

ME 4171 Environmentally Conscious Design and Manufacturing (Elective)

Catalog Description: ME 4171 Environmentally Conscious Design and Manufacturing (3-0-3)
Prerequisite: None
Including environmental considerations in engineering design; reducing environmental impact by design; recycling; material selection; de- and remanufacturing; life-cycle considerations, analyses, trade-offs; ISO 14000.

Textbook: Selected chapters from:
- “Green Products by Design: Choices for a Cleaner Environment”, US Congress, Office of Technology Assessment, OTA-E-541, US Government Printing Office, Washington, D.C., October 1992.
- “Environmentally Benign Manufacturing”, International Technology Research Institute, World Technology (WTEC) Division, Panel Report, April 2001.
Both can be downloaded from the course website.
Additional course notes and reading material are located on the class website (www.srl.gatech.edu/education/ME4171/)

Topics Covered:

1. Environmental impact of engineering products and processes
2. Life Cycle Design
3. Pollution Prevention
4. Recycling and Demanufacture
5. Service, Reuse and Remanufacturing
6. Life-Cycle Analysis (LCA)
7. ISO 14000 Environmental Management Standards
8. Sustainable development

Course Outcomes:

Outcome 1: To teach Mechanical Engineering students and others interested in engineering design how the environmental impact of engineering systems can be reduced by design.

1.1 Students will demonstrate the ability to reduce the environmental impact of engineering systems by providing viable options for the redesign of specific products and processes and demonstrating the reduction of environmental impact in a scientific manner. The documentation and completeness of the design process followed and results obtained are indicators of performance.

1.2 Specifically, the students will demonstrate:

- that they understand the motivation, terminology, and issues involved
- the ability to recommend viable pollution prevention options in a manufacturing and/or shop floor environment
- the ability to correctly assess and improve a product’s recyclability and remanufacturability,
- the ability to perform a life-cycle assessment and correctly interpret and utilize the results
- the ability to perform/document a product (re)design which takes all life-cycle considerations into account
- that they can reason about how to implement an ISO 14000 compliant environmental management standard in a specific business practice
- that they can identify the issues involved in achieving sustainable development.

Outcome 2: To illustrate to students the multi-disciplinary and multi-dimensional aspects of environmental issues, as well as the rapid development of the approaches and tools to reduce the environmental impact of engineering systems, and emphasize the need to keep learning.

2.1 Students will demonstrate the ability to seek and learn new material outside the class topics through the completion of an open-ended homework, report, term paper, computer assignment and/or project. The amount as well as depth of new material identified and used by the students are measurable indicators of the students' performance.

2.2 Student will demonstrate the ability to make proper assumptions, synthesize material from different subject areas, in particular from environmental engineering, public policy, management, and mechanical engineering disciplines.

Outcome 3: To teach students how to identify and quantify the environmental issues and perform design selection and trade-off decisions which include environmental issues.

3.1 Students will demonstrate the ability to take environmental health and safety, waste minimization, energy consumption, natural resource depletion, and other environmental issues (e.g., as identified by the Environmental Protection Agency) into account when assessing and redesigning a product. The breadth and depth of the issues taken into account by students are measurable indicators of their performance.

3.2 Specific issues to be quantified are process waste and mass balance, product recyclability, product remanufacturability, and product life-cycle assessment, in correspondence to the topical areas and performance criterion 1.3. The correctness of the quantification is a measurable indicator of the students' performance.

Outcome 4: To teach students how to apply specific guidelines, methods, techniques, and (computer-based) tools in reducing the environmental impact of engineering systems.

4.1 Students will demonstrate their ability to use existing (computer-based) methods, techniques and tools for the environmental assessment and improvement, in particular methods and tools focused on assessing and improving a) specific life-cycle and/or environmental aspects (e.g., recyclability, remanufacturability) and b) the total life-cycle impact (e.g., LCA tools). The maturity, completeness and efficiency of their approach are indicators for their performance.

Correlation between Course Outcomes and Program Educational Outcomes.

ME 4171												
	Mechanical Engineering Program Educational Outcomes											
Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l
Course Outcome 1.1			X		X		X	X		X		
Course Outcome 1.2	X	X		X				X		X	X	
Course Outcome 2.1				X			X	X	X	X		
Course Outcome 2.2				X	X	X		X	X		X	
Course Outcome 3.1					X	X		X		X		
Course Outcome 3.2	X				X			X			X	X
Course Outcome 4.1	X	X			X						X	X

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