

053
RECEIVED

AUG 31 2010

WSU Registrar

Washington State University
MAJOR CURRICULAR CHANGE FORM - - COURSE
(Submit original signed form and ten copies to the Registrar's Office, zip 1035)
See <https://www.ronet.wsu.edu/ROPubs/Apps/HomePage.ASP> for this form.

Required Effective Date: 01/01/2011
(effective date cannot be retroactive)

☒ New course ☐ Temporary course ☐ Drop service course
☐ There is a course fee associated with this course
<http://www.schedules.wsu.edu/Schedules/Apps/CourseFees.ASP>

- ☐ 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) _____

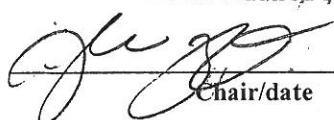
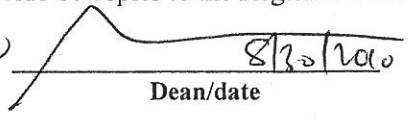
ME 503 Systems Design Approaches for Sustainability
course prefix course no. title

3	3			Graduate standing or permission of instructor
credit	lecture hrs per week	lab hrs per week	studio hrs per week	prerequisite

Description (20 words or less) Sustainability in systems design methodologies; systems modeling and decision-making for sustainability; multi-disciplinary design optimization; research topics.

Instructor: Dr. Jitesh H. Panchal Phone number: (509) 335-8491 Email: panchal@wsu.edu
Contact: Mary Simonsen Phone number: (509) 335-4546 Email: mbsimon@wsu.edu

- Please attach rationale for your request, a detailed course outline/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.

 8/27/10 Chair/date
 8/30/10 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.

Rationale for ME 503: Systems Design Approaches for Sustainability

Sustainability is one of the focus areas for the School of Mechanical and Materials Engineering and the College of Engineering. This new course is created due to the lack of courses that addressed sustainability in systems design and manufacturing. It will be a foundational course for a wide range of graduate students working on topics related to sustainability.

The course is cross-disciplinary. It is relevant for graduate students in other engineering domains (such as civil engineering). Since this is a web-based course, it is equally accessible for the students in branch campuses also. 17 graduate students, including students from Vancouver and Seattle took this course during its first offering in Fall 2009.

ME 503 Systems Design Approaches for Sustainability

<i>Course description:</i>	Sustainability in systems design methodologies; systems modeling and decision-making for sustainability; multi-disciplinary design optimization; research topics.
<i>Number of credits:</i>	3
<i>Course Coordinator:</i>	Jitesh H. Panchal
<i>Prerequisites by course:</i>	Graduate standing or permission of instructor
<i>Prerequisites by topic:</i>	Basic knowledge of the product design process, basic computer programming
<i>Postrequisites:</i>	Advanced sustainability analysis
<i>Textbooks/other required materials:</i>	<p>References:</p> <ol style="list-style-type: none">1. Pahl, G. and Beitz, W., 1996, <i>Engineering Design: A Systematic Approach</i>, 2nd Edition: Springer, London.2. Buede, D. M. <i>The Engineering Design of Systems: Models and Methods</i>, 2000, New York, N.Y.: John Wiley & Sons, Inc.3. Friedenthal, S., Moore, A., Steiner, R. <i>A Practical Guide to SysML: The Systems Modeling Language</i>, 2008: Morgan Kaufmann.4. Keeney, R. L. and Raiffa, H., 1976, <i>Decisions with Multiple Objectives: Preferences and Value Tradeoffs</i>, New York: John Wiley and Sons.
<i>Course objectives:</i>	<ol style="list-style-type: none">1. To gain a systems-level understanding of sustainability in engineering design and manufacturing2. To understand the approaches and tools used for sustainable systems design3. To learn rigorous approaches for multi-objective decision making under uncertainty
<i>Topics covered:</i>	<ol style="list-style-type: none">1. Engineering systems design and the role of sustainability (3 weeks)<ol style="list-style-type: none">a. Function-based design approachesb. Systems development lifecycle2. Systems modeling approaches & tools (2 weeks)<ol style="list-style-type: none">a. Developing model-based systems representationsb. Systems Modeling Language (SysML)c. Tools for systems modeling3. Designing sustainable engineering systems (3 weeks)<ol style="list-style-type: none">a. Overview of sustainability in the context of product realizationb. Overview of modeling approaches for impact on environment, society, and economicsc. Systems-level decisions in sustainable design4. Decision-making approaches and models for addressing sustainability considerations in design (3 weeks)<ol style="list-style-type: none">a. Value-theory and preference modelingb. Decision-making under uncertainty in sustainable designc. Multidisciplinary decision-making in sustainable systems design5. Research topics in design theory and methodology (3-4 weeks)
<i>Expected student outcomes:</i>	<ol style="list-style-type: none">1. Ability to consider sustainability as an integral part of systems design process2. Advanced knowledge of systematic processes for sustainable engineering systems design3. Ability to account for sustainability considerations in formulating, partitioning, and executing multidisciplinary systems-design problems

4. Ability to mathematically formulate sustainability decisions, formalize tradeoffs and execute them using computational approaches
5. Gain an understanding of the state of the art in engineering design research and to identify research topics worthy of investigation

Grading:

The grade for the course is based on 30% assignments, 20% mid-term project, and 50% final project.

Class schedule:

This is a web-based course. All lectures will be made available on the web.

Laboratory schedule:

None.

Prepared by:

Jitesh H. Panchal

Date: July 14, 2010

Disability Statement: 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 Disability Resource Center (DRC). All accommodations **MUST** be approved through the DRC (Washington Building, Room 217). Please stop by or call 509-335-3417 to make an appointment with a disability specialist.

Academic Integrity: 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 or lab reports from a previous semester, even if they were your own work. All incidences of cheating will be reported to the Office of Student Affairs. The first incidence of cheating will result in an F for the course. A second incident of cheating will result in possible dismissal from the University.

X REVISED X

AGEAD #53

ME503 – Systems Design Approaches for Sustainability

ME 503 – Systems Design Approaches for Sustainability

Instructor: Jitesh H. Panchal

School of Mechanical and Materials Engineering
Washington State University
Pullman, WA

Course Overview:

Background: Sustainability is defined as a characteristic of a process or state that can be maintained at a certain level indefinitely. Sustainable design and manufacturing involves balancing the technical, economic, social, and environmental objectives considering the needs of the present and the future. Due to the highly interdependent nature of these objectives, sustainable systems must be realized by adopting a systems-based approach.

Topics: In this course, the focus will be on addressing sustainability in design and manufacturing processes from a systems-based perspective starting from initial conception all the way to recycling. The course will consist of five core components that will be covered in the following sequence: a) systems design process, b) systems modeling approaches and tools, c) sustainable design and manufacturing, d) multidisciplinary decision-making approaches, and e) systems design for sustainability.

Activities: The activities include lectures, assignments, projects, group discussions, and research.

Audience: The approaches discussed in this course are cross-disciplinary. The course would benefit graduate students in all fields of engineering with an interest in sustainability, design and manufacturing, and multidisciplinary decision-making. The pre-requisite for this course is an undergraduate degree in engineering.

Instructional Approach: There will be two completely integrated sections in the course: on-campus and distance learning. The course will be carried out in a “web-based” format for both the sections. All the lectures and associated reading material will be available online in audio + video + PowerPoint + PDF format. The students and the instructor will meet regularly for group discussions. The students will review the assigned material before each group discussion. On-campus students will meet in the classroom and distance learning students will join via web-conference. The approach will combine both asynchronous and synchronous communication. Note that despite its web-based format, this will be a highly interactive course. The distance learning students will get equal opportunities to interact with the instructor and other students. The on-campus students will work with distance learning students on joint projects.

Technology Requirements for Distance Learning students: Access to a computer, webcam, microphone, speakers and high-speed Internet connection.

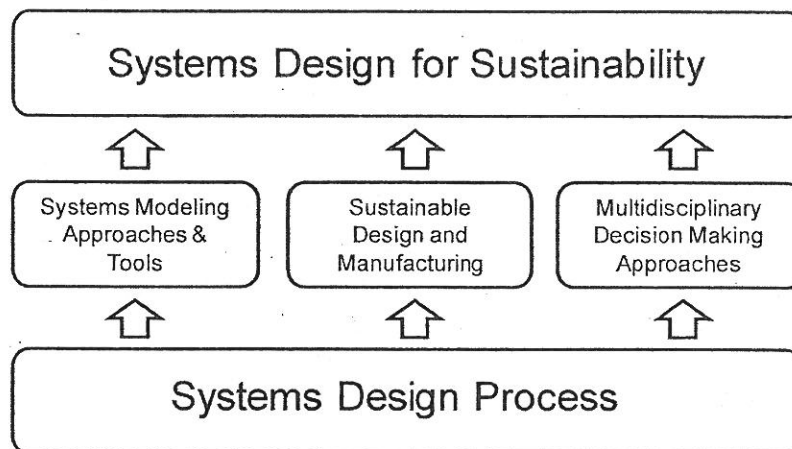
- Instructor:** Dr. Jitesh H Panchal
- Contact Info:** Office: EE/ME 147; Phone: 509-335-8491; E-mail: panchal@wsu.edu
- Class Time:** This is a web-based course. All lectures will be made available on the web <http://lms.wsu.edu/>
- Office Hours:** By Appointment
- Prerequisite:** Undergraduate degree in engineering
- References:**
- Pahl, G. and Beitz, W., 1996, *Engineering Design: A Systematic Approach*, 2nd Edition: Springer, London.
- Buede, D. M. *The Engineering Design of Systems: Models and Methods*, 2000, New York, N.Y.: John Wiley & Sons, Inc.
- Friedenthal, S., Moore, A., Steiner, R. *A Practical Guide to SysML: The Systems Modeling Language*, 2008: Morgan Kaufmann.
- Keeney, R. L. and Raiffa, H., 1976, *Decisions with Multiple Objectives: Preferences and Value Tradeoffs*, New York: John Wiley and Sons.
- Catalog Data:** Sustainability considerations in systems design methodologies; design decision-making for sustainability; systems modeling tools; accounting for sustainability in multi-disciplinary design and optimization; research topics.
- Web Component:** This course will be offered as a web-based course.
- Course Objectives:**
1. Ability to consider sustainability as an integral part of systems design process
 2. Advanced knowledge of systematic processes for sustainable engineering systems design
 3. Ability to account for sustainability considerations in formulating, partitioning, and executing multidisciplinary systems-design problems
 4. Ability to mathematically formulate sustainability decisions, formalize tradeoffs and execute them using computational approaches
 5. Gain an understanding of the state of the art in engineering design research and to identify research topics worthy of investigation

Grading Scheme:

Assignments	30%
Mid-term Project	20%
Final Project	50%

Topics to be covered:

1. Engineering systems design and the role of sustainability (3 weeks)
 - a. Function-based design approaches
 - b. Systems development lifecycle
2. Systems modeling approaches & tools (2 weeks)
 - a. Developing model-based systems representations
 - b. Systems Modeling Language (SysML)
 - c. Tools for systems modeling
3. Designing sustainable engineering systems (3 weeks)
 - a. Overview of sustainability in the context of product realization
 - b. Overview of modeling approaches for impact on environment, society, and economics
 - c. Systems-level decisions in sustainable design
4. Decision-making approaches and models for addressing sustainability considerations in design (3 weeks)
 - a. Value-theory and preference modeling
 - b. Decision-making under uncertainty in sustainable design
 - c. Multidisciplinary decision-making in sustainable systems design
5. Research topics in design theory and methodology (3-4 weeks)



Tentative Lecture and Assignment Schedule

Week	Tentative Schedule (and reading material)
1	Lecture 1: Course overview Lecture 2: Function-based design process (Pahl and Beitz Chapter 4)
2	Lecture 3: Function-based design process (contd.) Lecture 4: Overview of systems engineering lifecycle process (Buede Chapters 1, 2)
3	Lecture 5: Requirements management in system design (Buede Chapter 6)
4	Lecture 6: Architectures for systems design (Buede Chapters 7, 8) Lecture 7: Architectures and interfaces for systems design (Buede Chapters 9, 10) <i>Assignment 1 due</i>
5	Lecture 8: Overview of model-based systems engineering and SysML (Friedenthal Chapter 2,3) Lecture 9: SysML architecture and packages (Friedenthal Chapters 4,5)
6	Lecture 10: SysML behavior modeling (Friedenthal Chapters 6-9) Lecture 11: Demo of the tool for SysML modeling
7	Lecture 12: Role of Sustainability in product realization Lecture 13: Design for environment <i>Assignment 2 due</i>
8	Lecture 14: Design for environment (contd.)
9	Lecture 15: <i>Mid-term project presentations</i> Lecture 16: Economics considerations - Lifecycle cost
10	Lecture 17: Social aspects in design (socially responsible design) Lecture 18: Overview of decision making in systems design
11	Lecture 19: Value theory and tradeoffs under certainty (Keeney and Raiffa Chapters 1-3) <i>Assignment 3 Due</i> Lecture 20: Uni-dimensional utility theory (Keeney and Raiffa, Chapter 4)
12	Lecture 21: Multidimensional decision making under uncertainty (Keeney and Raiffa, Chapter 5) Lecture 22: Multidimensional decision making for sustainability
13	Lecture 23: Research topics Lecture 24: Research topics
14	<i>Assignment 4 due</i> Lecture 25: Research topics Lecture 26: Research topics
15	<i>Final project report due</i> <i>Final project presentations</i>

List of Assignments

Assignment 1: To develop the requirements document for your project

This is the first step in your project. By completing this assignment you will establish a formal requirements document for your system. The requirements document will be sent to the project sponsor for feedback and approval. The final design outcome will be assessed based on these requirements.

Assignment 2: To develop the functional, physical and allocated architectures for your project

This is the second step in your project. By completing this assignment you will establish functional and physical architectures for your system. These architectures should relate back requirements hierarchy through the allocated architecture.

Project: Mid Term Submission - Applying sustainability considerations for the system design problem. This is the first phase of deliverables for the project.

Assignment 3: To develop the design alternatives and to perform lifecycle analysis and cost analysis of different alternatives

This is the third step in your project. In this assignment you will a) generate different design alternatives for your system, b) perform the life cycle analysis (LCA), and c) perform lifecycle cost analysis (LCCA) for each alternative.

Assignment 4: Research topics

Suggested readings will be provided by the instructor. Each student will pick a set of papers to read and discuss it in class.

End-of-Semester Project Report and Presentations

Note: All the assignments are scaffolded and build towards the final project.

Time Commitment

This course is interesting and challenging because it involves you designing and conducting scientific studies of interest to you. Online participation is imperative so that you can master the subject. Participation in online discussions is an important component of this course. Group work is strongly encouraged. All students are encouraged to ask questions and share insights.

You are expected to behave professionally in online discussions and group work. Please be polite, courteous, and respectful towards your peers, and your professor, even if you do not agree with them.

Academic Regulations

Students enrolled in distance courses are subject to the same WSU academic regulations as on-campus students. A complete listing of the WSU academic regulations are available online ([Academic Regulations](#); select "Printable" next to "List All Academic Regulations" to view a printable list of all regulations).

Academic Integrity

Academic integrity is the cornerstone of the university. You assume full responsibility for the content and integrity of the academic work you submit. You may collaborate with classmates on assignments; however the guiding principle of academic integrity shall be that your submitted work, examinations, reports, and projects must be your own work. Any student who violates WSU's standard of conduct relating to academic integrity ([Academic Integrity Standards and Procedures](#)) will be referred to the Office of Student Conduct and may fail the course.

Disability Accommodations

Reasonable accommodations are available for students with a documented disability. DDP and the Disability Resource Center (DRC) work together to provide reasonable accommodations for students who have documented disabilities and who are registered both with DDP and the DRC. DDP's liaison to the DRC will assist you in getting started. To begin this process, contact DDP (800-222-4978 or distance@wsu.edu). We strongly recommend that you notify us as soon as possible. All accommodations must be approved through the Disability Resource Center.

If you have questions, please contact Rosie Pavlov at pavlovr@wsu.edu or 335-3417. Additional information is available on the DRC website: <http://www.drc.wsu.edu>.

Critical Thinking

The ability to think and write critically are essential skills in many walks of life. Critical thinking skills are developed and refined through practice, self-reflection, and the critique and support of peers and instructors. Throughout this course you will have many opportunities to exercise your analytical thinking, synthesize information, and apply knowledge to real-life situations. To help facilitate your thinking and writing, the "Critical Thinking Rubric" is provided in the online course space, if applicable, to assess your own writing and that of other students. Please review it carefully before completing each activity.

Technical Support

If you need technical assistance with this course, please click on "Technical Support" on the menu at left.

Library Support

All students enrolled in Washington State University distance courses can use the WSU Libraries online databases and receive reference and research assistance from the Distance Degree Library

Services (DDLS). Enrolled students can also borrow books and other circulating material and receive photocopies of journal articles.

Visit the DDLS Web page ([DDLS](#)) for links to the WSU online database and library support information.

Course Schedule

For specific course work due dates associated with each week, please refer to the Course Schedule in the Navigation Bar on the left of the screen.

WSU Safety

Please familiarize yourself with information regarding campus emergencies/school closings by visiting this website: <http://oem.wsu.edu/emergencies>