

MEC 520 Smart Materials and Structures

COURSE INFORMATION

Course Title: Smart Materials and Structures

Course Catalog # & Section: MEC 520

Credit Hours: 3

Pre-/Co-requisites: Knowledge in basic material structures, mechanics of solids, basic electronics, numerical methods in engineering design and analysis.

Lectures: TBD

Instructor Name: Shanshan Yao, Ph. D.

Instructor Contact Information: shanshan.yao@stonybrook.edu

Office Hours: TBD

Teaching Assistant: TBD

Course Description:

An introduction to the properties, characterization, and applications of various smart materials and structures. This course will cover sensors, actuators, and energy devices based on smart materials, including piezoelectric materials, electroactive polymers, magnetostrictive materials, magnetorheological fluids, and shape memory polymers. The goal is to expose students to fundamentals of smart materials and structures needed for the design and applications in engineering applications.

Learning Objectives:

1. Understand the fundamentals and applications of various smart materials and structures.
2. Be able to identify major smart materials and their properties.
3. Be able to identify major smart structures, mechanisms, and performance.
4. Be able to select and use smart materials and structures for specific engineering applications.
5. Get familiar with the characterization and manufacturing techniques for smart materials, structures, and systems.

Required Course Textbook and Materials:

Lecture notes, assignments, and other course materials will be uploaded on Blackboard.

Recommended Readings/Bibliography:

Johannes Michael Sinapius. Adaptronics-Smart Structures and Materials. Berlin, Germany: Springer, 2021.

Assignments and Expectations:

Homework Assignments: There will be regularly assigned homework problems (due in one week), which will be posted on blackboard and/or sent by email. Students will submit homework via Blackboard. Homework must be neat, professional, and well organized.

Exams: There will be in-class exams on the date to be determined by the instructor. Academic integrity during exams will be administered. Students must use a blue or black pen rather than pencil for writing in your answers. More detailed instructions will be given prior to each exam. No makeup exam unless arranged prior to the exam. An unexcused exam absence will be scored as a zero.

Final Project: The students will conduct a final project in groups of 3-4 students on topics related to smart materials and structures of their interest. Students are expected to submit a project proposal and get approved by the instructor. At the end of this class, students will orally present the design in class and submit a comprehensive written report (in .pdf or .docx format) by the end of the semester.

TOPICS (TENTATIVE):

1. Introduction to smart materials and smart structures
2. Fundamentals and classification of smart/functional materials
3. Piezoelectric materials, sensors, and actuators
4. Electrostrictive materials, sensors, and actuators
5. Magnetostrictive and magnetoelectric materials, sensors, and actuators
6. Magnetorheological and electrorheological fluids
7. Properties and device applications of shape memory alloys and polymers
8. Electrothermal and photothermal actuators
9. Dielectric elastomers and other actuators
10. Mechanism, materials, and structures for energy harvesting
11. Characterization techniques
12. Emerging manufacturing techniques for smart materials and structures
13. Case studies in biomedical device, energy harvesting, robotics

Assessment & Grading:

In this course, you will be assessed on the following:

Activity/Assignment	Percentage
Homework Assignments	20
Exam I	20
Exam II	20
Project Presentation	10
Project Written Report	30
Total Possible	100

Note: There will be no exam retakes. Above distributions are subject to minor adjustments. Question(s) on graded homework/exam must be settled within one week after the graded material is returned.

Letter Grades:

- [100, 95] = A
- (95, 90] = A-
- (90, 85] = B+
- (85, 80] = B
- (80, 75] = B-
- (75, 70] = C+
- (70, 65] = C
- (65, 60] = C-
- <60 = F

Final grades for this course maybe be curved and will be decided based your relative placement in the class.

Attendance, Late Work and Make Up Exam Policy:

Attendance: Attendance is required. Failure to participate in required course activities will impact your final grade.

Late Work Policy: No late submission is allowed.

Make up exams: If you miss an exam due to unforeseen events, you will have to contact Office of Dean of Students to send me an official notification before I will give you a makeup exam. There will be no make-up exams for reasons that are within your control. Make-up exam policy is consistent with university policy on:

1. Student Participation in University Sponsored Events

http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/policies_expectations/participation_univponsored_activities.php

2. University policy on Final Exams:

http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/records_registration/final_examinations.php

3. New York State Education Law regarding Equivalent Opportunity and Religious Absences

http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/policies_expectations/equivopportunity_religiousabsences.php

STUDENT ACCESSIBILITY SUPPORT CENTER STATEMENT

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Student Accessibility Support Center, ECC (Educational Communications Center) Building, Room 128, (631)632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Student Accessibility Support Center. For procedures and information go to the following website: <http://www.stonybrook.edu/ehs/fire/disabilities>.

ACADEMIC INTEGRITY STATEMENT:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at

http://www.stonybrook.edu/commcms/academic_integrity/index.html

CRITICAL INCIDENT MANAGEMENT:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior

that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.