

Decoders 1.6: Project Realization in Cleanroom

Style: *Teamwork*; Collective

To pass, you must: (i) attend at least 3/4 of the class sessions, (ii) participate in literature review, and (iii) complete the summary articles, which leads to the final perspective essay. By the end of Class #1, students must decide whether to register or drop the course.

Overview: *Decoders 1.6* builds on the combination of knowledge and skills learned in D1.0 and D1.4, respectively to guide students to develop their own mechanically adaptive (i.e., stretchable & flexible) piezoelectric systems. Students will learn how to write an article about their research findings that will be published on the course website by the end of semester. Students will learn how to do literature review, compose clear and concise sentences to describe their findings and write a perspective article in a collective manner.

Objectives:

1. To work in a team setting and accomplish the task of building a mechanically adaptive device,
2. To learn how to do effective literature review,
3. To write a scientific article on the research findings as a team,
4. To learn steps to publish the article in a peer-reviewed journal.

Schedule:**Class 1: February 18th, 2021**

- a. Review Outline & Timeline; Assign Sections
 - i. Discuss class expectations
 - ii. Get familiarized with paper topic

Class 2: February 25th, 2021

- b. Findings- Energy Harvesting
 - i. Overview (Why does this matter?)
 - ii. Piezoelectric materials, properties, and challenges

Class 3: March 4th, 2021

- c. Findings- Energy Harvesting
 - i. Piezoelectric materials, properties, and challenges
 - ii. Other methods for energy harvesting (triboelectricity, flexoelectricity, pyroelectricity, optoelectricity, etc.)
 - iii. Fabrication impacts properties

Class 4: March 11th, 2021

- d. Findings- Energy Harvesting; Configurations & Structures
 - i. Other methods for energy harvesting (triboelectricity, flexoelectricity, pyroelectricity, optoelectricity, etc.)
 - ii. Structures that minimize strain (pre-strained, kirigami, hydrogels)

Class 5: March 18th, 2021

- e. Findings- Configurations & Structures
 - i. Overflow from structures that minimize strain
 - ii. Structures that maximize strain (auxetics)

Class 6: March 25th, 2021

- f. Findings- Configurations & Structures
 - i. Combining strain-modifying structures (kirigami + auxetics)

Class 7: April 1st, 2021

- g. Findings- Applications
 - i. Applications for self-powered piezoelectric devices
 - ii. Strain sensing (replaces rigid sensors, gait monitoring, nonverbal communication)

Class 8: April 8th, 2021

- h. Findings- Applications
 - i. Sound (actuators/transducers by converse piezoelectric effect)
 - ii. Additional applications to be discussed

Class 9: April 15th, 2021

- i. Conclusion
 - i. Summary
 - ii. Limitations and considerations (mass-manufacturability, biocompatibility, etc.)
 - iii. Future directions: alternate implementations
 - iv. Future directions: alternate environments

Class 10: April 22nd, 2021

- j. Introduction
 - i. Background: current state of wearable devices (battery-powered, rigid, etc.)
 - ii. Background: self-powered devices
 - iii. Background: piezoelectrics for self-powered devices

Class 11: April 29th, 2021

- k. Introduction
 - i. Challenges: piezoelectrics for self-powered devices
 - ii. Challenges: on-body energy harvesting in general

Class 12: May 6th, 2021

- l. Introduction
 - i. Significance and impact
 - ii. Purpose and novelty: combining energy harvesting and sensing into conformable, self-powered sensors

Class 13: May 13th, 2021

- m. Abstract
 - i. Concise and compelling overview of paper as a whole
 - ii. Determine keywords

Class 14: May 20th, 2021

- n. Combine Sections; Create Cover Letter
 - i. Ensure cohesion of paper

Calendar

February 2021

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|--------|---------------------------------|---------|-----------|---|--------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| | Registration for classes begins | | | | | |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | | | | Class 1: Review Outline & Timeline; Assign Sections | | |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| | | | | Class 2: Findings-Energy Harvesting | | |
| 28 | | | | | | |
| | | | | | | |

March 2021

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|--------|------------------------------|------------------------------|-----------|--|--------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| | | | | Class 3: Findings-Energy Harvesting | | |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| | Student holiday - no classes | | | Class 4: Findings-Energy Harvesting; Configurations & Structures | | |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | | | | Class 5: Findings-Configurations & Structures | | |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| | Student holiday - no classes | Student holiday - no classes | | Class 6: Findings-Configurations & Structures | | |
| 28 | 29 | 30 | 31 | | | |

April 2021

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|--------|---------------------|------------------------------------|-----------|-------------------------------------|--------|----------|
| | | | | 1 Class 7: Findings-Applications | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 Class 8: Findings-Applications | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 Class 9: Conclusion | 16 | 17 |
| 18 | 19 Patriots' Day | 20 Student holiday - no classes | 21 | 22 Class 10: Introduction | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 Class 11: Introduction | 30 | |

May 2021

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|--------|--------------------|---------|-----------|---|--------|----------|
| | | | | | | 1 |
| 2 | 3 | 4 | 5 | 6 Class 12: Introduction | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 Class 13: Abstract | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 Class 14: Combine Sections; Create Cover Letter | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | 31 Memorial Day | | | 4 Commencement | | |