Undergraduate SOE C&C Meeting - minutes

SUMMARY OF COURSE & CURRICULUM 2014

Biomedical Engineering
- Add ENVE 3120 to the biomechanics track
- Change title of BME 4710 to Tissue Engineering
- New Course – BME 4400 - Dynamical Modeling of Biological Networks
- Remove Cross listing of BME 3120 and Engr 3120
- Restrict one independent study course for 9 credits of BME Electives
- Add new course to track electives for Biomaterials and Systems, Imaging and Instrumentation

Chemical & Biomolecular Engineering
- No updates

Civil Engineering
- Removed ME 2233 Thermodynamics from curriculum
- Reinstate and require ENVE 2251 Probability & Statistics and CE 2211 Engineering Economics and Remove CE 2210 Decision Analysis from curriculum
- Update Science Elective requirements

Computer Science & Engineering
- Removed ECE 3101 from curriculum
- Added CSE 1729 as option for CSE 1010
- Updated curriculum for ECE 2001 without W
- Added new course - CSE 3100 Systems Programming
- Expanding the pre-requisites for CSE 3504

Engineering (ENGR)
- Created new course – ENGR 3209 Sustainable Energy in the 21st Century for Human Rights minor (cross listed with HRTS and POLS)
- Created new course – ENGR 3315 Manufacturing 4P: People, Planet, Process & Profit for new Manufacturing Minor
- Created new course – ENGR 3320 Production and Manufacturing for new Manufacturing Minor
- Remove cross listing of ENGR 3120 and BME 3120

Environmental Engineering
- Replace ENVE 2320 Environmental Debate with ENVE 1000 (CA2)
- Replace CE 2210 Decision Analysis with ENVE 2251 and CE 2211
- Replace ENVE 4886 and ENVE 4896 with a Professional Requirement and allow these course to satisfy the Professional Requirement
- Honors students are required to take ENVE 4886 and ENVE 4896
- Restrict double counting between ENVE courses and Professional Requirements
- Update ENVE 4210 pre-requisites with ENVE 3220 and add co-requisite of ENVE 4320
- Updated Environmental Engineering Minor description and course requirements

**Electrical & Computer Engineering**
- ECE 3212 remove ECE 3001 as pre-requisite and make it a 4 credit course
- Updated course description for ECE 3231
- EE majors that did not take Engr 1166 – ECE section will be required to complete ECE 1101
- ECE 3211 move from 3 credits to 4 credits
- Update ECE 3211 course description
- Add ECE 3212 to satisfy restricted elective of ECE 3211 or ECE 3231
- Restrict credit for both MATH 3160 and STAT 3345
- STAT 3025Q and STAT 3375 are not allowed for STAT 3345
- Add ECE 2001 to required courses and remove ECE 2001W to both EE, EngrPhys (need CLAS approval) and CompE curriculums
- Add ECE 4099W to required courses to be taken concurrent with Senior Design to both EE and CompE curriculums

**Management & Engineering for Manufacturing**
- Added a new Manufacturing Minor
- Updated pre-requisites for MEM 2211 to include more STAT courses
- Replace MEM 4915W (4 cr) with two new courses MEM 4971W (2 cr) and MEM 4972W (2 cr)
- Updated the Engineering Management minors – changed required classes to be more flexible
- Add a new Engineering Management minor for Business - Construction Track
- Replaced ECE 3002 with ECE 2000
- Updated MEM 1151 course description
- Remove BADM 3001 from the curriculum

**Materials Science & Engineering**
- Added new course – MSE 4040 - Material Selection in Mechanical Design
- Restrict MSE 2001 and 2002 to MSE majors only
- Remove restriction on MSE Graduate level courses for more than just core courses
- Reduced MSE 3700 from 4 credit to 3 credit due to contact hours
- Update professional requirements
**Mechanical Engineering**

- Update Energy and Power Concentration to include new ME 3295 - Micro-Nanoscale Energy Transport and Conversion
- Update curriculum to include ECE 2001W or ECE 2001 or ECE 2000
- Update ME 3264 pre-requisite to include ME 2234
- Update Aerospace and Energy and Power Concentrations to reflect new courses
- Update Design and Manufacturing Concentration to include special topics in Advanced Manufacturing

**Details of Approvals**

**Biomedical Engineering**

Approved – April 22, 2014 – SOE C&C

The following item was approved unanimously by the BME C&C.

1. Revision to track electives
   - 04/07/14 – "add CE/ENVE 3120 to the list of electives for the Biomechanics track" with a clause stating that "CE/ENVE 3120 and ME3250 cannot both be taken for elective credit". The motion was put forth because "ME 3250: Fluid dynamics" is a popular track elective for BME Biomechanics students. This course is often filled to capacity and the ME department struggles to service BME students. "CE/ENVE 3120: Fluid mechanics" uses the same textbook and has a similar syllabus (both syllabi are attached).

"**No more than three credits of independent study can count towards the nine credits of BME elective.**"

Approved October 7th – SOE C&C

The following item was approved by the BME C&C on Sept 24, 2014.

- Add new Track Elective to “Systems, Imaging and Instrumentation” & “Biomaterials Track”: ME 3295/5895 Special Topics in ME “Three Dimensional Imaging of Materials”.

Approved November 4th – SOE C&C

The following item was approved by the BME C&C on Nov. 03, 2014.
• Rename BME 4710 “Intro to Tissue Engineering”/BME 5700 “Biomaterials Tissue Engineering” TO “Tissue Engineering”. All other courses in department do not contain “Intro” designation and the names will now be consistent. Proposal to rename course approved Unanimously

• BME 4985(BME 6086): Dynamical Modeling of Biological Networks – Kevin Brown’s course taught as special topics for two years – add to catalogue permanently. Approved Unanimously. This Course number will be BME 4400.

• BME 3120 / ENGR 3120 – LabView for BME – ENGR 3120 was created to allow non-BME students to take this course. Currently, all 3000 level BME courses are listed as BME only. Creates problems with catalog since the requirements need to be the same for cross-listed courses. Propose to remove BME/ENGR 3120 cross list to allow for different requirements in catalogue. SOE will place a restriction to “Engr. majors only” so that non-BME students can take the course as ENGR 3120. Approved Unanimously.

Amended: Both courses cannot be taken for credit. ENGR 3120 add School of Engineering majors only.

All items approved. (MAE, Nov 4, 2014).

Civil Engineering

Approved October 7th – SOE C&C

University of Connecticut
Civil Engineering Program
Undergraduate Course & Curriculum Change Proposals
Approved by CEE C&C April 7, 2014
Approved by CEE Faculty April 23, 2014
Revised and presented to CEE Faculty September 10, 2014

PROPOSAL: Replace Thermodynamics and Decision Analysis with Engineering Economics and Probability and Statistics

Background:
• Thermodynamics is no longer covered on the civil engineering section of the FE exam.
• Thermodynamics is not included in the CE program requirements in ABET.
• In an ad hoc survey of CE curriculums at 10 peer institutions, only two required thermodynamics (Penn State and Georgia Tech). Others NOT requiring thermodynamics include Maryland, Virginia, Illinois, Minnesota and Colorado. Berkeley and Texas-Austin require a choice between thermodynamics or dynamics.
• Instructors in CE 2210 have found it difficult to cover all of the engineering economics and probability and statistics topics in one semester with 3 credits.
• The one credit’s worth of engineering economics topics in CE 2210 does not cover enough to give students preparation for application on the FE exam or in practice.

Proposal:
• Split the one credit of engineering economics topics out of CE 2210 and cover the existing probability and statistics topics in the full three credits. Instead of CE 2210, CE students would be required to take CE 2251, a cross-listed version of ENVE 2251 which is still on the books. STAT 3025 would continue to be acceptable as a substitute.
• Update the course description of CE / ENVE 2251 to match the current probability and statistics content in CE 2210.
• Require the existing CE 2211 for all CE students and expand the course description to be more complete.
• Create a new one credit follow-on course in engineering economics as an elective: CE 2212 to cover additional topics in project evaluation, which would be useful for students interested in construction engineering and management.
• Drop the requirement of taking ME 2233 Thermodynamics.

Current course descriptions:

CE 2210. Decision Analysis in Civil and Environmental Engineering
(201) (Also offered as ENVE 2330.) Three credits. Prerequisite: MATH 1122Q or 1132Q. May not be taken for credit if the student has taken CE 2251, 281, 2211 or ENVE 2251.

CE 2211. Engineering Economics
One credit. Prerequisite: Open only to Civil Engineering majors, instructor consent. Not open for credit to students who have taken CE 2210 or ENVE 2330.
Time value of money. Evaluation of alternative projects.

ENVE 2251. Probability and Statistics in Civil Engineering
(251) Three credits. Recommended preparation: MATH 1121Q or 1131Q. This course and ENVE 2330 or CE 2210 may not both be taken for credit.
Application of statistical principles to the analysis of civil engineering problems. Topics include probability, random variable distributions, hypothesis testing, and linear regression analysis.

Proposed course descriptions:

**CE 2211. Engineering Economics I**
One credit. Prerequisite: Open only to Civil and Environmental Engineering majors. Not open for credit to students who have taken CE 2210 or ENVE 2330.

**CE 2212. Engineering Economics II**
One credit. Prerequisite: CE 2210 or 2211 or ENVE 2330.
Evaluation of engineering projects under consideration of depreciation, bonds, inflation, uncertainty in cash flow profiles and life cycle costs.

**CE 2251. Probability and Statistics in Civil and Environmental Engineering**
(251) Three credits. Recommended preparation: MATH 1121Q or 1131Q or 1151Q. This course and ENVE 2330 or CE 2210 or ENVE 2251 may not both be taken for credit.
Fundamentals of probability theory and statistics. Hypothesis testing, linear and multiple regression.

**ENVE 2251. Probability and Statistics in Civil and Environmental Engineering**
(251) Three credits. Recommended preparation: MATH 1121Q or 1131Q or 1151Q. This course and ENVE 2330 or CE 2210 or CE 2251 may not both be taken for credit.
Fundamentals of probability theory and statistics. Hypothesis testing, linear and multiple regression.
Current Curriculum Requirements in Catalog:

Civil Engineering majors are required to complete the following:

- **CE 2110, 2210, 2410, 2710, 3110, 3120, 3510, 3630 or 3640** and **4900W** and **4920W**;
  - **ENVE 2310; CE 3520 or ENVE 3200; CE 3610 or ENVE 3220**
- A minimum grade of C- is required in each of the following courses: **CE 2110, CE 2210, ENVE 2310, CE 2410, 2710, 3110, 3120, 3510 and 4900W** and **4920W**;
- **CHEM 1128Q or 1148Q; ME 2233; ENGR 1166** (section offered by the CEE Department recommended); **MATH 2110Q and 2410Q**;
- Professional Requirements courses (18 credits);
- Science elective (minimum of 3 credits);
- Elective courses (as needed to reach 128 credits total).

The professional requirements are satisfied by eighteen (18) credits of 2000-level or higher courses in engineering, science or mathematics or MGMT 5335. At least one course each from four of the following different technical areas must be selected:

- Construction Management Engineering – **CE 4210**
- Environmental/Sanitary Engineering – **ENVE 3220, 4310** (**ENVE 3220** may be used only to fill the professional requirements by students who have taken **CE 3610**)
- Geotechnical Engineering – **CE 4510, 4530, 4541**
- Hydraulic/Water Resources Engineering – **ENVE 4810, 4820**
- Structural Engineering – **CE 3630 or 3640**
- Surveying/Geodetic – **CE 4410**
- Transportation Engineering – **CE 4710, 4720, 4750**

No course that was used to meet another Civil Engineering course requirement may double count as a Professional Requirement. Courses taken from the above list but not used to fulfill the four technical area requirements may be used to satisfy remaining professional requirements.

Following is a list of suggested courses that may also be considered for the professional requirements: **ENVE 3220** or **CE 3610** (if both taken); **CE 3520 or ENVE 3200** (if both taken); **GSCI 3710; CE 3630 or CE 3640** (if both taken); **CE 4610; CE 4730; CE 4740; ENVE 4800; EEB 3247; ECE 2000**.

The science elective may be satisfied by **BIOL 1107; GSCI 1050; GSCI 1051; PSYC 1100; EEB 2208; GEOG 1300; GSCI 3710; ENVE 4320; NRE 3105, NRE 4135**; or any other science course outside of CHEM or PHYS approved by the CE Program.

The Civil Engineering undergraduate program educational objectives are to prepare our alumni/ae with the knowledge and skills needed to: actively contribute to the advancement practice and profession of engineering practice in the public or private sectors in the technical areas of environmental, geotechnical, structural, transportation, and water resources engineering; recognize the importance of, and follow a path that can lead to licensure as professional engineers who design and construct solutions to civil engineering problems in the natural and built environments; and adopt and continuously practice life-long learning through post-graduate and professional education.
Proposed Revisions to Curriculum Requirements for Catalog (includes changes approved in a previous SOE C&C meeting):

Civil Engineering majors are required to complete the following:

- CE 2110, 2210, 2211, 2251, 2410, 2710, 3110, 3120, 3510, 3630 or 3640 and 4900W and 4920W; ENVE 2310; CE 3520 or ENVE 3200; CE 3610 or ENVE 3220
- A minimum grade of C- is required in each of the following courses: CE 2110, 2210, CE 2211, CE 2251, ENVE 2310, CE 2410, 2710, 3110, 3120, 3510 and 4900W and 4920W;
- CHEM 1128Q or 1148Q; ME 2233; ENGR 1166 (section offered by the CEE Department recommended); MATH 2110Q and 2410Q;
- Professional Requirements courses (18 credits);
- Science elective (minimum of 3 credits);
- Elective courses (as needed to reach 128 credits total).

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- Construction Management Engineering – CE 4210
- Environmental/Sanitary Engineering – ENVE 3220, 4310 (ENVE 3220 may be used only to fill the professional requirements by students who have taken CE 3610)
- Geotechnical Engineering – CE 4510, 4530, 4541
- Hydraulic/Water Resources Engineering – ENVE 4810, 4820
- Structural Engineering – CE 3630 or 3640
- Surveying/Geodetic – CE 4410
- Transportation Engineering – CE 4710, 4720, 4750

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The Civil Engineering undergraduate program educational objectives are to prepare our alumni/ae with the knowledge and skills needed to: actively contribute to the advancement practice and profession of engineering practice in the public or private sectors in the technical areas of environmental, geotechnical, structural, transportation, and water resources engineering; recognize the importance of, and follow a path that can lead to licensure as professional engineers who design and construct solutions to civil engineering problems in the natural and built environments; and adopt and continuously practice life-long learning through post-graduate and professional education.
Computer Science & Engineering

Approved – September 2, 2014 – SOE C&C

Tabled – new course below on 4/22/14 – it will be taught as special topics in the fall semester


CSE 3100. Systems Programming. Three credits. Two 1-hour lectures and one 2-hour laboratory per week. Prerequisite: CSE 2100.

Introduction to system level programming with an emphasis on C programming, process management and small scale concurrency with multi-threaded programming. Special attention will be devoted to proficiency with memory management and debugging facilities both in a sequential and parallel setting.

List of Topics:
Part I: C (12 lectures)
C language Introduction
Control flow
Structures
Arrays, pointers and pointer arithmetic
Memory management (malloc/free)
Build process (compile / link / build –make–)
Debuggers (gdb example)

Part II: Process fundamentals (4 lectures)
Process and Address Space
Process lifecycle (fork/exec/wait)
File handle inheritance
File-based IPC (pipes)
Signals

Part III: Tools (4 lectures)
Profiling (gprof, dtrace, instruments, shark)
Memory leaks, memory corruption (dmalloc,valgrind)

Part IV: Small Scale concurrency (in-process) (6 lectures)
POSIX threads
Spinlocks
Mutexes
Semaphores
Conditions
Monitors
Producer/Consumer
Thread local storage

Approved November 4th – SOE C&C
Curriculum changes in CSE for C&C Meeting, November 4, 2014
(approved by CSE department February 2014 except 3.)

1. Approve the removal of ECE3101 from the CSE required courses and place the course on the PR list.


(approved by CSE Dept C&C, 11/3/2014. Dept. approved.)

3. Change the prerequisites for CSE 3504 from “Prerequisite: CSE 2100 and 2500; and one of STAT 3025Q or 3375Q or MATH 3160.” to “Prerequisite: CSE 2100 and 2500; and one of STAT 3025Q or 3345Q or 3375Q or MATH 3160.”
### Approved new CSE curriculum

**Computer Science & Engineering**

**Bachelor of Science in Engineering Program**

**Catalog Year 2015-2016**

#### FRESHMAN YEAR

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<td>CHEM 1127Q or 1147Q-Gen. Chem. I or Honors Chem I</td>
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<td>PHYS 1501Q-Engineering Phys. I</td>
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<td>MATH 1131Q- Calculus I</td>
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<td>MATH 11132Q-Calculus II</td>
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<td>ENGL 1010 or ENGL 1011-Acad. Writing</td>
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<td>CSE 1102-Object Oriented Design</td>
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<td>CSE 1729 - Intro to Principles of Programming or CSE 1010 - Intro Computing for Engineers</td>
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<td>Area 2 (Social Science)</td>
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#### SOPHOMORE YEAR

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<td>MATH 2410Q-Differential Equations</td>
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<td>MATH 2110Q-Multivariable Calculus</td>
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<td>CSE 2500-Intro to Discrete Systems</td>
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<td>CSE 2100 – Data Structures &amp; Intro to Algorithms</td>
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<td>ECE 2001 – Electric Circuits</td>
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<td>PHIL 1104 (Area 1) - Phil. and Social Ethics</td>
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#### JUNIOR YEAR

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<td>CSE 2102-Intro. to Software Engr.</td>
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<td>CSE 4302 - Advanced Computer Architecture</td>
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<td>CSE 3666- Intro. to Comp. Arch.</td>
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<td>CSE 3504- Prob. Perf. Analy. of Computer Sys.</td>
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<td>CSE 3500- Algorithms and Complexity</td>
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<td>CSE 3000-Contemporary Issues in CSE or CSE 3002-Social, Ethical and Prof. Issues in CSE</td>
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#### SENIOR YEAR

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<td>CSE 4940(^2)-CS &amp; E Design Project II</td>
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<td>CSE 3502-Theory of Computation</td>
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<td>CSE 4100 - Prog. Language Translation or CSE 4102 - Programming Languages</td>
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<td>CSE 4300-Operating Systems</td>
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1. This course must be chosen from the list of MATH 3160Q- Probability, STAT 3025Q Statistical Methods I, STAT 3345Q- Probability Models for Engineers or STAT 3375Q Introduction to Mathematical Statistics.
2. Professional Requirement courses must be chosen so that there is a minimum of 43 CSE credits.
3. The minimum number of credits for this degree is 126. Your choice between CSE 3000 or 3002 will determine the amount of elective credit needed.

**Removed ECE 3101 from curriculum**
Proposal to Add a New Undergraduate Course

1. Date: September 19, 2014
2. Department requesting this course: School of Engineering
3. Semester and year in which course will be first offered: Spring 2015

Final Catalog Listing

Assemble this after you have completed the components below. This listing should not contain any information that is not listed below!

ENGR 3209. Sustainable Energy in the 21st Century
Three credits. Open to sophomores or higher

Political, socioeconomic, environmental, science and engineering challenges of energy sources; comparison of feasibility and sustainability of energy policies around the world

Items Included in Catalog Listing

Obligatory Items
1. Standard abbreviation for Department, Program or Subject Area: ENGR
2. Course Number: 3209
3. Course Title: Sustainable Energy in the 21st Century
4. Number of Credits: 3
5. Course Description (second paragraph of catalog entry):

Political, socioeconomic, environmental, science and engineering challenges of energy sources; comparison of feasibility and sustainability of energy policies around the world

Optional Items
6. Pattern of instruction, if not standard: Lectures and discussion
7. Prerequisites, if applicable: None
   a. Consent of Instructor, if applicable: None
b. Open to sophomores/juniors or higher: X
8. Recommended Preparation, if applicable: None
9. Exclusions, if applicable: None
10. Repetition for credit, if applicable: None
11. Skill codes “W”, “Q” or “C”: None
12. University General Education Content Area(s), if any: Content Area 2
   a. If Content Area 1, specify a CLAS area, A-E: ____
   b. Justification for inclusion in CLAS area, A-E:
      (Please consult CLAS guidelines for areas A-E.)
13. S/U grading: No

Justification

1. Reasons for adding this course:
   Energy is truly an interdisciplinary and interconnected topic that requires a holistic approach. At UConn, there are a number of courses that focus on some aspects of energy but there is no course that brings together the political, socioeconomic, environmental, and engineering aspects of developing sustainable energy systems. This course provides a much-needed comprehensive understanding of energy sources and their policy implications.

2. Academic merit:
   This course will help students list and explain the main sources of energy and their primary applications in the US and the world; evaluate and compare the true costs of different energy sources on the economy, environment, politics and society; describe the principles of sustainability and compare the sustainability of different energy sources; understand the basics of the science and engineering behind different energy technologies; describe the challenges and problems associated with the use of various energy sources; understand the connection between energy, social justice, human rights, environment and public health, and compare different national approaches to energy policy and evaluate the sources of differences and similarities among them.

3. Overlapping courses:
   Other courses in the school of engineering focus on engineering aspects of some renewable energy technologies (ME), or environmental analysis of renewable energy systems (ENVE). None offer the comprehensive relationship between the technology, the environment, political systems and international relations proposed in this course.

4. Number of students expected: 55+
5. Number and size of sections: 1 section
6. Effects on other departments: This course will be cross-listed with POLS and HRTS. Professor from CHEG and POLS will co-teach the course. Therefore, the proposal has also been approved by POLS and HRTS.

7. Effects on regional campuses: none

8. Staffing: Prof. Richard Parnas

Syllabus

A syllabus for the new course is attached
Course Description:
States are increasingly under pressure to reform their energy policies given the concerns with global climate change, declining sources of affordable fossil fuels and the geopolitics of supply security. While the need for clean energy seems obvious, the transition to a low-carbon, sustainable economy in many countries around the world has been neither inevitable nor smooth. Needless to say, there are many technological and economic challenges: which energy sources provide the most viable and affordable replacement for fossil fuels? What are the potential and pitfalls of different energy technologies? To what extent can alternative energy sources be integrated into our existing technical and economic systems? How sustainable are they? What would be the cost and benefits to the citizens and the economy in general of reliance on alternative energy sources?

In addition to the technical and economic challenges, there are also many sociopolitical factors that explain why some countries are successful at promoting clean energy alternatives while others continue to perpetuate the dominance of fossil fuels in their economies. This raises questions such as: how are governments responding to opposing pressures to reform their energy policies? Who are the key players in energy debates and who are excluded? What are the human rights concerns associated with access to sustainable energy sources? How are energy issues framed by different interest groups? What are the public perceptions of energy choices and what do governments do to secure public legitimacy for long-term energy reforms? What is the appropriate role of government in supporting the development of alternative energy sources? How are political decisions on energy reform made? Which political institutions make the adoption of energy reforms more likely?

This course provides an interdisciplinary approach to understanding current energy issues. It covers the science, engineering and economics behind alternative energy sources as well as the current energy policies and the politics behind these policies on a cross-national basis. By the end of this course, students will have a fuller understanding of energy dynamics around the world. They will learn how to realistically evaluate the merits of alternative energy resources that can help create a more sustainable future.

Course Objectives:
Upon completion of the course, the students should be able to:

1) List and explain the main sources of energy and their primary applications in the US and the world

2) Evaluate and compare the true costs of different energy sources on the economy, environment, politics and society as well as relations among countries
3) Describe the principles of sustainability and compare the sustainability of different energy sources

4) Understand the basics of the science and engineering behind different energy technologies

5) Describe the challenges and problems associated with the use of various energy sources

6) Understand the connection between energy, social justice, human rights, environment and public health

7) Compare different national approaches to energy policy and evaluate the sources of differences and similarities among them

Course Requirements:

A. 2 Midterm Exams: (100 pts each) The exams will consist of short answer questions. We will provide a review sheet for the exams and distribute them a week before the exams. The questions on the exams will come from the review sheet.

B. Poster Project: (100 pts) You will be put into groups of 3 or 4 in the beginning of the semester and asked to choose a topic for research from a list of topics that we will provide. Your group research will be presented as a poster at the end of the semester. The poster session will be open to the whole UConn community to view. We will have guest judges to evaluate the merits of your project and presentation. You will also be asked to provide a short memo on your project to be handed to us before your poster presentation. Detailed instructions for the memo and poster presentation will be provided in the beginning of the semester.

C. Final Exam: (100 pts) The exam, which will be cumulative, will consist of a set of short answer questions. We will provide a review sheet for the exam and distribute it during the last week of the semester. The date of the final TBA.

Required Readings:
All required readings (listed below) are available on the huskyct under course readings. For some of the readings, the links are provided below.

Some Suggested Readings:
David J. C. MacKay, Sustainable Energy without the Hot Air (UIT Cambridge 2008)
Robert L. Evans, Fueling Our Future: An Introduction to Sustainable Energy (Cambridge University Press 2007)


Other important information:

- We will provide you with a review sheet before the exams to help you prepare for them. We will also dedicate some class time to your questions before the midterms. You can also use the HuskyCT to exchange questions/answers with your classmates.

- If you miss an exam because of an emergency (documentation required), you can be given a make-up exam. However, you need to notify us of your reason for the absence in advance. **If you miss the make-up exam that is scheduled for everyone, you will not be given another opportunity.** There will be no exceptions to this policy.

- Students are required to be available for the final exam. Students must visit the Dean of Students Office if they cannot make their exam. The DOS will give the student his or her instructions thereafter. Please note: vacations, previously purchased tickets or reservations, weddings (unless part of the wedding party), and other large or small scale social events, are not viable excuses for missing a final exam. Please contact the Dean of Students office with any questions.

- Academic dishonesty will not be tolerated. For information regarding the university policy, see Section VI of “The Student Conduct Code” available at [http://www.dosa.uconn.edu](http://www.dosa.uconn.edu) by clicking on “Judicial Affairs”, then clicking on “Part VI: Academic Integrity in Undergraduate Education and Research”. Also see the link to “Judicial Process FAQ” which is available from [http://www.dosa.uconn.edu](http://www.dosa.uconn.edu) after clicking on the “Judicial Affairs” link. Also, for useful information on plagiarism and the proper use of sources and citations, see “Writing Sources: A Guide for Harvard Students” at: [http://www.fas.harvard.edu/~expos/sources/](http://www.fas.harvard.edu/~expos/sources/)

- Our class is available through the HuskyCT. On our class website, you can find the calendar for important dates, the syllabus, lecture outlines (under course materials), grades, links to additional resources, a discussion board and class email list. We will use the HuskyCT to communicate with you: to distribute
useful information, test preparation hints and other material. It will also allow you to ask us questions and to learn from other students’ questions.

Schedule of Topics and Readings for the Course

PART I:
FOSSIL FUEL DEPENDENCE

Week 1:

Introduction
Energy Profile of the U.S. and the World

Distribution of reserves (conventional vs. unconventional),
energy production and consumption patterns, key energy actors

Readings:
US Department of Energy, Energy Literacy: Essential Principles and
IEA, World Energy Outlook Executive Summary 2013
IEA, Key World Energy Statistics 2013

Week 2:

Fossil Fuel Addiction (I): Economic Consequences

Supply security concerns, economic costs to consumers and
governments, resource curse, the Dutch disease, energy poverty

Readings:
Working Paper (June 2010)
Prices,” Foreign Affairs (July/August 2011)
Yergin, Daniel, “There will be Oil” The Wall Street Journal (September
17, 2011)
Frankel, Jeffrey, “The Natural Resource Curse: A Survey” Harvard
Kennedy School Faculty Research Working Paper Series (February
2010)

Week 3:

Fossil Fuel Addiction (II): Environmental Consequences

Oil spills and accidents, energy-related air/water pollution,
greenhouse emissions, public health issues

Readings:
“How has Fracking Changed Our Future?” National Geographic (Feb 19
2013) http://energyblog.nationalgeographic.com/2013/02/19/the-
big-energy-question-how-has-fracking-changed-our-future/
“Tar Sands Fever!” WorldWatch Institute (January 8, 2014)
http://www.worldwatch.org/node/5287
“The Lasting Impact of Deepwater Horizon: Five Reasons We Can’t Forget About the BP Oil Spill” Center for American Progress (19 April 2012)

“Arctic Oil Spill is Certain if Drilling Goes Ahead, Says Top Scientist” The Guardian (19 September 2013)
http://www.theguardian.com/world/2013/nov/19/arctic-oil-drilling-russia

Week 4:
Fossil Fuel Addiction (III): Political, Human Rights and National Security Consequences
Oil conflicts/wars, resource nationalism, oil weapon, pipeline politics, oil-related human rights violations, oil curse and democracy deficit

Readings:
Kelley, Michael “Look at the Conflicts That Were and Will be Caused By Oil” Business Insider (Jun 28 2012)
http://www.businessinsider.com/how-oil-has-driven-global-conflict-for-the-past-100-years-presentation-2012-6?op=1

Week 5:
Review Session/Group Time

MIDTERM 1

PART II:
SUSTAINABILITY OF ALTERNATIVE ENERGY SOURCES

Week 6:
Non-Fossil, Non-Renewable Energy Source: Nuclear

Readings:
http://www.eia.gov/nuclear/. Explore this web site and follow the links to gain an understanding of the nuclear fuel cycle, and relative benefits and
problems of nuclear generated electric power compared to fossil fuel generated electric power.

**Renewable Energy: Hydropower**

*Readings:*

http://www.canyonhydro.com/guide/index.html

Look through all the slides in this guide to building your own small hydropower system. Identify the critical concepts and the practical considerations.

**Week 7:**

**Renewable Energy: Solar, Geothermal**

*Readings:*


Explore this web site and follow the more detailed links to photovoltaics and to concentrated solar power to gain an understanding of the major technologies and relative benefits compared to other forms of energy production.

**Renewable Energy: Wind**

*Readings:*

http://en.wikipedia.org/wiki/Wind_turbine

Explore this web site and follow the more detailed link to wind turbine design to learn the key design requirements. Focus especially on the materials and production of the blades using composite materials.

**Week 8:**

**Renewable Energy: Biomass**

*Readings:*

http://www.afdc.energy.gov/

Explore this web site and follow the more detailed links to gain an understanding of relative benefits and deficiencies of the different types of fuels compared to standard petroleum fuels such as gasoline and diesel.


**Week 9:**

Spring Break – No classes

**Week 10:**

Electricity- Generation, Transmission and Use

Energy Efficiency and Conservation

*Readings:*

http://www.canyonhydro.com/guide/index.html


**Week 11:**

Review Session/Group Time

*MIDTERM 2*

**PART III: ENERGY POLICIES AND CHALLENGES**

**Week 12:**

Government Policy Tools for Sustainability

*Readings:*


**Week 13:**

Comparative Energy Policies: Economic, Technological and Political Challenges

*Readings:*

- Busby, J., “Chapter II: Overcoming Political Barriers to Reform in Energy Policy,” in Sharon Burke and Christine Parthemore (eds). *A Strategy*
Week 14:

**State of Connecticut and UCONN Energy Policies**

*Readings:*

- State Of Connecticut, Department of Energy and Environmental Protection website
- UCONN Office of Environmental Policy website
  [http://ecohusky.uconn.edu/](http://ecohusky.uconn.edu/)

Week 15:

**POSTER SESSION (Location TBA- open to public)**

**Conclusions**

- BME 3120 / ENGR 3120 – LabView for BME – ENGR 3120 was created to allow non-BME students to take this course. Currently, all 3000 level BME courses are listed as BME only. Creates problems with catalog since the requirements need to be the same for cross-listed courses. Propose to remove BME/ENGR 3120 cross list to allow for different requirements in catalogue. SOE will place a restriction to “Engr. majors only” so that non-BME students can take the course as ENGR 3120. Approved Unanimously.

  **Amended:** Both courses cannot be taken for credit. ENGR 3120 add School of Engineering majors only.

**Approve two new courses for the new Manufacturing Minor**

**ENGR 3315: Manufacturing 4P: People, Planet, Process & Profit (3 credits)**

Manufacturing has changed dramatically over time. The focus has changed due to increased concerns for the safety of their workers and designs to avoid overuse injuries; environmental concerns to minimize pollution and reduce material use and increase recycling; new fabrication techniques that must be considered and their impact on quality, and the profitability resulting from the interaction of all of these variables. This course will discuss how the 4P’s are impacted as the product progresses from design through production.

Schedule:
Week 1:
1. Overview of course and outline of learning objectives
2. Complexity of Manufacturing – factors that must be considered in the process, for control, risk, quality, cost, etc.

Week 2:
- Review of the Overall Product Design Process, including cost commitment by phase

Week 3:
- Design for X – how the process can optimize different outcomes, including manufacturing, repair, and recycling

Week 4:
- Human Factors Design

Week 5:
- Design for Sustainability and the Environment

Week 6:
- Quality, Robust Design, and Optimization; Midterm Exam

Week 7&8:
- Process Design and Improvement
  a. Process mapping
  b. Improvement techniques such as lean
  c. Procedure creation

Week 9:
- Impact of New/different Fabrication Techniques on Designs and Costs

Week 10&11:
- Cost Evaluation

Week 12:
- How all these factors impact the product during its manufacturing cycle

Week 13:
- Review
- Exam

ENGR 3320: Production and Manufacturing (3 credits) (Prerequisite is ENGR 3315)

Production & Manufacturing introduces the key topics of material selection and sustainability into the manufacturing curriculum. Material selection is discussed in terms of both the product being produced as well as the production equipment employed in the process. Material selection is discussed throughout the course as part of 3 case studies and in the description of general manufacturing methods for plastics, metals and fluids. Sustainability is emphasized in two of the case studies focusing on biofuels and the use of biomass waste for construction materials. Interactions between these two themes are brought out in discussions on material selection criteria for end-of-life product handling.
Schedule:
Week 1
  – Introduction and overview
  – Introduction to materials and properties

Week 2 (Material selection for products)
  – Product material selection for performance requirements
  – Product material selection for end of life disposal requirements

Week 3 (Material selection for processing equipment)
  – Introduction to processing equipment
  – Processing equipment material selection for manufacturing conditions

Week 4 (Case study 1: Biofuels from low grade wastes)
  – Introduction to liquid fuels and biofuels
  – Processing low grade wastes into fuels – the sulfur problem

Week 5 (Case study 1)
  – Process alternatives to meet the sulfur specification in biodiesel from FOG waste
  – Material selection issues for processing equipment using highly corrosive HCl

Week 6 (Case study 2: Particleboard from agricultural waste)
  – Industry requirements for particleboard and other construction panels
  – Processing agricultural waste biomass into particleboard

Week 7 (Case study 2)
  – Material selection to compensate for low properties of biofibers and high water content
  – Midterm exam

Week 8 (Case study 3: Metal forming – need to develop this case study)
  – Process introduction and alternatives
  – Material selection for product performance

Week 9 (case study 3)
  – Processing conditions for different applications
  – Material selection for processing equipment at different conditions

Week 10 (Plastics)
  – Molding processes
  – Drawing processes

Week 11 (Metals)
  – Forming by casting & forging
  – Joining by welding

Week 12 (Fluids processing)
  – Chemical reactors
  – Separation & purification by distillation and membranes

Week 13
  – Review
– Final exam
Environmental Engineering
Approved October 7th – SOE C&C

Environmental Engineering Undergraduate Program Meeting
Apr. 21, 2014

Minutes
Program Members present: Alex Agrios, Manos Anagnostou, Ross Bagtzoglou, Chad Johnston, Baikun Li, Lanbo Liu, Allison MacKay, Tim Vadas, Guiling Wang

A. Old Business

   None.

B. New Business

   1. Publicity - Thanks for putting together posters; shout out to Will Jolin and Jon Drasdis

   2. Change in Decision Analysis organization in CE to separate Engineering Economics (see appended details)

      a. Are both topics needed?

      The faculty supported inclusion of both topic areas in the ENVE curriculum and opened discussion for pathways to implement additional requirements in Engineering Economics without increasing the total credit count of the BS ENVE beyond 128 credits. Consensus was that CE 2211 was the only required Engineering Economics course to integrate into the curriculum with CE 2212 being an optional elective for ENVE students.

      b. If so, how to manage

         i. Add 1-credit (or 2-credits) to program?

         ii. Revise curriculum to integrate 2 credits?

      Consideration to place CE 2211 into the ENVE curriculum by replacing an existing credit expanded to consider the role of ENVE 2320 Environmental Debate and ENVE 4886 Thesis I and ENVE 4896 Thesis II.

      ENVE 2320 serves a function in ABET accreditation of introducing students to the global and societal impacts of engineering decisions and could be replaced by requiring students to take ENVE 1000 Environmental Sustainability (CA2). Students could then also use ENVE 1000 to fulfill a CA2 requirement (and will be written in as such on the semester-by-semester sequence).

      ENVE 4886 and ENVE 4896 serves a stronger function to prepare students for graduate school, a path that is not pursued by all of the ENVE majors. Optional status of this course would tend to attract students who are self-motivated to pursue the independent tasks necessary for a successful outcome. The 3-credits of thesis could then be replaced by 3-credits of Professional Requirements.
Credit balance as follows:

<table>
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<tr>
<th>Current credit allocation</th>
<th>Resultant credit allocation of replacement sequence</th>
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<tbody>
<tr>
<td>1 cr</td>
<td>ENVE 2320</td>
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<tr>
<td>3 cr</td>
<td>CE 2210</td>
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<tr>
<td>3 cr</td>
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<td>ENVE 1000 (CA)</td>
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<td>CE/ENVE 2251</td>
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<td>Prof Req</td>
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<td></td>
<td>CE 2211</td>
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3. Management of the ENVE thesis option – Honors students only?

Thesis requirement for Honors students is consistent with the Honors program requirement.

C. Future Business to address our web presence through (1) discussion of faculty expertise alignment, (2) redesign of web page (a) graduate program, (b) undergraduate program

D. Motions

1. Motion to replace ENVE 2320 *Environmental Debate* (1 cr) with ENVE 1000 *Environmental Sustainability* (CA2) (3 cr) and to replace CE 2210/ENVE 2330 *Decision Analysis in Civil and Environmental Engineering* (1 cr) with CE/ENVE 2251 *Probability and Statistics in Civil Engineering* (3 cr) and CE 2211 *Engineering Economics* (1 cr).

   Second: Tim Vadas
   Vote: 9-0-0

   *Rationale:* Changes implemented to coordinate with decision of Civil Engineering program to integrate full course in probability and statistics and two 1-credit courses in engineering economics into curriculum.

   *Caveat:* Motion dependent upon passage of appended C&C item at Apr. 23, 2014 Civil and Environmental Engineering Departmental faculty meeting.

2. Motion to replace ENVE 4886 *Thesis I* and ENVE 4896 *Thesis II* with Professional Requirement and the provision that three credits of Professional Requirement could be satisfied by ENVE 4886 *Thesis I* and ENVE 4896 *Thesis II*.

   Second: Ross Bagtzoglou
   Vote: 9-0-0

3. Motion to require Environmental Engineering Honors students to take ENVE 4886 *Thesis I* and ENVE 4896 *Thesis II*.

   Second: Guiling Wang
4. **Motion to edit catalog text** (i) to integrate changes from prior three motions, (ii) to clarify professional requirements in Environmental Engineering by listing courses explicitly in subject areas, and (iii) to forbid double-counting between Professional Requirements and other ENVE course requirements.
Second: Ross Bagtzoglou

Vote: 11-0-0 (via email)

Current description:
Environmental Engineering majors are required to complete the following:
CE 2110, 3120/ENVE 3120 (or CHEG 3123); CHEG 2111; ENVE 3270; CHEM 1128Q (or 1148Q); ENGR 1166; ENVE 2310, 2320, 2330, 3200, 3220, 3230, 4210, 4310, 4810 or 4820, 4910W, 4920W, 4886, and 4896; MATH 2110Q and 2410Q; ENVE 4320 and one of the following: NRE 3105, 3205, 3155; and NRE 4135 (or GSCI 3710/ENVE 3530); Elective course (6 credits); Professional Requirements courses (9 credits).

Professional Requirements include at least one course each to strengthen three of the following nine focus areas: Data Collection and Analysis, Renewable Energy, Systems Analysis, Environmental Chemistry, Environmental Biology, Water Resources, Geoenvironmental Processes, Atmospheric Processes, and Management and Policy. The following courses may be used to meet the Professional Requirements:

- AH 3275;
- ARE 3434 and 4462;
- CE 2410, 3510, 4210, 4410, 4530;
- CHEG 3151, 4147;
- CHEM 2241, 4370;
- EEB 3205;
- ENVE 3530, 4810, 4820;
- GEOG 3320W, 3340, 3400, and 4500;
- GSCI 3510;
- LAND 3230W;
- MARN 3016 and 4030W;
- MCB 2610;
- ME 3239, 3263, 3270, 3285;
- MEM 2221;
- NRE 3105, 3205, 3125, 3145, 3155, 3245, 3535, 4135, and 4165, 4175;
- OSH 4570;
- SOIL 3410 and 4420

New description:
Environmental Engineering majors are required to complete the following:
CE 2110, 2211, 3120/ENVE 3120 (or CHEG 3123); CHEG 2111; ENVE 3270; CHEM 1128Q (or 1148Q); ENGR 1166; ENVE 1000, 2310, 2320, 2330, 2251, 3200, 3220, 4100, 4310, 4810 or 4820, 4910W, 4920W, 4886, and 4896; MATH 2110Q and 2410Q; ENVE 4320 and one of the following: NRE 3105, 3205, 3155; and NRE 4135 (or GSCI 3710/ENVE 3530); Elective course (6 credits); Professional Requirements courses (9–12 credits).

Professional Requirements include at least one course each to strengthen three-four of the following nine focus areas: Data Collection and Analysis, Renewable Energy, Systems Analysis, Environmental Chemistry, Environmental Biology, Water Resources, Geoenvironmental Processes, Atmospheric Processes, and Management and Policy. Three credits of Professional Requirements may be replaced with the two-semester sequence, ENVE 4886 and 4896. The following courses may be used to meet the Professional Requirements:

- **Data Collection and Analysis** – NRE 3535; GEOG 4500; ME 3263; CE 2410, 4410
- **Renewable Energy** – ME 3270, 3285; Engineering courses offered as Special Topics in Renewable Energy
- **Systems Analysis** – CHEG 3151, 4147; CE 4210
- **Environmental Chemistry** – CHEM 2241, 4370; SOIL 3410, 4420; MARN 4030 W; NRE 3155
- **Environmental Biology** – MCB 2610; MARN 3016; NRE 3105, 3205
- **Water Resources** – ENVE 4810, 4820; NRE 3125, 4135, 4165
- **Geoenvironmental Processes** – CE 3510, 4350; ENVE 3530; GSCI 3510; NRE 4165
- **Atmospheric Processes** – GEOG 3400; NRE 3145, 4175; ME 3239
- **Management and Policy** – AH 3275; ARE 3434, 4462; EEB 3205; GEOG 3320W, 3340; LAND 3230W; MEM 2221; NRE 3245; OSH 4570
No course that was used to meet another Environmental Engineering requirement may double count as a Professional Requirement. Environmental Engineering Honors students are required to take ENVE 4886 and ENVE 4896.

Environmental Engineering Program Meeting Minutes
Sept. 12, 2014

In Attendance: Alex Agrios, Manos Anagnostou, Ross Bagtzoglou, Lanbo Liu, Allison MacKay, Tim Vadas

Announcements
None.

0. Motion to approve minutes from Apr. 21, 2014 and Sept. 5, 2014 meetings.
Second: Tim Vadas, Vote; 7-0-0

A. Old Business

1. Positioning our Program to capitalize on funding/collaboration opportunities: What potential calls may be coming? What strengths to we bring? What new linkages do we need to cultivate?

Excerpts from UCONN Strategic Plan (Appended)
Core Values: Innovation, Leadership, Global Engagement, Diversity
Goals for excellence: Research & Scholarship, Undergraduate Education, Graduate Education, Teaching Effectiveness, Public Engagement

B. New Business

1. Course Catalogue Revisions

   a. Motion to add ENVE3220 Water Quality Engineering as a prerequisite, and ENVE4210 Environmental Engineering Chemistry as a co-requisite to ENVE4320 Ecological Principles and Engineering. Second: Tim Vadas, Vote: 5-0-2

   Rationale: Both ENVE3220 and ENVE4210 were recommended preparation in the past. ENVE4320 was initially offered as a special topics course with few restrictions, but now has been integrated into the curriculum as a senior year course. ENVE4320 relies on previous knowledge of water quality contaminants and treatment technologies as well as fundamental physical-chemical processes. The major focus on physical-chemical processes comes after mid-semester and thus ENVE4210 is acceptable as a co-requisite.

   Current Description:

   4320. Ecological Principles and Engineering
   Three credits. Prerequisite: Enrollment in the School of Engineering. Recommended preparation: ENVE 3220 and 4210.
An introduction to ecology and natural treatment systems for managing waste and pollutants with a focus on aqueous contaminants. Topics will include stormwater management, treatment wetlands, restoration ecology, composting, and bioremediation.

New Description:

4320. Ecological Principles and Engineering
Three credits. Prerequisite: ENVE 3220; Enrollment in the School of Engineering. Corequisite: ENVE 4210. Recommended preparation: ENVE 3220 and 4210.

b. Motion to change the catalogue description for the Environmental Engineering Minor Second: Tim Vadas, Vote: 7-0-0

Rationale: Revision to catalogue description will list eligible elective courses explicitly, rather than reference a departmental list. This will allow easy tracking of eligible courses according to catalogue year as it will be in the permanent University record. Reference to the list for the Environmental Engineering major will enable the Program to maintain a single list of Area 1-9 courses.

Current Description:

Environmental Engineering Minor
This minor can significantly enhance and strengthen the educational experience of students to provide a firm basis for understanding the impact of human activity and pollutants on the environment as well as the need for environmentally sound manufacturing processes and sustainable development.

It requires completion of 18 credits including the following:

- An approved Plan of Study and ENVE/CE 2310, ENVE 3220/CE 3320, 4310; ENVE 3230.
- Six elective credits from an approved list of 2000-level and above courses, but not more than 3 credits of research.

The minor is offered by the Environmental Engineering Program(weblink). For more information, contact Dr. Amvrossios Bagtzoglou atacb@engr.uconn.edu.

New Description:

Environmental Engineering Minor
This minor can significantly enhance and strengthen the educational experience of students to provide a firm basis for understanding the impact of human activity and pollutants on the environment, as well as the need for environmentally sound manufacturing processes and sustainable development.

It requires completion of 18 credits including the following:

1. An approved Plan of Study and ENVE/CE 2310, ENVE 3220/CE 3320, 4310, ENVE 3230.
2. Six elective credits chosen from an approved list of 2000+ level and above courses, but not more than 3 credits of research, as follows:
   a. Three credits each from two different areas of approved Professional Requirements for the BS in Environmental Engineering, or
   b. Six credits chosen from ENVE 3200, 3270, 4210, 4320, or
   c. Three credits chosen from ENVE 3200, 3270, 4210, 4320 and three credits from approved Professional Requirements for the BS in Environmental Engineering.

The minor is offered by the Environmental Engineering Program(weblink). For more information, contact Dr. Amvrossios Bagtzoglou at acl@engr.uconn.edu.
# NORMAL SEMESTER BY SEMESTER COURSE SEQUENCE (128 credits)

<table>
<thead>
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<th>Cr.</th>
<th>Second Semester</th>
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<td>CHEM 1128Q General Chemistry</td>
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<td>ENGR 1000 Orientation to Engineering</td>
<td>1</td>
<td>ENGR 1166 Foundations of Engineering</td>
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<td>CSE 1010 Intro to Computing for Engineers</td>
<td>3</td>
<td>ENVE 1000 Environmental Sustainability (CA2)</td>
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<td>(1) ENGL 1010 Seminar in Academic Writing</td>
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<td>or ENGL 1011 Sem. in Writing thru Literature</td>
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<td>MATH 2110Q Multivariable Calculus</td>
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<td>CE 2110 Applied Mechanics I</td>
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<td>ENVE 2310 Environmental Eng’g Fundamentals</td>
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<td>ENVE 3120 Fluid Mechanics</td>
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<td>ENVE 3270 Environmental Microbiology</td>
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<td>ENVE 4210 Environ. Engineering Chemistry</td>
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<td>CE 2211 Engineering Economics</td>
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<td>ENVE 4320 Ecological Principles &amp; Eng’g (3) Elective</td>
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<td>(2) GenEd: CA 4 (3) Elective</td>
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<td>Free elective</td>
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**NOTES:**

1. These courses may be taken either semester in the first year.
2. CA = Content Area in General Education (GenEd) Requirements (For current lists of GenEd courses, visit [http://geoc.uconn.edu](http://geoc.uconn.edu)). These courses may be taken at any time and CA assignments to particular semesters are indicative only.
There are 7 total ELECTIVE courses that are to be selected to meet the following requirements:

**Natural Resource Requirement (1 Course):**
- NRE 3155- Water Quality Management (Fall semester even years) OR
- NRE 3205-Stream Ecology (Summer semester) OR
- NRE 3105-Wetlands Biology & Conservation (Fall odd yrs)

**Earth Science Requirement (1 Course):**
- NRE 4135-Intro. to Groundwater Hydrology (Fall semester) OR
- ENVE 3530- Engr. & Env. Geology (Spring semester, odd years)

**Hydrologic Science Requirement (1 Course)**
- ENVE 4810-Engineering Hydrology (Fall semester) OR
- ENVE 4820-Hydraulic Engineering (Spring semester)

**Professional Electives (4 Courses):** At least one course from four different focus areas (see pg. 2 for list of approved courses). ENVE 4886 Thesis I (1 cr) plus ENVE 4986 Thesis II (2 cr) may fulfill one professional elective. Honors students must fulfill one professional elective using ENVE 4886 + 4986. ENVE 4886 + 4986 is recommended as a professional elective for students planning to pursue graduate studies. Courses used to fulfill Natural Resource, Earth Science or Hydrologic Science requirements cannot also count as Professional Electives.

### ENVE Professional Requirements

<table>
<thead>
<tr>
<th>Area 1: Data Collection and Analysis</th>
<th>Area 6. Water Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOG 4500 Introduction to GIS</td>
<td>ENVE 4820. Hydraulic Engineering</td>
</tr>
<tr>
<td>ME 3263 Introduction to Sensors and Data Analysis</td>
<td>NRE 3125 Watershed Hydrology</td>
</tr>
<tr>
<td>CE 2410 Geomatics &amp; Spatial Measurement</td>
<td>NRE 4135. Introduction to Groundwater Hydrology</td>
</tr>
<tr>
<td>CE 4410 Computer Aided Site Design</td>
<td>NRE 4165. Soil and Water Management and Engineering</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area 2. Renewable Energy</th>
<th>Area 7. Geoenvironmental Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 3270 Fuel Cells</td>
<td>CE 3510. Soil Mechanics</td>
</tr>
<tr>
<td>ME 3285 Sustainable Energy Sources and Systems</td>
<td>CE 4530. Geoenvironmental Engineering</td>
</tr>
<tr>
<td>* Courses offered as Special Topics in Renewable Energy also qualify as PR under this area</td>
<td>ENVE 3530. Engineering and Environmental Geology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEG 3151. Process Kinetics</td>
<td>GEOG 3400. Climate and Weather</td>
</tr>
<tr>
<td>CHEG 4147. Introduction to Process Dynamics and Control.</td>
<td>NRE 3145. Meteorology</td>
</tr>
<tr>
<td>CE 4210. Operations Research in Civil and Environmental Engineering</td>
<td>NRE 4175 Environmental Meteorology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 2241. Organic Chemistry</td>
<td>AH 3275. HAZWOPER</td>
</tr>
<tr>
<td>SOIL 3410. Soil Chemistry Components</td>
<td>ARE 4462. Economics of Natural Resource Use</td>
</tr>
<tr>
<td>SOIL 4420. Soil Chemistry Processes</td>
<td>EEB 3205. Current Issues in Environmental Science</td>
</tr>
<tr>
<td>MARN 4030W. Marine Biogeochemistry</td>
<td></td>
</tr>
<tr>
<td>NRE 3155. Water Quality Management</td>
<td></td>
</tr>
</tbody>
</table>
MCB 2610. Fundamentals of Microbiology  
GEOG 3320W. Environmental Evaluation and Assessment  
MARN 3016. Marine Microbiology  
GEOG 3340. Environmental Planning and Management  
NRE 3105. Wetlands Biology and Conservation  
LAND 3230W. Environmental Planning and Landscape Design  
NRE 3205. Stream Ecology  
MEM 2221. Principles of Engineering Management  
NRE 3245. Environmental Law  
OSH 4570. Pollution Control, Prevention and Environmental Management Systems

Electrical & Computer Engineering

Approved November 7th – SOE C&C

Motions: ECE CCC, November 2014.

1. *ECE 3211 becomes a four-credit course and its catalog description changes to two 75-minute lectures and a 2-hour lab per week instead of two 1-hour lectures and a 2-hour lab per week.*

   The change is suggested to reflect the workload and commitment required in the class and also be consistent with ECE 3212, which is also 4 credits.

   New description:
   
   **3211. Power Electronics**
   
   (214) Three Four credits. Two 1-hour 75-minute lectures and one 2-hour laboratory.
   
   Prerequisite: ECE 3201; open only to students in the School of Engineering. This course and ECE 3610W may not both be taken for credit.

   Power converters for power processing, regulation, and control as applied to computer and telecommunication systems, transportation systems, industrial drives, and renewable power conversion systems. Power semiconductor device characteristics, transformers, and dc/dc converters including design projects.

2. *Add ECE3212 as a restricted elective substitute for ECE 3211 or ECE3231.*

   This should have been added as a restricted elective when ECE3212 was created as a new course last year.

3. *Disallow students from claiming credit for both STAT3345 and MATH3160 since both cover similar material*

4. *Do not allow STAT3025 or STAT3375 as substitutes for STAT3345*
The courses are not designed for engineering majors, and despite there being statements in the Catalog that one may not be taken if the other is, the overlap does not extend to the breadth of statistics knowledge that we intend our undergraduates to have.

5. *The normal course of ECE study (electrical engineering, computer engineering and engineering physics) should include only ECE2001, and no longer ECE2001W.*

The primary reason for this is that the workload in ECE2001W is unreasonably high, and it is felt by faculty and students alike that either this should become a 5-credit course or the W should be removed.

6. *The normal course of study (electrical engineering and computer engineering) should include ECE4099W in the seventh semester.*

The intention is that this one-credit independent study would be taken alongside senior design and thus make senior design a six-credit sequence consistent with other majors.
### FRESHMAN YEAR

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1131Q – Calculus I</td>
<td>4</td>
<td>MATH 1132Q – Calculus II</td>
</tr>
<tr>
<td>CHEM 1127Q – Gen. Chem. I</td>
<td>4</td>
<td>PHYS 1501Q – Engineering Physics I</td>
</tr>
<tr>
<td>CSE 1010 – Intro. to Computing for Engr.</td>
<td>3</td>
<td>CSE 1102 – Object Oriented Design or ENGR 1166 – Foundations of Engineering</td>
</tr>
<tr>
<td>ENGL 1010 or 1011 – Writing</td>
<td>4</td>
<td>Arts and Humanities course</td>
</tr>
<tr>
<td>ENGR 1000 – Orientation to Engr.</td>
<td>1</td>
<td>Elective</td>
</tr>
</tbody>
</table>

### SOPHOMORE YEAR

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 2001 – Electric Circuits</td>
<td>4</td>
<td>CSE 2300W – Logic Design</td>
</tr>
<tr>
<td>MATH 2110Q – Multivariable Calculus</td>
<td>4</td>
<td>ECE 3101 – Signals and Systems</td>
</tr>
<tr>
<td>MATH 2410Q – Differential Equations</td>
<td>3</td>
<td>ECE 3201 – Electronic Devices &amp; Circuits</td>
</tr>
<tr>
<td>PHYS 1502Q – Engineering Physics II</td>
<td>4</td>
<td>PHIL 1104 – Philosophy and Social Ethics</td>
</tr>
<tr>
<td>ENGL 1010 or 1011 – Writing</td>
<td>4</td>
<td>Arts and Humanities course</td>
</tr>
<tr>
<td>Arts and Humanities course</td>
<td>2</td>
<td>Diversity and Multiculturalism course</td>
</tr>
<tr>
<td>Elective</td>
<td>3</td>
<td>16</td>
</tr>
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</table>

### JUNIOR YEAR

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
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</thead>
<tbody>
<tr>
<td>ECE 3001 – EM Fields and Waves</td>
<td>3</td>
<td>ECE 3111 – Systems Analysis</td>
</tr>
<tr>
<td>Restricted Elective</td>
<td>3</td>
<td>Restricted Elective</td>
</tr>
<tr>
<td>Restricted Elective</td>
<td>3</td>
<td>Restricted Elective</td>
</tr>
<tr>
<td>MATH 2210Q – Linear Algebra</td>
<td>3</td>
<td>Social Sciences course</td>
</tr>
<tr>
<td>Diversity and Multiculturalism course</td>
<td>3</td>
<td>Elective</td>
</tr>
</tbody>
</table>

### SENIOR YEAR

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 4901 – E&amp;CE Design I</td>
<td>2</td>
<td>ECE 4902 – E&amp;CE Design II</td>
</tr>
<tr>
<td>ECE 4099W – Independent Study w-writing</td>
<td>1</td>
<td>Professional Requirement</td>
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<tr>
<td>Professional Requirement</td>
<td>3</td>
<td>Professional Requirement</td>
</tr>
<tr>
<td>Professional Requirement</td>
<td>3</td>
<td>Design Laboratory</td>
</tr>
<tr>
<td>Design Laboratory</td>
<td>3</td>
<td>Social Sciences course</td>
</tr>
<tr>
<td>Diversity and Multiculturalism course</td>
<td>3</td>
<td>15</td>
</tr>
</tbody>
</table>

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4 The three-semester sequence of PHYS 1201Q-1202Q followed by PHYS 1230 or 1530 may be taken instead to satisfy this requirement. However, only eight credits of PHYS 1201-1202-1230/1530 can be used toward the required 126 credits for the Engineering degree.

2 The courses from content areas one (Arts and Humanities) and two (Social Sciences) must be from four different departments. One course from either content area one (Arts and Humanities) or content area two (Social Sciences) may also be used to fulfill one of the requirements from content area four (Diversity and Multiculturalism). One course from content area four must be an international course.

3 The four restricted electives must be selected as follows: ECE 3211 or ECE 3231 or ECE 3212; ECE 3221 or ECE 4201; ECE 4211 or ECE 4225; and ECE 4111 or ECE 4112.

4 Four professional requirements are chosen from 3000 or 4000-level Math, Science, and Engineering courses. Two must be ECE courses.

5 Choose two from ECE 3225, ECE 3411, ECE 3421, ECE 4079, ECE 4113, ECE 4122, ECE 4132, ECE 4225, ECE 4242, ECE 4244, ECE 4401, and ECE 4402.
# COMPUTER ENGINEERING 2015-16

## FRESHMAN YEAR

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>MATH 1131Q – Calculus I</td>
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<td>4</td>
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<tr>
<td>CSE 1010 – Intro. to Computing for Engr.</td>
<td>3</td>
<td>CSE 1102 – Object Oriented Design</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 1010 or 1011 – Academic Writing</td>
<td>4</td>
<td>Arts and Humanities course²</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 1000 – Orientation to Engineering</td>
<td>1</td>
<td>Elective</td>
<td>3</td>
</tr>
</tbody>
</table>

| Total | 16 | 17 |

## SOPHOMORE YEAR

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 2110Q – Multivariable Calculus</td>
<td>4</td>
<td>MATH 2410Q – Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 1502Q – Engineering Physics II</td>
<td>4</td>
<td>ECE 2001 – Electric Circuits</td>
<td>4</td>
</tr>
<tr>
<td>CSE 2100 – Data Structures &amp; Algorithms</td>
<td>3</td>
<td>CSE 2500 – Intro to Discrete Systems</td>
<td>3</td>
</tr>
<tr>
<td>CSE 2300W – Logic Design</td>
<td>4</td>
<td>PHIL 1104 – Philosophy and Social Ethics</td>
<td>3</td>
</tr>
<tr>
<td>Social Sciences course²</td>
<td>3</td>
<td>Diversity and Multiculturalism course²</td>
<td>3</td>
</tr>
</tbody>
</table>

| Total | 15 | 16 |

## JUNIOR YEAR

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 3101 – Signals and Systems</td>
<td>3</td>
<td>ECE 3401 – Digital Systems Design</td>
<td>3</td>
</tr>
<tr>
<td>ECE 3201 – Electronic Devices &amp; Circuits</td>
<td>4</td>
<td>ECE 3411 – Microprocessor App. Lab or CSE 4903 – Microprocessor Lab</td>
<td>3</td>
</tr>
<tr>
<td>CSE 3666 – Intro. to Computer Architecture</td>
<td>3</td>
<td>CSE 2102 – Intro to Software Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MATH 2210Q – Linear Algebra</td>
<td>3</td>
<td>STAT 3345Q – Probability Models Engineers</td>
<td>3</td>
</tr>
<tr>
<td>Social Sciences course²</td>
<td>3</td>
<td>Diversity and Multiculturalism course²</td>
<td>3</td>
</tr>
</tbody>
</table>

| Total | 16 | 15 |

## SENIOR YEAR

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 4901 – E&amp;CE Design I</td>
<td>2</td>
<td>ECE 4902 – E&amp;CE Design II</td>
<td>3</td>
</tr>
<tr>
<td><strong>ECE 4099W – Independent Study writing</strong></td>
<td>1</td>
<td>ECE 3421 – VLSI Design &amp; Simulation</td>
<td>4</td>
</tr>
<tr>
<td>ECE 3221 – Digital Integrated Circuits</td>
<td>3</td>
<td>Professional Requirement¹</td>
<td>3</td>
</tr>
<tr>
<td>CSE 4300 – Operating Systems</td>
<td>3</td>
<td>Professional Requirement¹</td>
<td>3</td>
</tr>
<tr>
<td>Professional Requirement³</td>
<td>3</td>
<td>Diversity and Multiculturalism course²</td>
<td>3</td>
</tr>
<tr>
<td>Design Laboratory⁴</td>
<td>3</td>
<td></td>
<td>16</td>
</tr>
</tbody>
</table>

| Total | 16 |

¹The three-semester sequence of PHYS 1201Q-1202Q followed by PHYS 1230 or 1530 may be taken instead to satisfy this requirement. However, only eight credits of PHYS 1201-1202-1230/1530 can be used toward the required 126 credits for the Engineering degree.

²The courses from content areas one (Arts and Humanities) and two (Social Sciences) must be from four different departments. One course from either content area one (Arts and Humanities) or content area two (Social Sciences) may also be used to fulfill one of the requirements from content area four (Diversity and Multiculturalism). One course from content area four must be an international course.

³Choose three (3) from: ECE 3111, ECE 3431/CSE 3802, ECE 4111, ECE 4112, ECE 4121, ECE 4131, ECE 4243, CSE 3300, CSE 3504, and CSE 4302. At least one of the three must be ECE 4111, ECE 4112, or CSE 3504.

⁴Choose one (1) from: CSE 3350/ECE 4401, CSE 4901/ECE 4402, ECE 4132, ECE 4242, and ECE 4244.

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**Approved October 7th – SOE C&C**

**Motions: ECE CCC, September 18th, 2014.**

1. The ECE3001 prerequisite is to be removed from ECE 3212. Also ECE3212 will become a four credit course.

2. A final sentence will be added to the course description for ECE3231:
-3231. Introduction to Modern Power Systems. Three credits. Lecture. Prerequisite: ECE 2001W; open only to students in the School of Engineering. Fundamentals of power system planning, operation, and management. Power generation, transmission and distribution. Sustainable energy sources such as photovoltaics, solar-thermal power, wind farms, and their grid integration. Modern power system monitoring/control, fault analysis, and transient stability analysis using computer tools. Use of power system simulation tool e.g. PSS/E for power system planning.

(3) The EE curriculum will be changed such that any student who takes a non-EE version of ENGR1166 (as opposed to CSE1102 or the EE version of ENGR1166) must also take ECE1101. The one-credit course ECE1101 will be re-tooled to teach C.
Management & Engineering for Manufacturing

Approved October 7th – SOE C&C

Changes to Management and Engineering for Manufacturing (MEM) courses for Catalog 2015-2016.

**Motion #1:** Change the description of MEM 2211 to include all relevant topics that have been historically included in the class. Also, change the prerequisites to include all acceptable first courses in statistics, not just STAT 1100Q.

Rationale: Several Engineering topics have been taught in this course, but they were not adequately described, leading to an inaccurate depiction. Production optimization had been taught previously, but did not appear explicitly in the course description either. Any first course in statistics provides a sufficient background for the course content, and this should therefore be reflected in the catalogue.

Proposed catalogue wording with new additions underlined:
MEM 2211. Introduction to Manufacturing Systems
Three credits. Prerequisite: STAT 1000Q or STAT 1100Q or 3025Q or 3345Q or 3375Q, or CE 2210 or 2251, or MATH 3160.

Presents fundamental engineering aspects of manufacturing and allows students to become familiar with common processes in manufacturing such as cutting, casting, and bending while also introducing advanced techniques such as additive manufacturing. From the business perspective, students will gain familiarity with an overview of manufacturing operations management, production optimization, and the systems used in controlling manufacturing enterprises including the concepts of global competition, and manufacturing as a competitive weapon.

**Motion #2:** Change the description of MEM 1151 to include “lean concepts in business and engineering.”

Rationale: Lean concepts had been taught previously, but did not appear explicitly in the course description.

Proposed catalogue wording with new additions underlined:
MEM 1151. Introduction to the Management and Engineering for Manufacturing Program
Introduction to the goals of engineering and management for manufacturing enterprises, including lean concepts in business and engineering. Review of the history of technological development, including its effects on new products and processes. Written and oral communication skills will be developed

**Motion #3:** Introduce two new two-credit listings (proposed as MEM 4971W and 4972W) that split the content of the existing four-credit course MEM 4915W (Advanced Manufacturing Systems) to be delivered across two consecutive semesters, Fall and then Spring. Correspondingly, the set of required courses for MEM in the catalog will remove MEM 4915W and add MEM 4971W and MEM 4972W.

Rationale: The existing course has included the MEM Senior Design project, and the feedback of ABET reviewers and the MEM Industrial Advisory Board has indicated that a two-semester format is more appropriate for a senior-design experience, allowing appropriate time for interaction with external sponsors and a complete iterative approach to design. This new format would make MEM Senior Design consistent with other School of Engineering senior-design formats.

Proposed catalogue wording:
MEM 4971W. Senior Design Project 1
Two credits. Three 1-hour classes per week. Prerequisite ME 3221 and MEM 2211; ENGL 1010 or 1011 or 2011 or 3800. Not open to students who have passed MEM 4915W.

Part 1 of the capstone design course for the MEM Program. This semester will cover manufacturing and production cases in preparation for the senior design experience. Both written and oral reports are required. Students will also complete the first phase of their two-semester engineering design project focused on product/process creation or improvement, including problem definition, background, and a preliminary proposal. The Business and Engineering faculty will be jointly involved.

MEM 4972W. Senior Design Project 2
Two credits. One 2-hour class per week. Prerequisite MEM 4971W. Not open to students who have passed MEM 4915W.
Part 2 of the capstone design course for the MEM Program. Students will perform the design, fabrication, and testing of their product design; or implementation, testing, and procedure writing for their process design. The proposal from MEM 4971W will guide the fabrication, or implementation, and testing, to meet a detailed specification of engineering requirements. Both written and oral reports will be required. The Business and Engineering faculty will be jointly involved.

Motion #4: Change the curriculum requirements for the MEM major, replacing ECE 3002 with ECE 2000.
Rationale: This is a book-keeping change to update our curriculum to reflect changes made by the ECE department.

Motion #5: Update Plans of Study for the Minor in Engineering Management. (New Plans of study are attached as separate documents.) Minor updates are made to the existing EMME and EMMB plans (for the Engineering and Business versions of the minor, respectively) and a new version, EMMB-C, Engineering Management Minor, Business-Construction Track is introduced.
Rationale: The EMME POS has a new list of approved courses, including CE 4210 (Operations Research in Civil and Environmental Engineering) and several 1000-level ENGR classes, reflecting a review of relevant courses made by members of the MEM faculty. The EMM-B has only subtle organizational changes, updating prerequisite information and streamlining wording. The EMMB-C is a proposed new construction track, defined in consultation with the Civil Engineering dept., removing MEM 2211 (Intro to Manufacturing Systems) as required and instead requiring the Accounting dept.’s BADM 2710 (Principles of Managerial Accounting).

Approved November 7th – SOE C&C

MEM program

Motion #1: Remove BADM 3001 from required course for MEM majors
Rationale: School of Business has removed this for all business majors
MINOR IN ENGINEERING MANAGEMENT – ENGINEERING CONCENTRATION

The minor in Engineering Management – Engineering Concentration is designed to provide students with non-engineering majors with an understanding of the engineering activities involved in managing organizations and technology development including: i) planning, organizing, allocating, and controlling activities and resources, ii) project management, and iii) operations management, and entrepreneurship.

PLAN OF STUDY – MINOR IN ENGINEERING MANAGEMENT – ENGINEERING CONCENTRATION

DIRECTIONS: Complete the following information and turn in 2 copies of this sheet, with a copy of your UNOFFICIAL TRANSCRIPT, highlighting the courses you are using to meet the minor, attached. Submit your plan of study sheet with attached transcripts during the first four weeks of the semester in which you intend to graduate.

Additional Details: Students who have taken OPIM 3104 Operations Management are required to take a third elective and cannot take MEM 2221. This includes all School of Business Majors.

Name________________________ Major________________________ Anticipated Graduation Date_____/____Mo/Yr
Student ID #________________ Local Address________________________ Phone (____)________________
Student Signature________________________________________________________________________________ Date______________

Courses being used to complete the minor – please list them below:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Dept</th>
<th>No.</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____</td>
<td>MEM</td>
<td>2221</td>
<td>Introduction to Engineering Management</td>
</tr>
<tr>
<td>_____</td>
<td>OPIM</td>
<td>3801</td>
<td>Principles of Project Management</td>
</tr>
<tr>
<td>_____</td>
<td>MEM</td>
<td>2211</td>
<td>Introduction to Manufacturing Systems</td>
</tr>
</tbody>
</table>

Electives - choose two courses from the recommended electives listed on the reverse side, or three if you have completed OPIM 3104. Only one 1000 level course may be used toward completion of the minor.

_____ _____ _____ __________________________________________
_____ _____ _____ __________________________________________
_____ _____ _____ __________________________________________

Bring to: School of Engineering Undergraduate Programs Office

For School of Engineering Use Only

Signature of Associate Dean, School of Engineering [Effective Winter 2009]
Interested students must complete the listed requirements.

CORE REQUIRED COURSES INCLUDE:

MEM 2221. Introduction to Engineering Management. Either semester. Three credits. Prerequisite: Open to sophomores, juniors, and seniors. Not open to students who have passed or are taking OPIM 3104 or BADM 3761. Will not substitute for OPIM 3104 for students who enter the School of Business. Will not substitute for BADM 3761. May not be used to satisfy Junior-Senior level major requirements of the School of Business. The fundamentals of engineering management tasks of planning and control; the human element in production, research, and service organizations; the stochastic nature of management systems.

OPIM 3801. Principles of Project Management. Three credits. Prerequisite: Instructor consent; open to juniors or higher. This course provides an introduction to the concepts necessary for both project managers and project team members to deliver successful projects on time, on budget and in scope. The phases and knowledge areas of project management, as defined by the Project Management Institute (PMI), are covered as well as the tools and techniques in each area for successful project management. An introduction to Microsoft Project software will also be covered.

MEM 2211. Introduction to Manufacturing Systems. Three credits. Prerequisite: STAT 1000Q or 1100Q or 3025Q or 3345Q or 3375Q, or CE 2210 or 2251, or MATH 3160. Overview of manufacturing operations management and the systems used in controlling manufacturing enterprises including the concepts of global competition, lean concepts in business and engineering, and manufacturing as a competitive weapon.

RECOMMENDED ELECTIVE COURSES: (Only one 1000 level course may be used toward completion of the minor.)

CE 4210. Operations Research in Civil and Environmental Engineering. Three credits. Prerequisite: CE 2210, or STAT 1000Q or 1100Q. This course and CE 256 may not both be taken for credit. Resource allocation subject to constraints. One and two-phase simplex method for linear programming. Optimization of non-linear problems.

CSE 1000. Computers in Modern Society. Three credits. Two class periods and two 1-hour program design periods. Not open for credit to students who have passed CSE 110C or CSE 130 or CSE 1010 or CSE 1100. Introduction to computer applications in the humanities, social sciences, business, and other fields. Influence of the computer on modern society and technology. Elements of computer usage in the solution of numeric and non-numeric problems including introduction to programming methods.

CSE 1010. Introduction to Computing for Engineers. Three credits. Two 1-hour lectures and one 2-hour laboratory. Not open for credit to students who have passed CSE 110, 130 or 1100. Introduction to computing logic, algorithmic thinking, computing processes, a programming language and computing environment. Knowledge obtained in this course enables use of the computer as an instrument to solve computing problems. Representative problems from science, mathematics, and engineering will be solved.


ENGR 1101. Living in an Engineered World. Three credits. A survey course that provides students an insight into the technical world around them. As a society in the 21st Century, we will be faced with a rapidly changing world influenced greatly by the advances in technology, the history of technological changes and the continued need for conservation of energy and sustainability.

ENGR 1166. Foundations of Engineering. Three credits. Prerequisite: Not open to Junior or Senior students in the School of Engineering. Not open for credit for students who have passed ENGR 151. Introductory topics in a specific engineering major. Topics selected by Department or Program, or Regional Campus faculty. Students to select section based on their selected or intended major. In the context of the discipline, students would develop skills transferable to other engineering disciplines.

ENVE 2320. The Environmental Debate II. One credit. Structured review of environmental issues and active debate during class time Presentation of current environmental issues by environmental professionals and experts.

ME 3221. Manufacturing Automation. Three credits. Prerequisite: Consent of instructor. Not open to students who have passed ME 5440. Introduction to Computer Integrated Manufacturing (CIM), Fundamentals of automated manufacturing; Computer Numerical Control (CNC); production economics and optimization of production systems.

ME 3222. Production Engineering. Three credits. Prerequisite: Consent of instructor. Not open to students who have passed ME 5441. Introduction to the modern techniques of Production Systems including the Decision-Making Process, Economic Analysis, Demand Forecasting, Production and Process Design and Optimization, Production Scheduling, and Statistical Quality Control.
MINOR IN ENGINEERING MANAGEMENT – BUSINESS CONCENTRATION

The minor in Engineering Management – Business Concentration is designed to provide students with non-business majors with an understanding of the principles of managing organizations involved in engineering activities and technology development including: i) planning, organizing, allocating, and controlling activities and resources, ii) project management, and iii) operations management, and entrepreneurship.

Requirements:

- A minimum of five (5) 3-credit courses, which must include three core required courses: (i) Either MEM2221 Principles of Engineering Management or BADM 3761 Operations Management; (ii) OPIM 3801 - Principles of Project Management, and (iii) MEM 2211 - Introduction to Manufacturing Systems; and two electives from BADM 3741; BADM 3742; BADM 2710; BADM 3730; BADM 3750; either BADM 3760 or OPIM 3103 but not both; OPIM 4895.
- Prerequisites for BADM 2710 and OPIM 3103 include ACCT 2001; prerequisites for BADM 3730 include ACCT2101 or BADM2710, ECON1200 or both 1201 and 1202; MATH1070; STAT1000 or 1100; prerequisites for BADM 3750 include ACCT2001, ECON1200 or both 1201 and 1202; MATH1070 or 1071; STAT1000 or 1100; prerequisites for MEM 2211 include a first course in Statistics.
- Open to juniors or higher. Not open to students enrolled in a Business Major. Courses taken toward the Engineering Management minor cannot be counted toward the Business minor.
- A ‘C’ (2.0) grade or better in each course to be counted toward the minor.

Additional Details:

- A maximum of one three-credit hour course can be applied toward the minor from outside the University of Connecticut.
- Internship credit(s)/course(s) cannot be used to satisfy requirements of the Engineering Management minor.
- There can be no declaration of the minor prior to a student’s last semester.
- The Plan of Study for the Minor in Engineering Management – Business Concentration must be submitted during the student’s last semester when the student is in the process of completing or has completed the minor.
- No student in the School of Business can complete both a major and a minor in Engineering Management – Business Concentration.

BADM courses are not open to students in the School of Business. These courses may not be used to meet course or grade point average graduation requirements for School of Business majors, either as core business requirements or as required business electives.

PLAN OF STUDY – MINOR IN ENGINEERING MANAGEMENT – BUSINESS CONCENTRATION

DIRECTIONS: Complete the following information and turn in 2 copies of this sheet, with a copy of your UNOFFICIAL TRANSCRIPT, highlighting the business courses you are using to meet the minor, attached. Submit your plan of study sheet with attached transcripts during the first four weeks of the semester in which you intend to graduate.

Name __________________________ Major __________________________ Anticipated Graduation Date ______/____ Mo/Yr
Student ID # ______________ Local Address __________________________ Phone (____) ___________
Student Signature __________________________ Date __________________________

Courses being used to complete the minor – please list them below:

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<th>Grade</th>
<th>Dept</th>
<th>No.</th>
<th>Course Title</th>
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<td>MEM</td>
<td>2211</td>
<td>Introduction to Manufacturing Systems</td>
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</tbody>
</table>

Electives - choose any two courses from the recommended electives listed on the reverse side.

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Bring to: BUSN Room 121, or Mail to: School of Business Undergraduate Programs Office
2100 Hillside Road, Unit 1041
Storrs, CT 06269-1041

For School of Business Use Only

Signature of Associate Dean, School of Business
Date

[Effective Fall 2009]
Interested students must complete the listed requirements.
Please check the student admin for current BADM course listings.

CORE REQUIRED COURSES INCLUDE:

**MEM 2221. Principles of Engineering Management**, Either semester. Three credits. Prerequisite: Open to sophomores, juniors, and seniors. Not open to students who have passed or are taking OPIM 3104 or BADM 3761. Will not substitute for BADM 3761. May not be used to satisfy Junior-Senior level major requirements of the School of Business. The fundamentals of engineering management tasks of planning and control; the human element in production, research, and service organizations; the stochastic nature of management systems. **OR BADM 3761. Operations Management**, Either Semester. Three Credits. Prerequisite: open to juniors or higher. Not open to students who have passed OPIM 3101 or MEM 2221. Will not substitute for OPIM 3104 for students who enter the School of Business. An introduction to the fundamentals of Engineering Management: the tasks of planning and controlling activities that have a technological component; the human element in production, research, and service organizations; and the stochastic nature of management systems. Has extended coverage on technology and value innovation.

**OPIM 3801. Principles of Project Management**, Three credits. Prerequisite: Instructor consent; open to juniors or higher. This course provides an introduction to the concepts necessary for both project managers and project team members to deliver successful projects on time, on budget and in scope. The phases and knowledge areas of project management, as defined by the Project Management Institute (PMI), are covered as well as the tools and techniques in each area for successful project management. An introduction to Microsoft Project software will also be covered.

**MEM 2211. Introduction to Manufacturing Systems**, Three credits. Prerequisite: STAT 100Q or 1100Q or 3025Q or 3345Q or 3375Q, or CE 2210 or 2251, or MATH 3160. Overview of manufacturing operations management and the systems used in controlling manufacturing enterprises including the concepts of global competition, lean concepts in business and engineering, and manufacturing as a competitive weapon.

RECOMMENDED ELECTIVE COURSES:

**BADM 2710. Principles of Managerial Accounting**, Three credits. Prerequisite: ACCT 2001; open to juniors or higher. Not open to students who have passed or are taking ACCT 2101. A survey of internal reports to managers for use in planning and controlling operating systems, for use in decision-making, formulating major plans and policies, and for costing products for inventory valuation and income determination.

**BADM 3730. Financial Management**, Three credits. Prerequisite: ACCT 2101 or BADM 2710, which may be taken concurrently; ECON 1200 or both 1201 and 1202; MATH 1070; STAT 1000 or 1100; open to juniors or higher. Not open to students who have passed or are taking FNCE 3101. An introductory examination of how a business plans its needs for funds, raises the necessary funds, and invests them to attain its goals.

**BADM 3750. Introduction to Marketing Management**, Three credits. Prerequisite: ACCT 2001; ECON 1200 or both 1201 and 1202; MATH 1070 or 1071; STAT 1000 or 1100; open to juniors or higher. Not open to students who have passed or are taking MKTG 3101. An introduction to the marketing system, its foundations and institutions. Students are exposed to product, promotion, price, and distribution decision areas, strategic alliances, relationship marketing, and total marketing quality.

**BADM 3760. Business Information Systems**, Three credits. Prerequisite: open to juniors or higher. Not open to students who have passed or are taking OPIM 3103. An introduction to the information needs and managers, the structure of the information systems required to fill these needs, systems development, and business computing technology. Also covers selected management applications within the major business functions.

**BADM 3741. Risks and Rewards of Entrepreneurship**, Three credits. Prerequisite: open to juniors or higher. Not open to Business majors. Not open to students who have passed or are taking MGMT 3234. May not be used to meet Junior-Senior level major requirements of the School of Business. Emphasis on gaining an in-depth understanding of the entrepreneurial mindset. Students explore what makes an individual a successful entrepreneur. Examines the risks and the rewards of pursuing a new business and a career as an entrepreneur, via case study and invited speakers.

**BADM 3742. New Venture Management**, Three credits. Prerequisite: open to juniors or higher. Not open to Business majors. Not open to students who have passed or are taking MGMT 3235. May not be used to meet Junior-Senior level major requirements of the School of Business. Examines the process of getting a new venture started, growing the venture, successfully harvesting it and starting again. Students investigate the special problems of newly formed firms via case study and analysis of successful and unsuccessful business plans. Acquaints students with the unique strategic problems faced by new ventures and prepares them to evaluate new venture plans.

**OPIM 3103. Business Information Systems**, Three credits. Prerequisite: ACCT 2001. Not open to students who have passed or are taking BADM 3760. Information needs of managers, the structure of the information systems required to fill these needs, systems development, business computing technology, and management applications within major business functional subsystems.

**OPIM 4895. Special Topics**, Three credits. Prerequisite: OPIM 3103 and others as announced separately for each offering.
MINOR IN ENGINEERING MANAGEMENT – BUSINESS CONCENTRATION
CONSTRUCTION TRACK

The minor in Engineering Management – Business Concentration is designed to provide students with non-business majors with an understanding of the principles of managing organizations involved in engineering activities and technology development including: i) planning, organizing, allocating, and controlling activities and resources, ii) project management, and iii) operations management, and entrepreneurship. The Construction Track has been designed to meet the specific needs of Civil Engineering majors operating in a business environment.

Requirements:

- A minimum of five (5) 3-credit courses, which must include three core required courses: (i) Either MEM 2221 Principles of Engineering Management or BADM 3761 Operations Management; (ii) OPIM 3801 - Principles of Project Management, and (iii) BADM 2710 Principles of Managerial Accounting; and two electives from BADM 3730, BADM 3741, BADM 3742, or CE 4210.
- Prerequisites for BADM 2710 include ACCT 2001; prerequisites for BADM 3730 include ACCT 2101 or BADM 2710, ECON1200 or both 1201 and 1202, MATH 1070, STAT1000 or 1100;
- Open to juniors or higher. Not open to students enrolled in a Business Major. Courses taken toward the Engineering Management minor cannot be counted toward the Business minor.
- A ‘C’ (2.0) grade or better in each course to be counted toward the minor.

Additional Details:

- A maximum of one three-credit hour course can be applied toward the minor from outside the University of Connecticut.
- Internship credit(s)/course(s) cannot be used to satisfy requirements of the Engineering Management minor.
- There can be no declaration of the minor prior to a student’s last semester.
- The Plan of Study for the Minor in Engineering Management – Business Concentration must be submitted during the student’s last semester when the student is in the process of completing or has completed the minor.
- No student in the School of Business can complete both a major and a minor in Engineering Management – Business Concentration.

BADM courses are not open to students in the School of Business. These courses may not be used to meet course or grade point average graduation requirements for School of Business majors, either as core business requirements or as required business electives.

PLAN OF STUDY – MINOR IN ENGINEERING MANAGEMENT – BUSINESS CONCENTRATION

DIRECTIONS: Complete the following information and turn in 2 copies of this sheet, with a copy of your UNOFFICIAL TRANSCRIPT, highlighting the courses you are using to meet the minor, attached. Submit your plan of study sheet with attached transcripts during the first four weeks of the semester in which you intend to graduate.

Name_________________________________________Major_________________________Anticipated Graduation Date_____/____ Mo/Yr
Student ID #_____________Local Address______________________________________________Phone (____)_______________
Student Signature ___________________________________________________________________Date____________________

Courses being used to complete the minor – please list them below:

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Bring to: BUSN Room 121, or Mail to: School of Business Undergraduate Programs Office
2100 Hillside Road, Unit 1041
Storrs, CT 06269-1041

For School of Business Use Only

Signature of Associate Dean, School of Business Date

[Effective Fall 2009]
Interested students must complete the listed requirements.
Please check the student admin for current BADM course listings.

CORE REQUIRED COURSES INCLUDE:

MEM 2221. Principles of Engineering Management. Either semester. Three credits. Prerequisite: Open to sophomores, juniors, and seniors. Not open to students who have passed or are taking OPIM 3104 or BADM 3761. Will not substitute for OPIM 3104 for students who enter the School of Business. Will not substitute for BADM 3761. May not be used to satisfy Junior-Senior level major requirements of the School of Business. The fundamentals of engineering management tasks of planning and control; the human element in production, research, and service organizations; the stochastic nature of management systems. OR BADM 3761. Operations Management. Either Semester. Three Credits. Prerequisite: open to juniors or higher. Not open to students who have passed OPIM 3101 or MEM 2221. Will not substitute for OPIM 3104 for students who enter the School of Business. May not be used to satisfy Junior-Senior level major requirements of the School of Business. The fundamentals of engineering management tasks of planning and control; the human element in production, research, and service organizations; and the stochastic nature of management systems. Has extended coverage on technology and value innovation.

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BADM 3742. New Venture Management. Three credits. Prerequisite: open to juniors or higher. Not open to Business majors. Not open to students who have passed or are taking MGMT 3235. May not be used to meet Junior-Senior level major requirements of the School of Business. Examines the process of getting a new venture started, growing the venture, successfully harvesting it and starting again. Students investigate the special problems of newly formed firms via case study and analysis of successful and unsuccessful business plans. Acquaints students with the unique strategic problems faced by new ventures and prepares them to evaluate new venture plans.

CE 4210. Operations Research in Civil and Environmental Engineering. Three credits. Prerequisite: CE 2210, or STAT 1000Q or 1100Q. This course and CE 256 may not both be taken for credit. Resource allocation subject to constraints. One and two-phase simplex method for linear programming. Optimization of non-linear problems.
Approved November 4th – SOE C&C

Manufacturing Minor (approved)

This minor exposes engineering students to the fundamentals and applications of manufacturing. This minor is not allowed for Management and Engineering for Manufacturing (MEM) engineering students. This minor includes design and fabrication techniques, including evaluating the impact on the human and environmental factors, process, and profit associated with the steps from design through production. Actual case studies will help reinforce the concepts. The two core classes are ENGR 3315, Manufacturing-4P (3 credits) and ENGR 3320, Manufacturing and Production (3 credits). This minor will rely on the two core manufacturing courses and an elective as well as a manufacturing focused senior design from the student’s home department. This elective can also be counted as an elective in their home department. The minor requires the completion of 15 credits including as follows:

Application for the Manufacturing Minor two semesters before graduation.
An approved Plan of Study one semester before graduation.
ENGR 3315 and ENGR 3320 (3 credits each)
9 or more credits selected from Group II elective courses from any engineering department and may include Senior Capstone from your home department related to a manufacturing problem (subject to approval by Minor advisor).

Note: Group II courses can simultaneously be used towards the student’s major requirements.

Manufacturing minor electives

CHEG 4140. Chemical Engineering Capstone Design I; One credit.

CHEG 4142. Unit Operations and Process Simulation; Three credits.

CHEG 4143. Chemical Engineering Capstone Design II; Three credits.

CHEG 4989. Introduction to Research (associated to manufacturing); (299) Credits and hours by arrangement or as announced

CHEG 4995. Special Topics in Chemical Engineering (associated to manufacturing); (295) Credits and hours by arrangement or as announced.

CE 4210. Operations Research in Civil and Environmental Engineering; (202) Three credits. ;

ECE 3243. Introduction to Nanotechnology; Three credits.

ECE 4095. Special Topics in Electrical and Computer Engineering (If related to Manufacturing); (295) Credits by arrangement.

ECE 4211. Semiconductor Devices and Nanostructures; (245) Three credits.

ECE 4242. Micro/Opto-electronic Devices and Circuits Fabrication Laboratory; (268) Three credits.

ECE 4243. Nanoscience and Nanotechnology I; (Also offered as ENGR 4243.) Three credits.

ECE 4244. Nanotechnology II; (251) (Also offered as ENGR 4244.) Three credits.

ECE 4901. Electrical and Computer Engineering Design I (As long as associated with Manufacturing); (290) (Also offered as CSE 4950.) Two credits.

ECE 4902. Electrical and Computer Engineering Design II; (291) (Also offered as CSE 4951.) Three credits.

ENGR 4243. Nanoscience and Nanotechnology I; (250) (Also offered as ECE 4243.) Three credits.

ENGR 4244. Nanotechnology II; (251) (Also offered as ECE 4244.) Three credits.

MSE 4021. Materials Joining; (219) Three credits.

MSE 4038. Alloy Casting Processes; (238) Three credits.

MSE 4095. Special Topics in Materials Engineering (associated with Manufacturing); (298) Variable (1-3) credits.

MSE 4240. Nanomaterials Synthesis and Design; (260) Three credits.

MSE 4241. Nanomaterials Characterization and Application; (261) Three credits.

MSE 4901W. Capstone Design Project I (associated with Manufacturing); Three credits.

MSE 4902W. Capstone Design Project II (associated with Manufacturing); (288W) Three credits.

MSE 4989. Introduction to Research (associated with Manufacturing); (299) Credits and hours by arrangement.

ME 3217. Metal Cutting Principles; (217) Three credits.

ME 3221. Manufacturing Automation; (221) Three credits.

ME 3222. Production Engineering; (222) Three credits.

ME 3224. Analysis and Design of Mechanisms; (224) Three credits.


ME 3227. Design of Machine Elements; (227) Three credits.

ME 3228. Introduction to Fatigue in Mechanical Design; (228) Three credits.

ME 3295. Special Topics in Mechanical Engineering (associated with Manufacturing); (295) Credits and hours by arrangement or as announced.

ME 3299. Problems in Mechanical Engineering (associated with Manufacturing); (299) Hours by arrangement. Credits by arrangement, not to exceed four.

ME 4972. Senior Design Project I (associated with Manufacturing); (272) Three credits.
ME 4973W. Senior Design Project I (associated with Manufacturing); (273W) Three credits.
Materials Science & Engineering

Approved October 7th – SOE C&C

MSE C&C Proposals

(1) Proposal: Change catalog number for ‘Material Selection in Mechanical Design’ from MSE 4095 to MSE 4040. Course description is added in appendix A.

Rationale: This course was offered twice, so far, and will be offered in the spring and beyond. It therefore seems time for this course to obtain its own course number.

(2) Proposal: Adding “open for Materials Science and Engineering majors only” in the catalog descriptions for MSE 2001 and 2002. The current and the proposed new catalog description are added in appendix B.

Rationale: Non-MSE students have used a loophole in the enrollment process that allows them to enroll in 2001 and 2002 (and any other course) at the beginning of the semester. The addition to the catalog description will prevent non-MSE students to enroll in MSE 2001 and 2002.

(3) Proposal: The current catalog allows MSE undergrad students to enroll in graduate core courses as a professional elective course if their CGPA is greater than 3.2 (appendix C). The graduate core course curriculum was reduced a few years ago to three courses. It is proposed that qualified undergraduate students should be able to take one graduate course as a professional elective course, but not restricted to the graduate core courses.

Rationale: The change in the graduate core course curriculum was never followed up with the adjustment for the undergrad catalog. Qualified undergrads could currently take the graduate thermo course, which is a core course, but not the mechanical behavior course, which is not a core course, which does not make sense.

As a minor proposed change in the same catalog item, it is proposed that the “; and” be changed to “. Only….,” in order to avoid any confusion that the limit to one independent study project as a professional elective course is a recommendation rather than a rule.

(4) Proposal: Reduce credits from four to three for MSE 3700.

Rationale: BME 3700 is a four-credit course and the fourth credit is for a laboratory portion of the course. The MSE 3700 course does not involve a lab portion and therefore the current catalog listing with four credits should be reduced to three credits to account for the lecture only style of the class (appendix D).

Appendix:

A. Course description for MSE 4095 ‘Materials Selection in Mechanical Design”

Special Topics Course
Course Title (tentative): Material Selection in Mechanical Design
Course Description (short/course catalogue):
The course consists of a study of materials and how they are chosen for various mechanical designs. A wide range of materials will be discussed (metal, ceramic, polymer, etc.) and their key properties (modulus, strength, density, etc.) in design will be reviewed. Guidelines for material selection will be shown. As part of the course, design trades will also be discussed.
Course Description (long/detailed for wider distribution):
There are over 160,000 materials that an engineer can choose from for aspects of any design. Materials are used in designs for many uses: support load, contain pressure, transmit heat, etc. How an engineer picks a material can make or break the design. The wrong initial choice can not only hinder the use but could cause multiple redesigns with additional material choices or changes. Such costs can be significant and companies have failed due to poor material choices.

To best choose a material, the attributes of the material need to be understood: density, modulus, strength, cost, and so forth. This then leads into material indices in considering the design. If the objective is not coupled to a constraint, the index is simply the material property of interest. When there are multiple objectives, the index becomes a group of properties. An example of this is looking at specific stiffness (modulus/density) or specific strength (strength/density).

A key component in material selection is Ashby Charts. These charts plot material aspects on both axes showing how various materials group. When combined with material indices, the chart allows for simple and quick down-select of a material class. This initial optimization can save key time in the design process. With the CES EduPack, such charts can be created along with access to detailed information about the material for the final design selection. The goal is to demonstrate this through case studies to show practical material selection in design.

Appendix B – Catalog description for MSE 2001 and 2002
Current:
Introduction to Structure, Properties, and Processing of Materials
(243) Three credits. Prerequisite: CHEM 1127Q or 1147Q. Not open to students who have passed MSE 2101.
Bonding in materials, the crystal structure of metals and ceramics, and defects in materials will be introduced. Basic principles of phase diagrams and phase transformations will be given with particular emphasis on microstructural evolution and the effect of microstructure on the mechanical properties of metals and alloys. Introductory level knowledge of mechanical properties, testing methods, strengthening mechanisms, and fracture mechanics will be provided.

2002.
Introduction to Structure, Properties, and Processing of Materials II
(244) Three credits. Prerequisite: MSE 2001 or 2101.
Structures, properties, and processing of ceramics; structure, properties and processing of polymers and composites; electrical, thermal, magnetic and optical properties of solids; and corrosion.

Proposed:
Introduction to Structure, Properties, and Processing of Materials
(243) Three credits. Prerequisite: CHEM 1127Q or 1147Q. Not open to students who have passed MSE 2101.
Bonding in materials, the crystal structure of metals and ceramics, and defects in materials will be introduced. Basic principles of phase diagrams and phase transformations will be given with particular emphasis on microstructural evolution and the effect of microstructure on the mechanical properties of metals and alloys. Introductory level knowledge of mechanical properties, testing methods, strengthening mechanisms, and fracture mechanics will be provided. Open for Materials Science and Engineering majors only.

2002.
Introduction to Structure, Properties, and Processing of Materials II
(244) Three credits. Prerequisite: MSE 2001 or 2101.
Structures, properties, and processing of ceramics; structure, properties and processing of polymers and composites; electrical, thermal, magnetic and optical properties of solids; and corrosion. Open for Materials Science and Engineering majors only.

Appendix C:
Current catalog (2014-2015)
Recommended Professional Elective courses - 12 credits from: any 3000 and 4000 level MSE elective course, BME 3700 and 4701; CHEG 3156; ME 3217 and 3228; and only one 3-credit independent study course may be used as a professional elective. Students with CGPA of 3.2 or greater may elect graduate core courses.

Proposed version:
Recommended Professional Elective courses - 12 credits from: any 3000 and 4000 level MSE elective course, BME 3700 and 4701; CHEG 3156; ME 3217 and 3228. Only one 3-credit independent study course may be used as a professional elective. Students with CGPA of 3.2 or greater may elect letter-grade graduate core courses.

Appendix D:
Current catalog:
3700.
Biomaterials
Four credits. Prerequisite: MSE 2001 or MSE 2101.

Proposed version:
3700.
Biomaterials
Three credits. Prerequisite: MSE 2001 or MSE 2101.
Add a course to ME’s Energy and Power Concentration
**ME 3295 – Micro-Nanoscale Energy Transport and Conversion.** This course introduces the fundamentals and applications of micro- and nano-scale energy transport. A central theme throughout the course is a parallel theoretical treatment of the transport of various energy carriers including electrons, molecules, phonons, and photons in different applications. The main focuses are (i) theory and experiments of thermal transport in nanomaterials and nanoscale systems and (ii) fundamentals and recent advancements in thermal-to-electrical energy conversion. These topics are essential for advanced research in micro-nano scale heat transfer and are useful for existing and emerging applications in microelectronics, energy conversion, and nanotechnology. **Prerequisites:** ME 3242 Heat Transfer or instructor consent.

**Energy and Power Concentration**

- ME3239 – Combustion for Energy Conversion
- ME3270 – Fuel Cells
- ME3275 – Introduction to Computational Fluid Dynamics
- ME3280 – Turbines and Centrifugal Machinery
- ME3285 – Sustainable Energy Sources and Systems
- ME3295 – Special Topics: Energy Systems Engineering
- ME3295 – Special Topics: Fuel Cells
- **ME3295 – Special Topics: Micro-Nanoscale Energy Transport and Conversion**
- ME3295 – Special Topics: Propulsion
- ME3295 – Special Topics: Sustainable Energy
- ME3295 – Special Topics: Turbomachinery
- ME5311 – Computational Methods of Viscous Fluid Flow
- ME6160 – Turbines and Centrifugal Machinery

**Micro-Nanoscale Energy Transport and Conversion**

**ME 3295-004 (Class Number 14757) ME 5895-001 (Class Number 11145)**

**Credits & contact hours:** 3 credits. Two 75 minute lectures per week.

**Instructor:** Prof. Michael T. Pettes (Office: UTEB 354, Email: pettes@ engr. uconn.edu)

**Time & place:**

- **Lecture:** T/Th 12:30 – 1:45 p.m., AtwrA 001
- **Instructor office hours:** F 10:00 a.m. – 12:00 p.m., UTEB 354

**Web page:** [https://learn.uconn.edu/](https://learn.uconn.edu/) (HuskyCT, login with NetID)

**Course description:** This course introduces the fundamentals and applications of micro- and nano-scale energy transport. A central theme throughout the course is a parallel theoretical treatment of the transport of various energy carriers including electrons, molecules, phonons, and photons in different applications. The
main focuses are (i) theory and experiments of thermal transport in nanomaterials and nanoscale systems and (ii) fundamentals and recent advancements in thermal-to-electrical energy conversion. These topics are essential for advanced research in micro-nano scale heat transfer and are useful for existing and emerging applications in microelectronics, energy conversion, and nanotechnology.

**Prerequisites:** ME 3242 Heat Transfer or instructor consent.


**Software (Required):** *Mathematica* by Wolfram Research, available free to UConn faculty, staff, and students: [http://software.uconn.edu/software/software_detail.php?softid=mathematica](http://software.uconn.edu/software/software_detail.php?softid=mathematica). Students can obtain a physical copy of the program by going to UITS, Math & Science Building, Room M047 and access the software at [http://skybox.uconn.edu](http://skybox.uconn.edu).


**Grading:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework</td>
<td>25 %</td>
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<tr>
<td>Class participation</td>
<td>10 %</td>
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<tr>
<td>Midterm exam 1</td>
<td>15 %</td>
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<tr>
<td>Midterm exam 2</td>
<td>15 %</td>
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<tr>
<td>Final Project</td>
<td>20 %</td>
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<tr>
<td>Final exam</td>
<td>15 %</td>
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<tr>
<td>Bonus Credit</td>
<td>10 %</td>
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**Reading:** Students are responsible for the assigned material from the course text, whether covered in class or not. Material should be read prior to lecture.
<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Topic</th>
<th>Chapter</th>
<th>Reading</th>
<th>Homework</th>
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<tr>
<td>Aug. 26</td>
<td>T</td>
<td>Introduction to Nanoscale Transport Review of Energy Transfer Mechanisms</td>
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<td>Aug. 28</td>
<td>Th</td>
<td>Introduction to <em>Mathematica</em> programming Thermal Conductivity Measurement Schemes</td>
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<td>Sept. 2</td>
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<td>Kinetic Theory</td>
<td>1</td>
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<td>Sept. 4</td>
<td>Th</td>
<td>Quantum Concepts</td>
<td>2</td>
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<td>Sept. 9</td>
<td>T</td>
<td>Introduction to Crystallography</td>
<td>3</td>
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<tr>
<td>Sept. 11</td>
<td>Th</td>
<td>Electron Energy Levels</td>
<td>3</td>
<td>3.2</td>
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<tr>
<td>Sept. 12</td>
<td>F</td>
<td>Special Event, UTEB 175, 2:30-3:20 p.m.:</td>
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<tr>
<td></td>
<td></td>
<td>Prof. Theo Borca-Tasciuc, Mechanical Engineering, Rensselaer Polytechnic Institute, Troy, NY.</td>
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<tr>
<td>Sept. 15</td>
<td>M</td>
<td>Special Event, Konover Auditorium, Dodd Research Center, 11:15 a.m.:</td>
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<td>Prof. Matthias Scheffler, Director, Fritz Haber Institute of the Max Planck Society, Berlin, Germany.</td>
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<td>Sept. 16</td>
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<td>Crystal Vibrations and Phonons</td>
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<td>Density of States</td>
<td>3</td>
<td>3.4</td>
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<td>Sept. 23</td>
<td>T</td>
<td>Statistical Thermodynamics (Statistical Distributions)</td>
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<td>Specific Heat</td>
<td>4</td>
<td>4.2–4.3</td>
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<td>Sept. 30</td>
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<tr>
<td>Oct. 2</td>
<td>Th</td>
<td>Wave Propagation</td>
<td>5.1</td>
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<td>Final Topic Proposals – 5 min. ea.</td>
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<td>Interfacial Transport</td>
<td>5.2-5.4</td>
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<td>Oct. 14</td>
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<td>Quantum Conductance</td>
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<td>Oct. 16</td>
<td>Th</td>
<td>Coherence Effects</td>
<td>5.6</td>
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<td>Oct. 21</td>
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<td>Non-Equilibrium Effects</td>
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<td>Th</td>
<td>Scattering Theory I</td>
<td>6.2</td>
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<tr>
<td>Oct. 24</td>
<td>F</td>
<td>Special Event, Gant Science Complex, Physics Building, Room P036, 4 p.m.:</td>
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<td>Dr. David J. Wineland, Physical Measurement Laboratory, National Institute of Standards and Technology (NIST), Boulder, Co.</td>
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<td>6.2</td>
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<td>Th</td>
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<td>6.3</td>
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<tr>
<td>Nov. 4</td>
<td>T</td>
<td>Midterm Exam 2 (Chapters 4–6.2, in class, open book, 1 double sided notes page)</td>
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<td>Nov. 6</td>
<td>Th</td>
<td>Thermoelectric Transport II</td>
<td>6.3</td>
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<td>Nov. 11</td>
<td>T</td>
<td>Thermal Conductivity</td>
<td>6.3</td>
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<td>T</td>
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<td>Nov. 27</td>
<td>Th</td>
<td>Thanksgiving recess</td>
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<tr>
<td>Dec. 2</td>
<td>T</td>
<td>No Class, Fall 2014 Materials Research Society Meeting, Boston, MA</td>
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<td>Dec. 4</td>
<td>Th</td>
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<tr>
<td>Dec. 12</td>
<td>F</td>
<td>Final Exam, 10:30 a.m. – 12:30 p.m. (Ch. 1–6, open book, closed note) ← Verify with registrar</td>
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</table>

Approved November 4th – SOE C&C

ME C&C - 10/22/2014 - Passed  
ME Faculty - 10/24/2014 - Passed  
SOE C&C - 11/4/2014

**Proposed Catalog Changes**

**Proposal #1** - Add ME 2234 Applied Thermodynamics as a prerequisite to ME 3264 Applied Measurements Lab.

**3264. Applied Measurements Laboratory**

Three credits. Two class periods and one 2-hour laboratory period. Prerequisite: ME 3263 and ME 2234.

Application of fundamental measurement techniques developed in ME 3263 to various mechanical systems and processes. Hands-on laboratory experiences include measurements in energy conversion, solid mechanics, dynamics, and fluid and thermal sciences, as well as statistical methods to analysis of experimental data.

**Proposal #2** - Add “or” to the ECE requirement to clarify that only one course is required.

Mechanical Engineering majors are required to complete the following:

- CE 2110, 2120, and 3110;  
- ECE 2000, 2001 or 2001W;  
- ENGR 1166;  
- MATH 2110Q and 2410Q;  
- ME 2233, 2234, 3220, 3227, 3242, 3250, 3253, 3255, 3263, 3264, 4972, and 4973W;  
- MSE 2001 or 2101;  
- ME Requirement (9 credits);  
- Professional Requirements (6 credits);  
- Electives (5 credits).

**Proposal 3** Change list of AoC courses. Remove ME 3295 “Turbomachinery” and “Energy Systems Engineering”. Courses have been changed to ME 3285 and ME 3280 respectively.
Aerospace Concentration
Three courses from:
- **ME 3239, 3251, 3275, 3280, 5311*, 6160*, and ME 3295** (Special Topics) taught as any of the following:
  - Acoustics
  - Aerospace Control Systems
  - Computer Aided Engineering
  - Propulsion
  - Turbomachinery (name change ME 3280)

Energy and Power Concentration
Three courses from:
- **ME 3239, 3270, 3275, 3280, 3285, 5311*, 6160*, and ME 3295** (Special Topics) when taught as any of the following:
  - Energy Systems Engineering (name change ME 3285)
  - Fuel Cells
  - Propulsion
  - Sustainable Energy (name change ME 3285)
  - Micro-Nanoscale Energy Transport and Conversion (Passed SOE C&C)
  - Turbomachinery (name change ME 3280)

Proposal 4: Add ME 3295 “Advanced Manufacturing” to the Design and Manufacturing Concentration.

Design and Manufacturing Concentration
Three courses from:
- **ME 3217, 3221, 3222, 3224, 3225, 3228, 5511, 5155, 5150, 5210, 5220, and 3295** (Special Topics) when taught as any of the following:
  - Analytical and Applied Kinematics
  - Computer Aided Engineering
  - Geometric Modeling
  - Intelligent Material Systems and Structures
  - Principles of Machining and Machine Tools
  - Principles of Optimum Design
  - Advanced Manufacturing