OBJECTIVES
- Incorporation of Emerging Technologies into the Mechanical Engineering Curriculum
- Introduction of New Teaching Strategies Focused on Student Learning
- Recruitment and Retention Efforts to Increase Students Majoring in Mechanical Engineering, Especially Underrepresented Minorities and Women

INTEGRATION OF EMERGING TECHNOLOGIES INTO THE ME CURRICULUM
- MEMS/NEMS
- Advanced Materials
- Computer Aided Engineering
- Intelligent Systems/Electronics
- Biotechnology
- Nanotechnology
- Nontraditional Energy

INTEGRATION OF NEW TEACHING STRATEGIES
- Cooperative Learning
- Project-based Learning
- Research Methods
- Laboratory Experience
- Independent Learning

RECRUITMENT AND RETENTION
- Recruitment:
  - The Freshmen / High School Design Contest
  - The ASME, SAE and AIAA Design Contests
  - Reverse Engineering Workshop
- Retention:
  - Early Exposure to Engineering
  - Early Intervention with Marginal Students
  - Creating a Receptive Environment for Women Students

ELIMINATION AND ADDITION OF COURSES
- New course: Micro/Nano Materials and Manufacturing
- Combine: Thermodynamics II, Energy Systems Design, To one New course: Thermal Systems Design and Analysis
- Establish new Energy Systems Laboratory
- Restrict 2nd Science Elective to: Human Physiology, Organic Chemistry or Modern Physics

COLLABORATION WITH ASME
- Incorporation of ASME Professional Practice Curriculum Modules into the ME curriculum
- Effective Teaching Workshop
- Industry Advisory Board
- Dissemination

INTEGRATION OF EMERGING TECHNOLOGIES
New Micro/Nano Technology Course
- ME 45000: Micro/Nano Technology: Mechanics, Materials, and Manufacturing

The aims of this course are to introduce students with diverse technical interests to the emerging area of micro and nano phenomena in science and engineering. Micro-Electrical Mechanical Systems (MEMS) and Nanotechnology continue to revolutionize research in the engineering and science communities requiring newcomers to familiarize themselves with these fundamental principles. This course will address synthesis and manufacturing techniques of microminiature devices, relevant mechanics concepts (such as friction and contact mechanics, elasticity), material property determination at small scales (e.g., size-scale strength effects), and engineering difficulties with manipulation and control of materials and phenomena on scales less than 1000 times the width of a human hair. The course will be centered upon a series of investigational exercises including microlithography experiments, electro-mechanical testing of microelectromechanical systems, transport and deposition of macromolecules (e.g., DNA, proteins), nanodiffusivity, and manipulation of carbon microspheres. Course material will also briefly discuss the evolution of select micro/nano innovations and their impact and applications in applied sciences, medicine, space development, policy, and the environment.

INTEGRATION OF EMERGING TECHNOLOGIES IN THERMODYNAMICS

Reversible computing (electrical engineering)
Current trends indicate that integrated circuits with transistors roughly an order of magnitude smaller than today’s will generate 1 MWm2 of heat, melting their substrates and consuming energy equivalent to the output of a small commercial power plant. One workaround is to dramatically change the chip architecture, as Intel is now doing, to increase processing speed through increased parallelism rather than through increased clock rate. A second option is to make chips operate reversibly and therefore eliminate waste heat generation. A research group at the University of Florida recently created the world’s first fully adiabatic microprocessor. Presenting this technology illustrates the critical importance of thermodynamic reasoning in a very nontraditional application.

Magnetic levitation, superconductor, and superfluidity (electrical and mechanical engineering)
Magnetic levitation provides students with an example of an emerging technology based on reversible electric conduction and irreversible magnetic work. Furthermore, discussing the high thermal conductivity of superfluid liquid helium and its application to cooling superconducting magnets provides an example of one of the few truly reversible mechanical processes in nature.

NEW TEACHING STRATEGIES: AN EXAMPLE
INTEGRATION OF HOME EXPERIMENTS INTO MECHANICS OF MATERIALS COURSE

- Home Experiments: Students perform simple experiments at home using common materials and supplies to learn about concept introduced in class

Experiment 1: Elongation in Axial Loading
- Supports a stick of chalk horizontally at both ends on two round pencils as shown in Fig. 7. Load the chalk by suspending a weight at its mid-span. Increase the load until failure occurs. Use theory and data from this test to predict failure due to a load at another location. Compare your result with theoretical prediction of the elargations.

Experiment 2: Bending Failure of Chalk
- Supports a stick of chalk horizontally at both ends on two round pencils as shown in Fig. 7. Load the chalk by suspending a weight at its mid-span. Increase the load until failure occurs. Use theory and data from this test to predict failure due to a load at another location. Compare your result with theoretical prediction of the elargations.

Experiment 3: Torsion Failure of Chalk
- Apply torsion to a stick of chalk by placing it vertically on a table and suspending a load with a string wrapped around the chalk as shown in Fig.8. Increase the load until failure occurs. Compare with theoretical prediction of failure load.