TO: The Faculty of the College of Engineering

FROM: Elmore Family School of Electrical and Computer Engineering

RE: New Graduate Course, ECE 60282 Epidemic Processes

The faculty of the School of Electrical and Computer Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

ECE 60282 Epidemic Processes
Sem. 1, Lecture 3, Cr. 1, 5 weeks.
Prerequisite: Introduction to Mathematical Fundamentals for Systems & Control Theory, obtaining a grade of at least C- (permanent number request for this course ECE 60281)

Description: This course provides a control theory and data science approach to traditional epidemic models. Traditional epidemiological ideas will be explored and combined with probability theory and systems theoretic ideas to be able to capture spread behavior, learn from data, and design mitigation techniques. Namely, the course consists of four modules: 1) Virus Models, 2) Limiting Behavior, 3) Parameter Identification, and 4) Mitigation Algorithms.

Reason: This course provides a control theory and data science approach to traditional epidemic models. Traditional epidemiological ideas will be explored and combined with probability theory and systems theoretic ideas to be able to capture spread behavior, learn from data, and design mitigation techniques. Namely, the course consists of four modules: 1) Group Virus Models, 2) Solutions and Limiting Behavior, 3) Model Parameter Identification, and 4) Mitigation Algorithms. Given the impact of the COVID-19 pandemic, these problems are of the utmost importance.

Course History: Spring 2022 – 5, Spring 2021 - 12

Milind Kulkarni,
Associate Head for Teaching and Learning
Elmore Family School of Electrical and Computer Engineering

ECE 60282: Epidemic Processes

Instructor

- Philip E. Paré, *Assistant Professor of Electrical and Computer Engineering, Purdue University*

Course Description

This course provides a control theory and data science approach to traditional epidemic models. Traditional epidemiological ideas will be explored and combined with probability theory and systems theoretic ideas to be able to capture spread behavior, learn from data, and design mitigation techniques. Namely, the course consists of four modules: 1) Virus Models, 2) Limiting Behavior, 3) Parameter Identification, and 4) Mitigation Algorithms.

Course Learning Outcomes

After completing this course, you will be able to:

- Differentiate between distinct compartmental models for epidemics (SI, SIS, SIR, etc.) and identify the best model for a given scenario.
- Analyze the limiting behavior of models for epidemic processes by identifying the different possible equilibria of the models and specifying conditions for converging to different equilibria.
- Estimate model parameters from data for the different epidemic models.
- Employ the estimated model parameters to forecast the impact of an outbreak.
- Choose the best model for a given scenario/dataset by employing their knowledge of the epidemic models and by comparing the fit from the estimated parameters and the forecast accuracy.
- Develop and implement mitigation algorithms for the different models of epidemic processes.

Required Software

You will need access to MATLAB® or an equivalent tool for this course.

- **MATLAB®** is the preferred tool for this course.
- **GNU Octave** is the recommended alternative to **MATLAB®**.

Options for Accessing MATLAB

1. Purchase a student version of MATLAB for $99.
2. Use MATLAB through Purdue Software Remote.

Notes:

- Additional information on Software Remote

- For assistance using Software Remote, contact Purdue ITAP.
- MATLAB is the preferred tool for this course. Students are welcome to use equivalent tools of their choice.
- ***Important:*** Purdue has a limited number of MATLAB licenses for Software Remote, and access may be unavailable during busy times.

Accessing GNU Octave (version 5.2.0)

1. Go to the GNU Octave website.
2. Click the *Download* button on the right of the screen for download information for your specific system.

Notes:

- Download information for specific systems
- GNU Octave Support/Help
- Octave is the recommended tool for this course. Students are welcome to use equivalent tools of their choice.
- ***Important:*** Octave is a free software under the GNU General Public License.

Recommended Reading

- *Modeling Infectious Diseases in Humans and Animals*, M. J. Keeling and P. Rohani, Princeton University Press, 2008, ISBN: 9780691116174

Prerequisites

- ECE_695_IMF, Introduction to Mathematical Fundamentals for Systems & Control Theory, obtaining a grade of at least C-

Grading

This course will be graded based on the following criteria:

Assessment Type	Description	% of Final Grade
Homework	There will be two (2) homework assignments. Homework will be based on the content of the module in which it is located, but each module builds on the previous. Each assignment will be worth 25 points and will consist of five questions. Your answers to the homework assignments should be typed in LaTeX and will be submitted via Gradescope.	40%
Final Exam	The final exam will be comprehensive and worth 20 points. The final exam will be available to access for 48 hours (see the schedule below), but you will only have 2.5 hours to complete the final exam once you have started. The final exam will consist of 20 multiple choice questions (one point per question). The exam will be proctored using Proctortrack.	60%

Grading Scale

98% - 100%	A+
90% - 98%	A
84% - 90%	A-
78% - 84%	B+
72% - 78%	B
68% - 72%	B-
63% - 68%	C+
58% - 63%	C
53% - 58%	C-
48% - 53%	D+
45% - 48%	D
40% - 45%	D-
<40%	F

Course Schedule

Week	Module	Dates	Assignments and Exams

1 - 2	**1 – Virus Models**	9/25 – 10/1	• Homework 1 Assigned:
			  ○ Available in course: 9/25
			• Proctortrack Onboarding:
			  ○ Due Date: **Sunday, 10/1 at 11:59 PM ET** *(10/2 at 04:59 UTC)*

3	**2 – Limiting Behavior**	10/2 – 10/8	• Homework 1 Due:
			  ○ Due Date: **Wednesday, 10/4 at 11:59 PM ET** *(10/5 at 04:59 UTC)*
			• Homework 2 Assigned:
			  ○ Available in course: 10/2

4	**3 – Model Parameter Identification**	10/9 – 10/15	
5	**4 - Mitigation Algorithms**	10/16 – 10/22	• Homework 2 Due: ○ Due Date: **Wednesday, 10/18 at 11:59 PM ET** *(10/19 at 03:59 UTC)* • Final Exam Assigned:

			○ Available in course: **Saturday, 10/21 at 12:00 AM ET** *(3/27 at 04:00 UTC)*
	Final Exam Due		• Final Exam Due: ○ Due Date: **Wednesday, 10/25 at 11:59 PM ET** *(10/26 at 03:59 UTC)*

Course Help

To get help with course content, comment in the discussion forums located in each unit. By commenting in the unit discussion forums, the course team will be able to respond to your question more quickly. During the work week, the course team will respond to your question within 36 hours.

Discussion Guidelines

Please follow the Discussion Guidelines when contributing to discussions in this course. Here are a few of the key points you should remember:

- Do not use offensive language. Present ideas appropriately.
- Be cautious in using Internet language. For example, do not capitalize all letters since this suggests shouting.
- Avoid using vernacular or slang language. This could possibly lead to misinterpretation.
- Do not hesitate to ask for feedback.
- Be concise and to the point.
- Think and edit before you push the "Send" button.

Technical Help

If you experience technical difficulties with the edX platform, contact edX Support using:

- The email address: support-masters@edx.org
- edX's Contact Us form

Accessibility Information

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

The **Office of Institutional Equity**, which is responsible for ensuring Americans with Disability Act compliance, can be contacted with any accessibility concerns at:

Phone: (765) 494-7253
Email: equity@purdue.edu
TTY: (765) 496-1343
Website

- Purdue's Disability Resource Center Website
- Purdue's Web Accessibility Policy
- edX's Website Accessibility Policy
- MATLAB's Accessibility Policy
- GNU Accessibility Policy
- Proctortrack's Web Accessibility Policy

Academic Integrity

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

The Purdue Honor Pledge

> *"As a Boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue."*

Nondiscrimination Statement

Purdue University is committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Link to Purdue's nondiscrimination policy statement.