

ECE 5630/4630

Communication Systems II

Fall Semester 2024: Independent Study use YouTube Videos

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<https://faculty.uccs.edu/mwickert/>
- Office Hrs:** Wed. 10:40-11:30 am, others by appointment, including *Daily*, *Teams*, or *Zoom*.
- Required Text:** R. Ziemer and W. Tranter, *Principles of Communications*, seventh edition, Wiley, 2014 (ISBN-13: 978-1118078914). Full course notes available on the course Web Site.
- Optional Text** M. Rice, *Digital Communications A Discrete-Time Approach*, Prentice Hall, 2009 (ISBN 978-0-13-030497-1). Used for emphasis on DSP implementation.
- Optional Software:** Scientific Python via the Jupyter notebook (installed with <https://anaconda.org/anaconda/python>). Julia with Pluto notebook is very nice. Mathematica?
- Grading:**
- 1.) Graded homework assignments, including the use of Python (or MATLAB or Mathematica OK too) in problem solutions + Python project 1; 25%.
 - 2.) Final Python computer project worth 20%/15%. Grade option with final.
 - 3.) Two "Hour" exams at 15% each, 30% total. One take-home likely.
 - 4.) Final exam worth 25%/30%. A take-home likely.

Topics	Text Sections
1. Introduction and course overview	1.1–1.5
2. Review of Probability and Random Variables	6.1–6.4
3. Introduction to Random Processes	7.1–7.5
4. Principles of Baseband Digital Data Transmission	5.1–5.8
5. Principles of Data Transmission in Noise	9.1–9.9
6. Advanced Data Communications (includes wireless comm and the mobile radio channel)	10.1–10.6
7. Information Theory and Coding	12.1–12.8

Important: If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to register with Disability Services and provide them with documentation of your disability. They will work with you to determine what accommodations are appropriate for your situation. To avoid any delay, you should contact Disability Services as soon as possible. Please note that accommodations are not retro-active and disability accommodations cannot be provided until a Faculty Accommodation Letter has been given to me. Please contact Disability Services for more information at Main Hall, 3rd floor, Room 324, (719) 255-3354, or dservice@uccs.edu.

Learning Outcomes

The expected learning outcomes of this course are a continuation of ECE4625/5625. In this course the learning experience will focus on a quick review of probability and random variables; an introduction to random processes, with an emphasis on continuous-time modeling; various forms of digital modulation and demodulation; adaptive equalization; error correcting code performance in noise; introduction to spread spectrum and mobile radio. Simulation in general and specifically waveform level simulation of digital communication systems.

Installing Julia and Python, with Jupyter Lab together

Documents linked on the course Web Site provide details on how to install both Python and Julia along with various Julia and Python packages ([Julia_with_Python_Setup.pdf](#)). Under Jupyter Lab you create notebook documents (.ipynb) for either Python or Julia.

Note: Jupyter Lab is the perfect place to write code, document code, write text using markdown, import figures, and typeset math equations using LaTeX syntax. Julia makes a significant step in solving the *two language problem* (Python for rapid prototyping and C/C++ for execution speed). I want you to experience this. You will also see the *reactive* Julia Pluto notebook in action.

Setting up Python via miniconda

To set up Python alone but with advantage of virtual environments, I recommend using [miniconda](#). The helper document [new_python39_virtual_environment.pdf](#) is provided. [Installer links](#). In order to run real-time DSP code in Jupyter Lab using [pyaudio_helper](#) we need to stay with Python 3.9 for now.

Install vs code

Microsoft Visual Studio Code (vs code): <https://code.visualstudio.com/> is great for writing and debugging Python and Julia code source code files or Jupyter Lab notebooks. *Extensions* are available for Python, Julia, and Jupyter Lab. See the [Julia_with_Python_Setup](#) doc for vs code setup info

Notebook to mark-down, edit, PDF print

Install Typora: A (\$14.99 & 3 machines) markdown editor is at: <https://typora.io/>. Now you can export Jupyter notebooks as *.mcd and then open the file in Typora and save to PDF directly. You can also do some nice file editing if need be. Custom Header/footer, page numbers, etc.