1. *Course number and name*

**ENGR 838: Smart Structures Technology**

1. *Credits and contact hours*

3 credits; one 165-minute lecture sessions/week; engineering topic

1. *Instructor’s or course coordinator’s name*

Zhaoshuo Jiang

1. *Text book, title, author, and year (Recommended, not required)*

Hibbeler, Russell Charles, Kiang-Hwee Tan, and Barry Nolan. Structural analysis. Pearson Prentice Hall, 2006.

Erdey, Charles K. Earthquake engineering: application to design. John Wiley & Sons, 2007.

Chopra, Anil K. Dynamics of Structures. 5th Edition. Pearson, 2016. ISBN-10: 9780134555126.

Ogata, Katsuhiko. System Dynamics. Vol. 3. New Jersey: Prentice Hall, 1998.

Bendat, Julius S., and Allan G. Piersol. Random data: analysis and measurement procedures. Vol. 729. John Wiley & Sons, 2011.

Wenzel, Helmut, and Dieter Pichler. Ambient vibration monitoring. John Wiley & Sons, 2005.

Farrar, Charles R., and Keith Worden. Structural health monitoring: a machine learning perspective. John Wiley & Sons, 2012.

Balageas, Daniel, Claus-Peter Fritzen, and Alfredo Güemes, eds. Structural health monitoring. Vol. 493. London: ISTE, 2006.

1. *other supplemental materials*

Supplemental online content (apps, recorded videos, web-based tools, etc.) delivered via course webpage

1. *Specific course information*
2. *brief description of the content of the course (catalog description)*

This course focuses on smart structure technologies in the applications to structures including areas of structural control, structural health monitoring, and smart sensing. Topics include structural system identification, stability analysis, sensor data acquisition systems, and signal processing tailored specifically for structural engineering.

1. *prerequisites or co-requisites*

ENGR 323 and ENGR 461.

1. *indicate whether a required, elective, or selected elective course (as per Table 5-1) in the program*

Elective for Civil Engineering.

1. *Specific goals for the course*
2. *specific outcomes of instruction.*

* Students will demonstrate an ability to:
* Identify smart structure technologies
* Describe the behaviors of SDOF and MDOF systems
* Formulate transfer function and state space equations to describe structural systems
* Convert between transfer function and state space
* Performa stability analysis of structural systems
* Formulate frequency response function
* Explain the working principles of sensors
* Describe the components and operation of data acquisition systems
* Perform signal processing to extract the desired information from measurements
* Understand how to perform experimental modal analysis and vibration-based structural health monitoring
* Identify applications of integrated structural control and structural health monitoring

1. *Brief list of topics to be covered*

* Basic concepts of smart structure technology and its applications
* Structural dynamics and vibration of SDOF and MDOF systems
* Overview of structure control
* System representation using state space and transfer function
* Stability analysis through root locus
* Frequency response function and bode plot
* Overview of structural health monitoring
* Data acquisition system and signal processing
* Experimental modal analysis
* Vibration-based structural health monitoring
* Integrated structural control and structural health monitoring system