ESM 450 Engineering Systems Laboratory (Required)

Course Catalog description:

A systems approach will be undertaken to understand the fundamental properties of materials and their implications on engineering design and applications. Advanced gas turbine engine used in energy and propulsion serves as the main testbed for this laboratory class. The system drives requirements in design, materials and processes which are linked together through the class activities, presenationa and laboratory. Results from the various laboratories are analyzed in the context of real-world system construction, operation and reliability.
3 credits

Pre- or Corequisite(s): ESG 332 Materials Science I: Structure and Properties of Materials
ESM 334: Materials Engineering (optional elective)
ESM 335: Mechanical Behavior of Materials (optional elective)

Text(s) or other required material:

None required. Students are urged to review information on the internet regarding gas turbine engines. Reference text books relating gas turbines is optional.

The technical content of the laboratory is available through the ESG332 text book.

Course learning outcomes:

Topics Covered:
Indentation methods of testing
Tensile testing including discussion on fatigue and creep
Differential thermal analysis
Dilatometry
Bilayer curvature analysis for thermostructural coatings
Metallography
Scanning Electron Microscopy
X-ray Diffraction
Materials processing via thermal spray deposition of coatings

Class/ Laboratory Schedule:

ESM	450	Engineering Systems Laboratory	LEC	1	W	2:20 PM	3:15 PM
			REC	R01	RECM	3:50 PM	4:45 PM
			LAB	L01	W	3:15 PM	6:15 PM

Contribution of Course to meet requirement of Criterion 5:

ESM 450 considers the laboratory activities within a system context. As such students are taught to consider contemporary societal issues in the system level considerations. Safety is an integral part of the discussion especially as it relates to aeroengines. Issues of ethics underlie the safe design of these complex engineering systems. This course's primary contribution to Criterion 5 lies in the area of safety.

Relationship of course to program outcomes:

ESM 450 addresses many of the program outcomes set-forth in the ESG curriculum. They include:

1. Working in multidisciplinary teams: During the 1st three weeks, the students participate in a group activity to research, distill and present information relating to a specific sub-system/component of a gas turbines. Communication skills are gained through the presentations as well ability to comprehend complex engineering issues considered within the context of a system
2. The students participate in groups to conduct some experiments themselves, collect and analyze data and present reports. Since this course follows a systems approach many of the realistic constraints experienced in the system are considered. They include cost, safety and manufacturability. Issues are also addressed within the framework of a global context.
3. Students apply knowledge of science and engineering through interpretation of the lab results and analysis. They build of their knowledge of past courses in ESG.
4. Given the importance of the gas turbine system to modern engineering, the students are exposed to techniques in materials design, system and sub-system integration necessary for engineering practice.

   This course was redesigned over the last two years, with the explicit goals to meet the ESG program objectives.

Person(s) who prepared this description and date of preparation:

Sanjay Sampath, June 23, 2009