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JAN 29 2013
WSU REGISTRAR

Washington State University
MAJOR CURRICULAR CHANGE FORM - - COURSE
(Submit original signed form and ten copies to the Registrar's Office, zip 1035.)

Future Effective Date: 08/01/2013 ☒ New course ☐ Temporary course ☐ Drop service course
(effective date cannot be retroactive) ☐ There is a course fee associated with this course (see instructions)

☐ Variable credit _____ ☐ Repeat credit (cumulative maximum _____ hours)

☐ Increase credit (former credit _____) ☐ Lecture-lab ratio (former ratio _____)

☐ Number (former number _____) ☐ Prefix (former prefix _____)

☐ Crosslisting (between WSU departments) **(Must have both departmental signatures)** ☐ Cooperative listing (UI prefix and number _____)
taught by: WSU ☐ UI ☐ jointly taught ☐

☐ Conjoint listing (400/500) ☐ S, F grading

☐ Request to meet Writing in the Major [M] requirement **(Must have All-University Writing Committee Approval)**

☐ Request to meet GER in _____ **(Must have GenEd Committee Approval)** ☐ Fulfills GER lab (L) requirement

☐ Professional course **(Pharmacy & Vet Med only)** ☐ Graduate credit **(professional programs only)**

☑ Other (please list request) Drop conjoint listing – Drop CE 404 (see rationale)

C E	~~504~~ 506 507	Sustainability: Life Cycle Assessment
course prefix	course no.	title

3	3			
credit	lecture hrs per week	lab hrs per week	studio hrs per week	prerequisite

Description (**20 words or less**) ~~Green building and sustainable development topics including low impact development (LID) stormwater design and environmental life cycle assessment (LCA). Offered at 400 and 500 level.~~
Topics include principles of life cycle assessment (LCA), environmental impacts categories, LCA system models, and methods for life cycle inventory.

Instructor: Liv Haselbach Phone number: 335-4874 Email: haselbach@wsu.edu
Contact: Brooke Whiting Phone number: 335-1219 Email: bwhiting@wsu.edu
Campus Zip Code: 2910

- Please attach rationale for your request, a current and complete syllabus, and explain how this impacts other units in Pullman and other branches (if applicable).
- Secure all required signatures and provide 10 copies to the Registrar's Office.

B Luhurthan 25Jan 2013	Robert M Ch 1/25/13	
Chair/date	**Dean/date**	**General Education Com/date**
Chair (if crosslisted/interdisciplinary)*	**Dean (if crosslisted/interdisciplinary) ***	**Graduate Studies Com/date**
All-University Writing Com/date	**Academic Affairs Com/date**	**Senate/date**

***If the proposed change impacts or involves collaboration with other units, use the additional signature lines provided for each impacted unit and college.**

Request: ***Separate CE404 and CE504 to be only one advanced Graduate Course CE504 renamed to Sustainability: Life Cycle Assessment***
Request by Liv Haselbach, Civil and Environmental Engineering

Current Course Descriptions:
404 Sustainability Engineering I 3 Course Prerequisite: Senior standing; certified major in Architecture, Construction Management, Civil Engr, Electrical Engr, Bioengineering, Chemical Engr, Mechanical Engr, Computer Science, Materials Science Engr, or Computer Engr. Green building and sustainable development topics including low impact development(LID) stormwater design and environmental life cycle assessment (LCA). Credit not granted for both CE 404 and CE 504. Offered at the 400 and 500 level.

Proposed Course Descriptions:
504 Sustainability: Life Cycle Assessment: 3 Topics include principles of life cycle assessment (LCA), environmental impacts categories, LCA system models, and methods for life cycle inventory.

Rationale:
LID and LCA are separate rapidly developing topics that were included in CE404/504 with the intent that they may eventually warrant their own separate more rigorous courses. At this time the need for a more detailed graduate level class in LCA is becoming apparent, particularly with respect to such important regional and global issues such as carbon accounting. LCA provides a methodology to answer some of the questions such as: 'So what environmental impacts might that project, research, new material, etc. have?' This can be important for many vastly different researchers and graduate students to include in their work. In fact, LCA components are being included in many grant applications.

Life Cycle Assessment is also currently taught in mechanical engineering with respect to manufacturing, but is now rapidly expanding into the green building field and there is a demand for its inclusion in many civil, environmental and materials engineering research projects, in addition to project development and evaluations. Dr. Haselbach recently participated in a joint research project with the University of Washington initiated by The State of Washington to evaluate how LCA might eventually be incorporated into the State Building Code. The time is right to develop a more rigorous graduate level course in LCA to benefit both graduate students and many research projects here at WSU. In fact some researchers at WSU have been going outside to other universities to gain this expertise for their projects. Many other universities are offering multiple sustainability related courses in Civil and Environmental Engineering. Some examples from Carnegie Mellon, University of Pittsburgh, and Stanford, all leaders in LCA, are attached. All three offer a graduate course in LCA. Our offering is patterned similar to the UPitt offering.

This is the course description for the complementary ME course. Our graduate students who have taken it confirm that it is different from a rigorous LCA course focusing on the built environment and impact factors.
WSU ME502 Sustainability Assessment for Engineering Design 3 Prereq degree in engineering or permission of the instructor. Sustainability assessment, including environmental, societal, and economic assessment, in design and planning for entire product life cycle.

CE 504 Sustainability: Life Cycle Assessment Draft Syllabus (1/23/2013)

This course focuses on the engineering concepts and environmental concerns important in sustainability engineering with a focus on environmental and resource life cycle assessment (LCA). It teaches the framework, methods, and tools that can be applied to environmental and resource decision making in the design, construction, operation, and maintenance of the built environment. Topics include the principles of life cycle assessment (LCA), investigation of various environmental impacts and impact category indicators, LCA system models, and methods for life cycle inventory. The course aims to encourage systems thinking and to facilitate life cycle applications to graduate students' individual research topics.

Credits: 3
Form of Instruction: Lecture

Required Resources:
1: The Hitchhikers Guide to Life Cycle Assessment or similar Text
2: ISO 14040 and 14044
3: The NIST BEES Manual (free download)
4: Miscellaneous research articles and other LCA case studies.

Online Resource: Whenever possible, the Collaborate system will be used to have live distance availability or recordings of the classes.

Prerequisites:
Graduate standing in the College of Engineering or Architecture, or instructor permission.

Course Objectives:

1: Students will become familiar with some of the applicable LCA related regulations, guidances, resources such as inventories and standards.
2: Students will demonstrate the ability to understand typical environmental impacts of the built environment and calculate associated impact category factors based on developing models.
3: The students will understand many of the fundamental mathematical, physical or chemical principles used for LCA evaluations.
4: The students will demonstrate the ability to perform applicable material and/or energy balances related to LCA.
5: The students will learn how to model sustainability engineering from a systems/process perspective with associated inputs and outputs.
6: The students will become familiar with several LCA computer-based tools.
7: The students will perform an actual LCA problem/project.
8: Students will become familiar with how LCA is developing in the US and Europe with introduction to Product Category Rules (PCRs), Environmental Product Declarations (EPDs) and developing standards.

Course Outline: (Objectives in parentheses)

1: Review of pertinent LCA literature and standards. LCA terminology. (1)
2: Work with TRACI, other environmental impact factors and typical resource loading (2-4)
3: Case study and example development of system inputs, outputs, boundaries, processes, flows and introduction to inventories. (5)
4: Use of BEES, EIO-LCA other LCA tools. Process versus EIO versus Hybrid models. (6)
5: Individual LCA project as determined by advisor or chosen with help from instructor (7)
6: Introduction to the state of the art in the developing world of LCA (8)

Grading and Assignments: Final grades will be based on the following factors:
- Quizzes (30%)
- Homework Sets or Literature Reviews (20%)
- LCA project (50%).
- The following scale will be used to determine letter grades:

90% to 100%	A
88% to <90%	A-
84% to <88%	B+
80% to <84%	B
78% to <80%	B-
74% to <78%	C+
70% to <74%	C
65% to <70%	D+
60% to <65%	D
<60%	F

STUDENTS WITH DISABILITIES: Reasonable accommodations are available for students with a documented disability. If you have a disability and may need accommodations to fully participate in this class, please visit the Access Center. All accommodations MUST be approved through the Access Center (Washington Building Room 217). Please stop by or call 509-335-3417 to make an appointment with a disability specialist.

WSU Safety Statement:
Washington State University is committed to maintaining a safe environment for its faculty, staff, and students. Safety is the responsibility of every member of the campus community and individuals should know the appropriate actions to take when an emergency arises. In support of our commitment to the safety of the campus community the University has developed a Campus Safety Plan, http://safetyplan.wsu.edu. It is highly recommended that you visit this web site as well as the University emergency management web site at http://oem.wsu.edu/emergencies to become familiar with the information provided.

Academic Integrity:
- All members of the University community share responsibility for maintaining and promoting the principles of truth and academic honesty.
- The Office of Student Standards and Accountability has a policy defining academic dishonesty and the procedures to follow if dishonesty occurs. This information can be found at www.conduct.wsu.edu.
- Cheating or plagiarism in any form will not be tolerated. Cheating includes, but is not limited to, copying work or allowing your work to be copied. Plagiarism includes resubmitting previously graded homework from a previous semester, even if it was your own work.
- If academic dishonesty has occurred on any homework or other assignment, the incident will be reported to the Office of Student Standards and Accountability and the student(s) involved will receive no credit (a score of zero) for that particular material.
- If academic dishonesty has occurred on any quiz or test, the incident will be reported to the Office of Student Standards and Accountability and the student(s) involved will receive an F in the class.
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CARNEGIE MELLON: 'Environmental Engineering, Sustainability, and Science (EESS) air and water quality engineering, science, and modeling; environmental nanotechnology; environment-energy studies, including, bioenergy, carbon capture and sequestration, shale gas; environmental sensing; green design and construction; industrial ecology; life cycle assessment; remediation; risk assessment; sustainable engineering; climate change' **Relevant** Sustainability/Green Design Specialty Courses:
12-712 Introduction to Ecology and Sustainability Engineering
12-714 Environmental Life Cycle Assessment
12-718 Sustainable Engineering Project
12-747 Sustainable Buildings
19-696 Sustainability and Innovation
48-596 LEED Buildings and Green Design

UNIVERSITY OF PITTSBURGH: Graduate program in Civil and Environmental Engineering
CEE 2210: ENGINEERING AND SUSTAINABLE DEVELOPMENT
CEE 2211: RESOURCE USE AND ENVIRONMENTAL QUALITY IN CONSTRUCTION
CEE 2217: Green Building Design and Construction
CEE 2209: LIFE CYCLE ASSESSMENT METHODS & TOOLS Credits: 3 Term(s) Offered: Fall: No Spring: No Life Cycle Assessment (LCA) is a tool for evaluating the environmental impacts of a product or process by documenting energy and material flows from inception to ultimate disposal. This course teaches framework, methods, and tools that can be applied to decision making in the design, construction, operation, and maintenance of the built environment. Topics include the principles of life cycle assessment, case studies of applications of life cycle assessment, methods for life cycle inventory, and methods for life cycle impact assessment. The course aims to encourage systems thinking and to facilitate ***life cycle applications to graduate students' individual research topics***.

STANFORD: Civil and Environmental Engineering: MS in Sustainable Design and Construction (SDC) prepares students for careers in planning, designing, building and operating sustainable buildings and infrastructure to maximize their life-cycle economic value, their net contribution to environmental functions and services, and their social equity.The program offers courses in: project finance;sustainable multidisciplinary, multi-stakeholder planning and design processes;green architecture;performance-based structural design;building energy systems; and sustainable construction processes and materials.
CEE 215. Goals and Methods of Sustainable Building Projects. 3 Units. (Undergraduate 115) Goals related to sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and economic and social sustainability. Methods to integrate these goals and enhance the economic, ecological, and equitable value of building projects. Industry and academic rating systems, project case studies, guest lecturers, and group project.
CEE 224A. Sustainable Development Studio. 1-5 Units.(Undergraduates 124.) Project-based. Sustainable design, development, use and evolution of buildings; connections of building systems to broader resource systems. Areas include architecture, structure, materials, energy, water, air, landscape, and food. Projects use a cradle-to-cradle approach focusing on technical and biological nutrient cycles and information and knowledge generation and organization. May be repeated for credit.
CEE 226. Life Cycle Assessment for Complex Systems. 3-4 Units.Life cycle modeling of products, industrial processes, and infrastructure/building systems; material and energy balances for large interdependent systems; environmental accounting; and life cycle costing. These methods, based on ISO 14000 standards, are used to examine emerging technologies, such as biobased products, building materials, building integrated photovoltaics, and alternative design strategies, such as remanufacturing, dematerialization, LEED, and Design for Environment: DfE. Student teams complete a life cycle assessment of a product or system chosen from industry.

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CE 506 Sustainability: Life Cycle Assessment Draft Syllabus (2/14/2013)

This course focuses on the engineering concepts and environmental concerns important in sustainability engineering with a focus on environmental and resource life cycle assessment (LCA). It teaches the framework, methods, and tools that can be applied to environmental and resource decision making in the design, construction, operation, and maintenance of the built environment. Topics include the principles of life cycle assessment (LCA), investigation of various environmental impacts and impact category indicators, LCA system models, and methods for life cycle inventory. The course aims to encourage systems thinking and to facilitate life cycle applications to graduate students' individual research topics.

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Course Outline: (Objectives in parentheses)

1: Review of pertinent LCA literature and standards. LCA terminology. (1) *(Weeks 1-3)*
2: Work with TRACI, other environmental impact factors and typical resource loading (2-4) *(Weeks 4-5)*
3: Case study and example development of system inputs, outputs, boundaries, processes, flows and introduction to inventories. (5) *(Weeks 6-7)*
4: Use of BEES, EIO-LCA other LCA tools. Process versus EIO versus Hybrid models. (6) *(Weeks 8-10)*
5: Individual LCA project as determined by advisor or chosen with help from instructor (7) *(Initiate system design Week 7, Apply tools Week 10, Midterm Presentations Week 11, Final Presentations and Reports Weeks 14-15)*
6: Introduction to the state of the art in the developing world of LCA (8) *(Weeks 12-13)*

CE 506 Sustainability: Life Cycle Assessment Draft Syllabus (2/14/2013)

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78% to <80%	B-
74% to <78%	C+
70% to <74%	C
65% to <70%	D+
60% to <65%	D
<60%	F

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Wherland, Scot

From: Haselbach, Liv
Sent: Thursday, February 14, 2013 11:50 AM
To: Whiting, Brooke Erin; Wherland, Scot
Subject: RE: Catalog agenda # 184a CE 504
Attachments: CE506 LCA Syllabus Draft 2_14_2013.doc

New Syllabus attached and possible Titles:

CE 506 Sustainability: Life Cycle Assessment
CE 405/505 Sustainability: Green Engineering

Thank you, Liv
Liv Haselbach, PE, PhD, LEED-AP BD+C
Associate Professor
Civil and Environmental Engineering
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Pullman, WA 99164-2910
haselbach@wsu.edu
509 335-4874
FAX 509 335-7632

Author: *The Engineering Guide to LEED-New Construction: Sustainable Construction for Engineers*
McGraw-Hill 2008, Second Edition August 2010

From: Whiting, Brooke Erin
Sent: Thursday, February 14, 2013 10:23 AM
To: Wherland, Scot
Cc: Haselbach, Liv
Subject: RE: Catalog agenda # 184a CE 504

Scot,

We can use CE 506 as the new number, to keep it in sequence with our other sustainability class, CE 505. I will submit a minor change to update the title of CE 405/505.

Liv,

I'll let you follow up on item #2.

Brooke

Brooke Whiting, Ed.M./Academic Coordinator
Washington State University/Department of Civil and Environmental Engineering/Sloan Rm 103
PO Box 642910/Pullman, WA 99164-2910/Phone: 509-335-1219/Fax: 509-335-7632/bwhiting@wsu.edu

Find us on Facebook: Department of Civil and Environmental Engineering

STUDENTS: PLEASE MENTION YOUR ID NUMBER IN YOUR EMAIL. THANK YOU!