

PURDUE UNIVERSITY
Elmore Family School of Electrical and Computer Engineering
ECE 679 Advanced Digital Communications
Class Information
Spring 2026

Prerequisites: ECE 600 (or equivalent)

Instructor: Prof. David Love
MSEE 364
765 496-6797
djlove @ purdue.edu

Lecture Schedule: MWF 10:30-11:20 AM in WANG 2579

Help/Office Sessions:

M 1-2 PM (Virtual Office Hours via Zoom)

T 2-3 PM (Virtual Office Hours via Zoom)

Recommended Text:

Fundamentals of Wireless Communications, 1st Edition, D. Tse and P. Vishwanath,
Cambridge, 2005, ISBN No. 0521845270

Homework:

There will be homework assigned roughly every two weeks that will be collected, graded, and returned to you along with a copy of the solutions. Only a subset of the problems may be graded. **Homework will be posted and turned in using Brightspace.** For your own benefit, please attempt the problems before consulting your friends, TA, or me. In any case, the final write-up of the homework *must* be your own. **You will be required to use a camera (e.g., smartphone) or scanner to submit your homework.**

Exams:

There will be one in-class one-hour exam. Online students will use guidelines given by the university. Unless otherwise stated, the exam will be closed book, no crib sheet, and no calculator. However, some tables or formulas may be provided. The date for the exam will be given and cannot be changed. Please schedule your plant trips and interviews so that they do not conflict with this date. No exams can be taken early. The exam topics will cover through the lecture one week before the exam date (i.e. topics discussed on or before the Friday before the exam). The exam will typically contain four problems. The material that the exam tests for will be discussed before the exam. Graded exams will be returned within 3-4 class periods of administration.

If you have a disability or other needs, please see the Disability Resource Center (DRC) for possible accommodations. The web location is <http://www.purdue.edu/odos/drc/>.

Regrades:

Regrade requests on any graded exercise must be submitted in writing within one week of the date when the material was returned to you. After this time, no further change in grade will be considered. When you return your paper for a regrade, please attach a dated sheet to the front, indicating where you think that your paper was graded incorrectly.

Grades:

The final grade is computed as:

Homework 15%

1 Hour Exam 40%

Final Project 45% (proposal 8%, initial results 7%, presentation 10%, final report 20%)

Plus-minus grading will not be used.

In the event of a major campus emergency or other event, course requirements, deadlines, and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. You can obtain information about changes in the course by contacting me by email. I will also send out information using the class email list. Students are encouraged to stay home if having any symptoms.

Cheating:

Purdue University takes cheating VERY seriously. Any actions that might unfairly improve a student's score on homeworks, quizzes, or exams will be considered cheating and will not be tolerated. Examples of cheating include (but are not limited to):

Homework: The only requirement is that whatever you turn in is something that you wrote up (by hand or by computer) yourself. Working in groups is fine. Most of the problems are exam type problems. This means that:

1. Solutions are probably available to the exact problem or similar problems.
2. If you can not work these problems by yourself, you will find the exam extremely hard. It is better to challenge yourself on homeworks than on exams.

Exams: The list of things not to do includes, but is not limited to:

1. Share results or other information during an exam.
2. Bring forbidden notes, computers, calculators, or other devices.
3. Work on exam before or after official time.
4. Request regrade for work that has been altered.

Mental Health Statement

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 of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Course Outcomes

- 1) Ability to formulate and analyze communication system models for various scenarios, including wireless communications.
- 2) Understanding of multiple access techniques used in multiple user communication systems.
- 3) Understanding of broadband communication techniques such as orthogonal frequency division multiplexing (OFDM).
- 4) Understanding of multiple-input multiple-output (MIMO) techniques.

Rough Course Outline

- Communication input-output models
- Wireless channel modeling
- Capacity and achievable rate analysis
- Probability of error analysis in fading channels
- Broadband modulation
- Multiple access communication
 - CDMA
 - OFDM
- Multiple-input multiple output communication
 - Spatial multiplexing
 - Space-time coding
 - Beamforming
 - Precoding

EE 679 Project Overview

Breakdown (all count for a percentage of grade)

- Proposal (due February 20, 2026)
- Initial results and literature review (due March 6, 2026)
- Final oral report (Around last week class) (presented in-person or Zoom with prior approval)
- Final written report (TBD)

Two-page project proposal: Proposal will allow me to give feedback on the project topic. Please try to be as explicit as possible about what you will do. *Please describe what you will simulate.* References can count to the minimum page length requirement if needed. Please use single column format with single or 1.5 line spacing.

Initial results and literature review: A five-page document (excluding references) showing your initial results and findings. If you are doing a literature review, you will need to include at least 15 references. If you are doing original work, you will need to include at least 5 references. Please use single-column format with single or 1.5 line spacing. *Must include at least one simulation result with Matlab/Python code.*

Final written report: A two-column single spaced or single-column double spaced typed document. It is preferable to use LaTeX. Length depends on option chosen. If you choose to submit in two-column format, please also send me a single-column rough draft for page length verification. *Must include simulation results and some derivations/analysis with Matlab/Python code.*

Final oral report: A conference-style presentation, which will likely be completed in class, Zoom, or as a recording). Length (somewhere between 10-30 minutes) will depend on class size. Presentations MUST be done using slides. *Must include simulation results.*

Do NOT use ChatGPT, Gemini, or any similar AI tools to write your report.

Final Project Options

- Minimum 18+ pages (in single column) excluding references and figures for a single student or 25+ pages (in single column) excluding references and figures for a two-student group.
- Give an overview of an advanced digital comm related area OR try to do original research.
- Include summary of prior work in field, simulations, and necessary references.
- It is unacceptable to simply copy simulation results from papers. You MUST perform the simulations on your own.

If you choose to try and do original research, please DO NOT use your PhD or MS research. This is not fair to non-research students in the class.

Group Work

Individual work is preferred. Students can work in groups of two with my approval.

If working in a group of two, the following must be satisfied

- The proposal must specify each person's contributions.
- A document must be attached to the final project specifying each group member's contributions.
- The final report will be split between the two group members.
- The length of the final report must be a minimum of 25 pages (excluding references)

Random Topic Ideas

- SC-FDMA
- 5G NR reference signals
- 5G NR beamforming
- Quantum communication
- Coordinated multipoint
- Millimeter wave wireless communications
- 5G NR synchronization
- TDD calibration for channel reciprocity
- IEEE 802.11 (something) channel estimation and MIMO tutorial
- Joint radar and comm
- Low latency communication
- Library of probability of error and ergodic capacity calculations
- Hybrid ARQ
- Channel output feedback tutorial
- Channel state feedback tutorial
- Spectrum sharing
- Distributed synchronization of wireless devices
- Rate compatible coding techniques
- Binary interleaved coded modulation
- OFDMA
- Peak to average power analysis for a specific category of transmission
- Noncoherent capacity analysis (point-to-point or MIMO)