**Syllabus**  
**ME 490 Smart Structures**  
Spring 2018

**Time:** TR 11:00 – 12:15

**Instructor:**  
Dr. Nathan P. Salowitz  
Email: Salowitz@UWM.edu  
Office: 955 EMS  
Office hours: TBD

**Text:**  
- Leo, Donald J., 2007 *Engineering Analysis of Smart Material Systems*, Wiley  
  - The main textbook is available online through the UWM library  
- Additional reading will be provided through D2L

**Other References (No Purchase Required)**  
- Fraden, Jacob, 2010 *Handbook of Modern Sensors*, Springer

**Course Website:** https://d2l.uwm.edu  
- The web site will serve as a repository of course information. Lecture notes (PDF), handouts, homework assignments, video files, and other miscellaneous items will be posted on the site.  
- Draft lecture notes will be posted online the night before class. You are responsible for printing and bringing them to class. *Lecture sessions will add content not contained in the posted notes.*

**Course Description:**  
- Smart materials and structures can detect and respond to their state detecting damage, automatically heal internal fractures, and adapting to environmental changes. Making structures smarter leads to engineering systems (e.g. aircraft, automobiles and medical devices) that are lightweight, more aerodynamic and have increased operational
lifetimes. In this course, current approaches for designing and implementing smart structures in real-world applications will be reviewed. Students will learn and analyze constitutive equations that model the behavior of common components in intelligent materials including piezoelectric ceramics, electroactive polymers (artificial muscle), shape memory alloys, and basics of sensing. This course is for students from various disciplines of engineering, however basic knowledge of linear algebra, mechanics of materials, and electrical circuits are highly recommended.

**Course Objectives:**
By the end of the course students will be able to:

1) Analyze the behavior of smart materials such as piezoelectric ceramics, shape memory alloys and electroactive polymers
2) Identify state-of-the-art approaches for making structures smarter (e.g. health assessment, self-heal and adapt to environment)
3) Communicate technical concepts with peers orally and in writing and provide constructive feedback.

**Pre-requisites:**
- Civ Eng 303 Strength of materials or equivalent
- Elec Eng 301 Electrical circuits or equivalent

**Topics:**
- Definition of smart structures
- Bio-inspired materials and structures
- Basics of elasticity
- Piezoelectric materials
- Shape memory alloys
- Electro-active polymers (artificial muscle)
- Basics of sensors
- Basics of energy harvesting

**Grading:**
- **Homework assignments (30%)**
  - A series of homework sets will be assigned throughout the quarter. These homework assignments will allow students to demonstrate their mastery of the theoretical principles presented in class.
- **Midterm Presentation (15%) & Report (15%)**
  - Students will give a short oral presentation and submit a report on a topic during the lecture period. In this assignment/activity, students will select a topic and find a recent (circa 2005 to 2016) journal paper on the topic. Students will propose the topic and the selected journal article as HW at least 3 weeks before the scheduled
presentation and receive instructor feedback at least 2 weeks before the scheduled presentation. The oral presentations will introduce a topic, describe the principle of operation and propose future directions for the specific topic. Students watching the presentations will be asked to provide constructive feedback to the presenters through written evaluation.

- **Final Presentation (20%) & Report (20%)**
  - Students will give an oral presentation (20%) and submit a report (20%) on a topic. In this assignment/activity, students will select a topic and find recent (circa 2005 to 2016) journal papers on the topic. Students will propose the topic and the selected journal articles (3 to 5) as HW at least 3 weeks before the scheduled presentation and receive instructor feedback at least 2 weeks before the scheduled presentation. The oral presentation and final report will introduce the topic, describe the principle of operation and propose future directions for the specific topic.

**Workload Expectations:**

This is a 3 credit hour course, so the expected time commitment from students is an average of 10 hours per week including lectures, reading, homework, studying, projects, and exams. This will vary by student and week but is expected to total 160 hours in the semester.