ME 316: Systems Design

Course description:	Systems and component design; product development from specifications to manufacturing; team-based CAD design projects; engineering economics; engineering professional skills.
Number of credits:	3
Course Coordinator:	C. Pezeshki
Prerequisites by course:	CE 215; ME 216; certified major in Mechanical Engineering, Materials Science and Engineering, Civil Engineering, or Electrical Engineering
Prerequisites by topic:	1. Applications of CAD in Engineering Design and Analysis 2. Mechanics of Materials 3. Dynamics
Postrequisites:	ME 416
Textbooks/other required materials:	1. Olivier de Weck, D. Roos, and C.L. Magee, Engineering Systems: Meeting Human Needs in a Complex Technological World, 2nd Edition, 2011, MIT Press. 2. Sepulveda, Souder, & Gottfried, Schawm's Outline for Engineering Economics, 1984, McGraw-Hill. 3. Paradis & Zimmerman, The MIT Guide to Science and Engineering Communication: Second Edition, 2002, MIT Press. 4. National Society of Professional Eng. Board of "Ethical Review Cases" http://www.nspe.org/resources/ethics/ethics-resources/board-of-ethical-review-cases
Course objectives:	1. To understand the engineering design process and the engineering decision making process. 2. To understand how modern CAD systems are used in a team-based engineering design process. 3. To understand the basic concepts of engineering economics and using engineering economics in the decision making process. 4. To use effective communication methods to present and convey design and engineering information. 5. To understand the importance of professional and ethical responsibility. 6. To understand group dynamics and to learn to work effectively in groups. 7. To be familiar with engineering codes and standards. 8. To gain engineering design experience incorporating engineering knowledge and skills, engineering standards and codes, and multiple realistic constraints.
Topics covered:	1. Engineering design process. 2. Engineering decision making process. 3. Product life cycle management (PLM). 4. Geometric Dimensioning and Tolerancing (GD&T) 5. Engineering Economics (time value of money; cost including incremental, average, sunk, and estimating; economic analysis; depreciation). 6. Engineering communications – writing and presentations. 7. Professional and ethical responsibility (codes of ethics; agreements and contracts; ethical and legal considerations; professional liability; public health, safety, and welfare). 8. Engineering standards and codes. 9. Contemporary issues in engineering design. 10. Societal and global issues. 11. Planning and executing design projects incorporating appropriate engineering standards and meeting multiple realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

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Expected student outcomes:

1. Be able to use CAD tools in the design process.
2. Be able to manage design configurations through the product development.
3. Understand the basics of geometric dimensions and tolerances to designs.
4. Be able to use the basic concepts of engineering economics to aid in design decision making.
5. Be able to use correct style and format in formal and informal methods of engineering communication.
6. Gain hands-on experience on project planning and execution.
7. Gain hands-on experience on how a team can use the engineering design process to carry out a project; as a member of a team, complete a design project to a finished, functional design.
8. Understand the importance of professional and ethical responsibility, contemporary issues, and global and societal impact of engineering decisions.
9. Understand the basic concepts of and be able to identify and apply appropriate engineering standards and codes in the design process.
10. Gain engineering design experience incorporating engineering knowledge and skills-engineering standards and codes, and multiple realistic constraints.

Class schedule: Three 50-minute lecture sessions per week, for one semester.

Laboratory schedule: Lecture sessions converted to laboratory sessions as needed for CAD and design activities.

Contribution to meeting the professional component: Engineering Topics

Relationship of course to program objectives: Meets:

1. School of MME ME educational objectives: 1, 2, 3
2. School of MME ME program outcomes: (a), (c), (d), (e), (f), (g), (h), (i), (j), (k)
3. ABET EC2000, Criterion 3 program outcomes: (a), (c), (d), (e), (f), (g), (h), (i), (j), (k)

Prepared by: C. Pezeshki *Date:* November 5, 2014

POLICIES

A. **Reasonable Accommodation** (the nature of the particular course determines which one applies): • Pullman Campus. Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center. • WSU Online Course. Reasonable accommodations are available in online classes for students with a documented disability. All accommodations must be approved through your WSU Disability Services office. If you have a disability and need accommodations, we recommend you begin the process as soon as possible. For more information contact a Disability Specialist on your home campus: Pullman or WSU Online (http://accesscenter.wsu.edu), Spokane (http://spokane.wsu.edu/students/current/studentaffairs/disability/), Tri-Cities (http://www.tricity.wsu.edu/disability), Vancouver (http://studentaffairs.vancouver.wsu.edu/student-resource-center/disability-services).

B. **Academic Integrity:**
WSU expects all students to behave in a manner consistent with its high standards of scholarship and conduct. Students are expected to uphold these standards both on and off campus and acknowledge the university's authority to take disciplinary action. The Standards of Conduct for Students found at http://conduct.wsu.edu.

C. **WSU Safety:**
Classroom and campus safety are of paramount importance at Washington State University, and are the shared responsibility of the entire campus population. WSU urges students to follow the "***Alert, Assess, Act***" protocol for all types of emergencies and the *"Run, Hide, Fight"* response for an active shooter incident. Remain ***ALERT*** (through direct observation or emergency notification), ***ASSESS*** your specific situation, and ***ACT*** in the most appropriate way to assure your own safety (and the safety of others if you are able).

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Specifics for Spring 2016 Section 2

MEETING TIME AND LOCATION: EME 154, M,W,F 3:10 - 4 PM
INSTRUCTOR: Dr. Jacob Leachman, Office: Sloan 217, Phone: 509-335-7711, e-mail: jacob.leachman@wsu.edu
TA: Mohammad (Sadeq) Saleh, mohammadsadeq.saleh@wsu.edu, Office: ETRL 249
GRADING: Standard WSU grade distribution applies. Team-based grades are assigned for 1) Design concept/proposal presentation (15%), 2) Mid-term design specification report (15%), and 3) Final Website & Presentation (30%). Individual grades are assigned for participation in the following course sections: 1) Design Process (10%), 2) Detailed Design Specification (10%), Production (10%), and Professionalism (10%).

SCHEDULE: *the class schedule topics & order may change during the semester based on need

Day		Lecture Topic
Jan 11	Design Process	1. Introduction, Motivation, & Values for Systems Design
Jan 13		2. Team formation, Information/file structure, & Conway's Law
Jan 15		3. Customer/client interview & identification of desired qualities
Jan 18		**Martin Luther King Jr Day--ALL UNIVERSITY HOLIDAY**
Jan 20		4. Literature reviews, prior art, & design standards
Jan 22		5. Design matrix methods & the House Of Quality (HOQ)/Quality Functional Deployment (QFD) Phase I
Jan 25		6. Engineering characteristics/metrics & parts planning HOQ/QFD Phase II
Jan 27		7. Concept generation, ideation, & the concept/idea of creativity
Jan 29		8. Achieving different design paradigms
Feb 1		9. The 'ilities' of design (specifically modularity)
Feb 3		10. Concept down-select and pitch development
Feb 5		11. Concept round-robin, elevator pitch practice, and the SII feedback model
Feb 8		12. Achieving coherence via the SII model
Feb 10		13. Procedure for presentations & effective visuals
Feb 12		14. Design concept/proposal presentations
Feb 15	Detailed Design Specification	**President's Day—CLASS HOLIDAY**
Feb 17		15. Presentation review/feedback, Developing detailed design specifications
Feb 19		16. Process Design & HOQ/QFD Phase III
Feb 22		17. Standards for Geometric Dimensioning and Tolerancing (GD&T) & conformance/compliance
Feb 24		18. Vendor sourcing/quotation, procurement, and Bill of Materials (BOMs)
Feb 26		19. Estimating costs, the time value of money, present vs. future worth
Feb 29		20. Recurring costs and expenses expressed as uniform & gradient series
Mar 2		21. Capitalized cost, MARR, & depreciation
Mar 4		22. Basics of Failure Modes & Effects Analysis (FMEA) & Life Cycle Management (LCM)
Mar 7		23. Report format & rules for engineering communication
Mar 9		24. Abstracts, front-matter, and executive summaries
Mar 11		25. Mid-term design specification submission
Mar 14-18		**SPRING BREAK!**
Mar 21	Production & Testing	26. Specification review/feedback,
Mar 23		27. Introduction to Lean Manufacturing & HOQ/QFD Phase IV
Mar 25		28. Safety on the production floor
Mar 28		29. Kaizen and Kanban
Mar 30		30. Developing a test plan & HOQ/QFD Phase V
Apr 1		31. Executing the plan
Apr 4		32. Managing conflicts
Apr 6		33. Iteration
Apr 8		34. Progress updates
Apr 10	Professionalism	35. Narration of work through WordPress and other web-development tools
Apr 12		36. Authoritarian abuse and the emergence of standards for behavior
Apr 14		37. Engineer's creed, the ASME code of ethics, whistleblowing
Apr 17		38. Ethical case studies in design: currency of standards
Apr 19		39. Ethical case studies in design: delegating understanding
Apr 21		40. Ethical case studies in design: sustainable development
Apr 24		41. Systems design review 1
Apr 26		42. Systems design review 2
Apr 28		43. End-of-term course evaluation
May 3		**Final Design Presentation 3:10-5:10 PM in EE/ME 154**