TO: The Faculty of the College of Engineering

FROM: Elmore Family School of Electrical and Computer Engineering

RE: New Graduate Course, ECE 50874 Advanced Software Engineering

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 50874   Advanced Software Engineering
Sem. 2, Lecture 3, Cr. 3.
Prerequisites: ECE 46100

Description: Software engineering is a difficult endeavor. Software engineers work in diverse teams to create and comprehend complex information, such as: code structure, implementation rationale, dynamic software behavior, change implications, and team dynamics. In this class, we will study principles of software engineering and discuss state-of-the-art research. In their course project, students will work to understand and extend the state of the art in software engineering, or to apply the concepts in an assessment of an existing open-source project. This is a graduate-level, research-oriented course. It briefly reviews, but largely builds on, ECE 46100. This course follows a project-based learning (PBL) approach – most of the grade is obtained through the completion of a team-based project. The primary audiences for this course are: - Students whose research interests lie in software engineering and adjacent areas (e.g. cybersecurity or systems). - Students who intend to develop computer-based systems, either as software engineers or working alongside them, and wish to have a more rigorous basis for their systems than "it seems to work".

Reason: This course builds on the material presented in ECE 30861/461 "Software engineering". ~2 weeks are spent reviewing content and the other weeks are new content (with a somewhat more mathematical treatment than is given in ECE 30861/461). ECE 595-AdvSE is more research-oriented; the course project is research-based.

Course Enrollment History: Spring 2021 – 35, Spring 2022 – 43, Fall 2022 – 42, Spring 2024 - 52

Mithuna Thottethodi,
Associate Head for Teaching and Learning
Elmore Family School of Electrical and Computer Engineering

Quick Links

Course Information

- **Course number and title:** ECE 50874 Advanced Software Engineering
- **Modality:** This course will be delivered in two modes as follows:
  - Face-to-face synchronous lecture (in-person grad and undergrad students)
  - Asynchronous section (online-MSc students)
- **Meeting days and times:**
  - See Brightspace for information about class sessions, office hours, media recordings, etc.
- **Course credit hours**: 3
- **Prerequisites (if any)**
  - *Undergraduates*: ECE 461 (Software Engineering); or commensurate experience with instructor approval.
  - *Graduate students*: Graduate standing and an interest in software engineering. Students will be best equipped for success if they have prior experience developing non-trivial software projects, whether professionally or through pertinent coursework.

Instructor Contact Information

- **Name of the instructor**: Assistant Professor James C. Davis
- **Office Location**: ECE 334D
- **Office Phone Number**: 765-494-3133, although make an appointment if you want me to answer it.
- **Purdue Email Address**: davisjam@purdue.edu

- **Office/Consultation hours, times, and location:** See Brightspace

- **About the instructor and course staff**: See Brightspace

Teaching Philosophy

I teach courses about material that I find interesting and societally impactful. I strive to communicate this passion to my students.

There seems to be no end to the knowledge of humankind. I have not mastered it all and do not pretend to have done so. I may know more about some topics than some of my students. Sometimes, students may know more than me. As a class, we will proceed down the road of learning together.

I keep busywork to a minimum. I will assign meaningful assignments, exams, and projects. In return, I expect students to submit good work.

The relationship between teacher and student is two-way. I will do my part to the best of my ability. But I cannot force you to learn. You will get out of this course what you put into it.

I believe that an interested student can master any material they want to. Of course, a student must invest an appropriate amount of time and follow effective study practices. Those practices can be learned. I can give advice on this if you want.

Course Description

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This is a graduate-level, research-oriented course. It briefly reviews, but largely builds on, ECE 461—Software Engineering.

This course follows a project-based learning (PBL) approach – most of the grade is obtained through the completion of a team-based project.

The primary audiences for this course are:

- Students whose research interests lie in software engineering and adjacent areas (e.g. cybersecurity or systems).

- Students who intend to develop computer-based systems, either as software engineers or working alongside them, and wish to have a more rigorous basis for their systems than "it seems to work".

Learning Resources, Technology & Texts

- **Required texts**:
  - I will assign readings from these books, following the approximate schedule below. Both texts are available from standard retailers, in addition to various purveyors of used copies.
    - *Software Engineering.* Sommerville, Pearson, 2016. The text has undergone major revisions over the years. I will refer to the 10th edition. The 9th edition has a similar table of contents and should be comparable. I would not recommend a version earlier than the 9th edition.
    - *Software Engineering at Google*. O'Reilly, 2020. An e-edition of this book is available through the Purdue library.
- **Recommended references:** I would be remiss in my duties as a scholar if I skipped an opportunity to share book recommendations! Here are some favorites.
  - To improve your knowledge of Software Engineering
    - *The Mythical Man-Month: Essays on Software Engineering*. Brooks.
    - *Design Patterns*. Gamma, Holm, Johnsson, Vlissides.
  - To improve your academic writing
    - *Style: Toward Clarity and Grace*. Williams.
    - *They say, I say: The moves that matter in academic writing*. Graff, Gerald, Cathy Birkenstein, and Cyndee Maxwell.
  - To develop as a researcher
    - *The Craft of Research*. Booth, Colomb, Williams, Bizup, and Fitzgerald.
- **Additional readings:**
  - I will assign readings from the course text, as well as online resources and research papers. Links or PDFs will be available on Brightspace.
- **Software/web resources**
  - Brightspace (for assignments, feedback, course discussions, and recordings)
  - Software for presentation and text processing (MS Office is free for all students)
  - Zoom will be used for e-meetings
  - If you need access to a Linux machine, you should have access to the Linux servers run by ECN (currently known as ECEProg) using your Purdue credentials. Most cloud providers also have a "free tier" or credits you can make use of.
- **Hardware requirements (e.g., webcam for exam proctoring)**
  - N/A
- **Tutoring support**
  - N/A
- **Brightspace learning management system**
  - Yes, accessible through the Brightspace Home.

Learning Outcomes

The following table indicates the course learning outcomes, their correspondence to ABET criteria (see ABET criteria), and the planned assessment instruments.

Outcome	Primary Instruments
1. Understand mathematical bases for software engineering (*e.g.* formal methods in software design and software verification) [ABET 1].	• Homework • Project
2. Formulate, conduct, and report on a team-based research-oriented project in software engineering [ABET 1,5,6,7]	• Project
3. Consider the ethical implications of software engineering failures and successes [ABET 4]	• Homework • Class participation
4. Summarize and analyze scholarly findings, both verbally and in writing [ABET 3]	• Homework • Class participation • Project

See the **Assignments** section of the Syllabus for more information about the assessment instruments.

Assignments

The primary assessment of your learning will be a combination of homework, class participation, and a team-based course project. Details on these assignments will be posted on Brightspace, including the due date, the points, and a grading rubric.

The following table gives the general breakdown of activities and weights. This outline is subject to change. Notably, the use of a final exam may vary from semester to semester.

Type of assessment	Planned activities	Total points
Homework	1. "Typical homework" Exercises to illustrate material presented in class 2. Reading responses 3. Project peer critique 4. Guest speaker preparation/reflections (if applicable)	20
Class participation	1. Class discussions: Posing good questions, formulating good answers (tracked via discussion board) 2. Research paper presentation (asynchronous students may record this for viewing in class, or join synchronously to present)	20
Project	1. Proposal sketch (oral and written) 2. Proposal (oral and written) 3. Response to proposal critiques (written) 4. Peer assessment 1 5. Project updates 6. Final report rough draft 7. Final report (oral and written) 8. Peer assessment 2	60
		Total: 100

Grading Scale

Your grades in this course are intended to assess how well you have met the learning outcomes for which the course is designed. Your grades reflect the sum of your achievement throughout the semester. You will accumulate points as described in the assignments portion above, with each assignment graded according to a rubric. At the end of the semester, final grades will be calculated by applying the appropriate weight to each assignment and translating the result into the following letters.

> A: 93-100
> A-: 90-92
> B+: 87-89
> B: 83-86
> B-: 80-82
> C+: 77-79
> C: 73-76
> C-: 70-72
> D: 60-69
> F: Below 60

Attendance and Deadline Policy

To succeed in the course, stay engaged.

Much of this class is discussion-based. If you are enrolled in the face-to-face version, I expect you will come to class unless there are mitigating circumstances (illness, travel, job interviews, etc.). A portion of your grade depends on in-class participation (or the asynchronous equivalent).

The assignments in this course have deadlines. However, I am not so naïve as to believe you have no other demands on your time. This is a graduate-level course, and I will treat you as professionals. **If you need an extension or accommodation, contact me and request it**. A professional strives to manage their time and completes assignments in a timely manner. However, surprises and emergencies of many kinds – including health, finances, and family matters – are all excellent reasons to retroactively request an accommodation. As needed, you or your representative should contact the Office of the Dean of Students via email or phone at 765-494-1747.

I reserve the right to assess a late penalty, or to refuse to grant an extension.

Course Schedule

See Brightspace for details and deadlines.

Academic Integrity

General policy

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 integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information is submitted the greater the opportunity for the university to investigate the concern.

If I find evidence that you have engaged in academic dishonesty, I will likely contact you to discuss it. If I conclude that there is a preponderance of evidence that you have behaved dishonestly (e.g. blatant copying), then at my discretion:

- o At a minimum, you will receive a 0 on the assignment and can re-submit it following honest conduct.
- o At my discretion, you may receive a failing grade in the course and have your behavior reported to the Office of the Dean of Students.
- o At a maximum, based on the Office of the Dean of Students' analysis of your behavior, further penalties may be considered, including removal from the university.

What does academic dishonesty mean in this course?

The Purdue Honor Pledge is "**As a Boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together – We are Purdue.**" Let me clarify what it means to be "honest and true" on the different assignments in this course.

In each kind of assignment, the primary consideration is that you clearly indicate which parts of your submission are your own work, which parts are communicating someone else's work. A failure to make this distinction is commonly called **plagiarism**. To avoid plagiarism, follow scholarly norms:

- Use quotation marks when making a direct quote, and include a citation in the text and a reference in your bibliography.
- If you are describing someone else's work, include a citation and a reference in your bibliography. When I say "someone else's work" I mean this broadly; that might include their study design, methodology, analysis technique, or research findings; a blog post they wrote; a talk they gave; personal communication; and so on.
- Use traditional document structure to make it easy to distinguish between your own work and someone else's work based on section title.
- Cite high-quality material. There are an abundance of research papers and "grey literature" (blog posts, Stack Overflow posts, Wikipedia pages, etc.). They are of varying quality. Do you trust the author?
- Honor the copyright of any images you use.

Here are some additional requirements for the main kinds of assignments in this course.

Homework: Paper summary

Clearly indicate that you are summarizing a paper, with a sentence at the top and a reference at the bottom. If you extract a quote, include the section number and/or page number as appropriate (this may be helpful to you in a class discussion).

Project: Project report

Structure your document so that your own work is in clearly noted sections. Here is a common outline for papers in the field of software engineering.

Section	Description	Has citations?
Abstract	Describes what you did. You can refer to facts (e.g. "Current techniques fail to…") without citation, but only if you expand on that claim in the body of your document and include citations there.	Unusual in this field
Introductions	Contextualizes and summarizes your work.	Yes (many)

Background and/or Motivation	Provides the concepts, key terms, and related work that a reader must know to understand your contribution. May include a motivating example	Yes (many)
Research Questions / Study Design / Methodology (Usually 1-3 sections)	Explain what you want to know, why you want to know it, and how you intend to find it out.	Often (e.g. to explain your experimental design)
Results	What did you find?	Unusual
Analysis	What do your findings mean?	Sometimes (e.g. to justify a choice of analysis)
Related work	Contextualizes your work in more detail. Lines of research that you described in the Background may be omitted, but work that is similar to yours in spirit should be considered. Sometimes combined with "Background".	Yes (many)

Class participation: Discussion

If you share your own thought, use phrases like "I think that…" or "Based on my experience, …" or "Based on my understanding of Zimmermann's work, …"

If you share someone else's thought, prefer phrases like "Zimmermann's work showed that …"

Class participation: Presenting a paper

Distinguish between summarizing a paper and sharing your own thoughts on a work. Use signpost slides that say things like "My Analysis", and verbalize transition phrases like "Now let me share my analysis of this work".

If you include a figure from someone else's work, indicate that you have done so through a citation at the bottom of the slide.

If you are re-using someone else's slides, indicate that at the beginning of your talk.

Project: Software

Understand and honor the license(s) associated with other code that you incorporate into your project.

You may rely on external dependencies, so long as they do not impose restrictions that are incompatible with your use.

On the use of generative AI

I expect that any thinking needed for assignments is done by you. You may use generative AI tools (e.g. ChatGPT) as editors but not as generators of ideas.

For any programming assignments, you may use Generative AI to help you write "boilerplate"-type code. Otherwise, stick to your own brain.

Nondiscrimination Statement

I will not tolerate intolerance. I will discriminate against discrimination.
(https://en.wikipedia.org/wiki/Paradox_of_tolerance).

Purdue University is committed to maintaining a community which 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 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. For further reading on this theme, see: *Purdue's Nondiscrimination Policy Statement*

Accessibility

All course material will be available through Brightspace.

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.

Mental Health/Wellness Statement

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack**.** Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours.

If you need additional academic resources: Consider Purdue's Academic Success Center and CAPS.

Basic Needs Security

Any student who faces challenges securing their **food** or **housing** and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student

Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday. Students may also submit requests for emergency assistance from the [Critical Need Fund.](#)

Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.