ Cross Listed Course Information	Cross Listed Course Information: MFG Manufacturing 515
☐ Course Title	Course Title: Fatigue of Structures
TITLE ABBREVIATION — Time Sched Max = 19 Spaces; Transcript Max = 20 Spaces	TITLE ABBREVIATION — Time Sched Max = 19 Spaces: Fatigue of Structures; Transcript Max = 20 Spaces: Fatigue of Structures
☐ Course Description	Course Description for Official Publication (Max = 50 words): Fundamental concepts associated with fatigue damage and failure in engineering structures and contemporary design and analysis procedures with an emphasis on fatigue of welded structures, including most recent developments in finite element based fatigue design and analysis procedures, e.g., mesh-insensitive structural stress method and master S-N curve approach.
PROGRAM OUTCOMES: ☐a ☐b ☐c ☐d ☐e ☐f ☐g ☐h ☐i ☐j ☐k	PROGRAM OUTCOMES: ☐a ☐b ☐c ☐d ☐e ☐f ☐g ☐h ☐i ☐j ☐k
Degree Requirements: ○ Degree Requirement ○ Core Course ○ Free Elective ○ Tech Elective ○ Other	Degree Requirements: ○ Degree Requirement ○ Core Course ○ Free Elective ○ Tech Elective ◉ Other
☐ Prereq: ○ Enforced ○ Advised	Prereq: ○ Enforced ◉ Advised
Credit Restrictions	Credit Restrictions
☐ Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad; ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work	Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☒ Non-Rckhm Grad ☒ Ugrad or Rckhm Grad; ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work
Credit Hours Min 4 Max 4; Contact Hrs/Wk 4; Number of Wks 14	Credit Hours Min 3 Max 3; Contact Hrs/Wk 3; Number of Wks 14
☒	

C.

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ○ Yes ◉ No Max Hours? ____ Max Times? ____ Can it be repeated in the same term? ○ Yes ○ No

☐ Class Type(s): ☒ Lec ☐ Rec ☐ Sem ☐ Lab ☐ Dis ☐ Ind ☐ Other ____
Graded Section: ☒ Lec ☐ Rec ☐ Sem ☐ Lab ☐ Dis ☐ Ind ☐ Other ____
Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U
Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension
Course Is Y Graded ☐

Cognizant Faculty Member: Dong
Title: Professor
Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info / Approved by Name / Approved Date
☐ Curriculum Comm.
☐ Faculty
☐ Cross listed Unit 1
☐ Cross listed Unit 2

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.
Department Chair Name / Chair Signature
Home Dept. Naval Arch & Marine Engin
Cross-listed Dept(s). Manufacturing
Albert Shih

79

Form Number

2597

SUPPORTING STATEMENT

Structural fatigue is one of major failure modes of concern in design, manufacture, and analysis of engineering structures spanning aerospace, automotive, earth-moving equipment, marine/offshore, petrochemical and power generation industries. With an increasing pressure for cost reduction, product durability, environmental safety, computational methods that are capable of predicting fatigue life at final product level has been identified as a key enabler to achieving competitive edge in global market place. At present, there is no equivalent course offering at College of Engineering. This course should complement ME 576 (Fatigue in Mechanical Design) by focusing on computational fatigue analysis theories and methodologies at structural level, particularly on as fabricated structures such as ship and offshore structures subjected to random wave loadings.

Lab component is being dropped to facilitate online course offering, hence the reduction in credits from 4 to 3.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number 2561
Date 12/22/2014
Effective Term Fall 2015
Course Offer Freq ☒ Indefinitely ☐ One term only

Action Requested
◉ New Course
○ Modification of Existing Course
○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING	B. REQUESTED LISTING
Home Department / Course Number	Home Department: NAVARCH Naval Arch & Marine Engin / Course Number: 551
☐ Cross Listed Course Information	Cross Listed Course Information
☐ Course Title	Course Title: Offshore Engineering I
TITLE ABBREVIATION — Time Sched Max = 19 Spaces / Transcript Max = 20 Spaces	Time Sched Max = 19 Spaces: Offshore Engin I / Transcript Max = 20 Spaces: Offshore Engin I
☐ Course Description	Course Description for Official Publication (Max = 50 words): Offshore engineering structures. Introduction to hydrodynamic loads on offshore platforms. Detailed study of forces on slender bodies – risers, pipelines, cables. Morison's equation. Flow induced motions, vortex induced vibrations, galloping. Two-cylinder flows. Mathematical modeling, experiments, data processing. Marine hydrokinetic energy harnessing.
PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j	PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j
Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ○ Tech Elective	Degree Requirements: ○ Degree Requirement ◉ Free Elective ○ Other ○ Core Course ○ Tech Elective
Prereq: ○ Enforced ○ Advised	Prereq: Graduate student standing or permission of instructor — ◉ Enforced ○ Advised
☐ Credit Restrictions	Credit Restrictions
Level of Credit: ☐ Undergrad only ☐ Ugrad or Non-Rckhm Grad ☐ Rackham Grad ☐ All Credit types ☐ Non-Rckhm Grad ☐ Rckhm Grad w/add'l Work ☐ Ugrad or Rckhm Grad; Credit Hours Min Max; Contact Hrs/Wk; Number of Wks	Level of Credit: ☐ Undergrad only ☐ Ugrad or Non-Rckhm Grad ☒ Rackham Grad ☐ All Credit types ☐ Non-Rckhm Grad ☐ Rckhm Grad w/add'l Work ☐ Ugrad or Rckhm Grad; Credit Hours Min 3 Max 3; Contact Hrs/Wk 3; Number of Wks 14

C.

Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? ◉ Yes ○ No Max Hours? ____ Max Times? ____ Can it be repeated in the same term? ○ Yes ◉ No

Class Type(s): ☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☐ Lab ☐ Ind
Graded Section: ☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☐ Lab ☐ Ind
Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U
Course Is Y Graded ☐
Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Cognizant Faculty Member: Michael Bernitsas — Title: Professor

Grad Course: Attach nomination if Cognizant Faculty Is not a regular graduate faculty

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.
Department Chair Name: [illegible] — Chair Signature: [signature]
Home Dept. Naval Arch & Marine Engin
Cross-listed Dept(s).

81

Form Number

2561

SUPPORTING STATEMENT

The offshore oil and gas industry employs about 1/3 of our students overall and as many as 50% of our PhD students. The students typically took NA550 (4) as a crash course to be ready for employment. The material was not covered adequately in one course resulting in excessive work and very eight lengthy projects. In 2014-2015, we propose to replace NA550 (4) with two courses: NA551(3) offered in Fall 2014 and NA552(3) offered in Winter 2015.

NA551(3) focuses on the hydrodynamic loads on slender bodies, while NA552(3) focuses on the design of offshore platforms wave loads, dynamics of slender bodies, marine risers, mooring system dynamics.

Are any special resources or facilities required for this course? ☒ Yes ☐ No

Detail the Special requirements

The Low Turbulence Free Surface Water Channel and the resources of the Marine Renewable Energy Laboratory (MRELab) will be used to conduct vortex induced vibration testing and hydrokinetic energy harnessing. Depending on availability, the Towing Tank of the Marine Hydrodynamics Laboratories (MHL) may be used.

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number: 2586
Date: 2/13/2015
Effective Term: ~~Winter 2015~~ FT 2015

Action Requested
- ○ New Course
- ◉ Modification of Existing Course
- ○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

Course Offer Freq: ☒ Indefinitely ☐ One term only

A. CURRENT LISTING	B. REQUESTED LISTING
Home Department / Course Number	Home Department: NERS Nuclear Engin & Radiolog Sci / Course Number: 671
☐ Cross Listed Course Information	Cross Listed Course Information
☒ Course Title	Course Title: Theory of Plasma Confinement in Fusion Systems
	TITLE ABBREVIATION — Time Sched Max = 19 Spaces: Plasma Conf Fus Sys; Transcript Max = 20 Spaces: PLASMA CONF FUS SYS
☐ Course Description	Course Description for Official Publication (Max = 50 words): Study of the equilibrium, stability and transport of plasma in controlled fusion devices. Topics include MHD equilibrium for circular and non-circular cross section plasmas; magneto-hydrodynamic and micro-instabilities; classical and anomalous diffusion of particles and energy and scaling laws.
PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k	PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k
Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ◉ Tech Elective	Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ◉ Tech Elective
☐ Prereq: ○ Enforced ○ Advised	Prereq: NERS 572 ○ Enforced ◉ Advised
☐ Credit Restrictions	Credit Restrictions
☐ Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work; Credit Hours Min Max; Contact Hrs/Wk; Number of Wks	Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☒ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work; Credit Hours Min 3 Max 3; Contact Hrs/Wk 3; Number of Wks 14

C.

Repeatability (Indi Research, Dir. Study, Dissertation): Is this course repeatable? ○ Yes ◉ No; Max Hours? ___ Max Times? ___ Can it be repeated in the same term? ○ Yes ○ No

Class Type(s): ☒ Lec ☐ Sem ☐ Dis ☐ Other ___ ☐ Rec ☐ Lab ☐ Ind
Graded Section: ☒ Lec ☐ Sem ☐ Dis ☐ Other ___ ☐ Rec ☐ Lab ☐ Ind
Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U
Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension
Course Is Y Graded ☐

Cognizant Faculty Member: Alexander Thomas
Title: Associate Professor
Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Submitted By: ☒ Home Dept ☐ Cross-listed Dept.

	Department Chair Name	Chair Signature
Home Dept	Ronald Gilgenbach, Chair & Professor	
Cross-listed Dept(s).	Nuclear Engin & Radiolog Sci	

83

Form Number

2586

SUPPORTING STATEMENT

NERS 671 and 672 are two courses containing advanced material relating to magnetic confinement fusion. The courses have not been taught for a number of years, in part because there has been no active research program in this area in the Nuclear Engineering & Radiological Sciences Department. However, it is still an important core course in plasma science and engineering. Following discussions amongst faculty in the plasmas research area in the NERS Department, it was unanimously agreed that while the content is still very important and there are faculty members who could teach them, the very advanced details are beyond the scope of the program. It was therefore unanimously agreed within the Plasmas Option that the material could be reduced to the fundamentals by condensing NERS 671 and 672 into a single course, NERS 671 - Theory of Plasma Confinement in Fusion Systems. This single course could then be taught by the current cohort of faculty in the Plasmas Option.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number: 2588
Date: 2/13/2015
Effective Term: ~~Winter 2015~~ FT 2015
Course Offer Freq: ☒ Indefinitely ☐ One term only

Action Requested
○ New Course
○ Modification of Existing Course
◉ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

A. CURRENT LISTING		B. REQUESTED LISTING	
Home Department	Course Number	Home Department	Course Number
NERS Nuclear Engin & Radiolog Sci	672		
Cross Listed Course Information		Cross Listed Course Information	
Course Title		Course Title	
Theory of Plasma Confinement in Fusion Systems II			
TITLE ABBREVIATION — Time Sched Max = 19 Spaces	Plsm Con Fus Sys II	TITLE ABBREVIATION — Time Sched Max = 19 Spaces	
TITLE ABBREVIATION — Transcript Max = 20 Spaces	PLSM CON FUS SYS II	TITLE ABBREVIATION — Transcript Max = 20 Spaces	
Course Description		Course Description for Official Publication (Max = 50 words)	
Study of the equilibrium, stability and transport of plasma in controlled fusion devices. Topics include MHD equilibrium for circular and non-circular cross section plasmas; magneto-hydrodynamic and micro-instabilities; classical and anomalous diffusion of particles and energy and scaling laws.			
PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j		PROGRAM OUTCOMES: ☐a ☐c ☐e ☐g ☐i ☐k ☐b ☐d ☐f ☐h ☐j	
Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ◉ Tech Elective		Degree Requirements: ○ Degree Requirement ○ Free Elective ○ Other ○ Core Course ○ Tech Elective	
Prereq: NERS 671 ◉ Enforced ○ Advised		Prereq: ○ Enforced ○ Advised	
Credit Restrictions		Credit Restrictions	
Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☒ Ugrad or Rckhm Grad; ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/addl Work	Credit Hours Min 3 Max 3; Contact Hrs/Wk 3; Number of Wks 14	Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad; ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/addl Work	Credit Hours Min Max; Contact Hrs/Wk; Number of Wks

C.

Repeatability (Indi Research, Dir. Study, Dissertation): Is this course repeatable? ○ Yes ◉ No; Max Hours?; Max Times?; Can it be repeated in the same term? ○ Yes ○ No

Class Type(s): ☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☐ Lab ☐ Ind
Graded Section: ☒ Lec ☐ Sem ☐ Dis ☐ Other ☐ Rec ☐ Lab ☐ Ind
Grading: ☒ A-E ☐ CR/NC ☐ P/F ☐ S/U
Course Is Y Graded ☐
Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Cognizant Faculty Member: Alexander Thomas
Title: Associate Professor
Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval Info	Approved by Name	Approved Date
☐ Curriculum Comm.		
☐ Faculty		
☐ Cross listed Unit 1		
☐ Cross listed Unit 2		

Submitted By: ☒ Home Dept. ☐ Cross-listed Dept.

	Department Chair Name	Chair Signature
Home Dept.	Ronald Gilgenbach, Chair & Professor	
Cross-listed Dept(s).	Nuclear Engin & Radiolog Sci	

85

Form Number

2588

SUPPORTING STATEMENT

NERS 671 and 672 are two courses containing advanced material relating to magnetic confinement fusion. The courses have not been taught for a number of years, in part because there has been no active research program in this area in the Nuclear Engineering & Radiological Sciences Department. However, it is still an important core course in plasma science and engineering. Following discussions amongst faculty in the plasmas research area in the NERS Department, it was unanimously agreed that while the content is still very important and there are faculty members who could teach them, the very advanced details are beyond the scope of the program. It was therefore unanimously agreed within the Plasmas Option that the material could be reduced to the fundamentals by condensing NERS 671 and 672 into a single course, NERS 671 - Theory of Plasma Confinement in Fusion Systems. This single course could then be taught by the current cohort of faculty in the Plasmas Option.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

gb