

# ECE 4670

## Communication Laboratory

### Spring Semester 2022

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**Office Hrs:** Wednesday 12:00–1:30pm (always make an appointment at least 1 hour prior to your requested time, available at other times via appointment if necessary)

**Course Description:** This is a lab offered in conjunction with (or after) taking Communication Systems 1. The goal for this lab is to gain hands-on experience implementing many of the topics covered in the Communication Systems class. Since testing basic communication systems requires the use of various pieces of equipment, the labs are designed to introduce their function as well.

The course text for ECE 4625, Principles of Communications, serves as the theory reference for this course. Individual Lab experiment reader docs and support software, one per lab, can be downloaded from the course Web site.

**Grading:** The labs plus reports constitute 90% of your total grade. A final lab quiz will be given for 10% of the grade. Grading for the labs will be a mixture of subjective (report format, clarity, etc.) and objective (correct answers) criteria. In order to ensure that partners contribute equally, class participation is required and will be reflected in grading. Lab reports are due one week after the assigned lab time is up. Penalties may be assessed for late lab reports.

**Teams:** Students will pair up and each partner is expected to participate in the lab work. The ability to work with others in a lab environment is one of the implied goals of this type of class. I may periodically pose questions to students in order to gauge whether or not they are contributing equally.

Topics	Weeks
Lab 1: RF spectrum analyzer and network analyzer	2
Lab 2: Spectrum analysis	2
Lab 3: Mixers and Amplitude Modulation	3
Lab 4: Radio Receivers for Analog and Digital Modulation	2
Lab 5: Frequency modulation, demodulation, and phase-locked loops	2
Lab 6: Software defined radios and the RTL-SDR	3
Lab 7: FieldFox measurement campaign with log-periodic ant.	1
Final Communications Laboratory Exam	1

**Drop Date**      The last day to drop is Friday, April 1.

## Installing Python & scikit-dsp-comm

**Download and Install** the Anaconda Python 3.7+ Distribution: <https://anaconda.org/anaconda/python>. At this time I personally prefer miniconda and a Python 3.9 virtual environment. Using Python virtual environment via miniconda is the way the Lab Computers are now configured and a recommended approach for your laptop. [See the configuration details doc](#). This doc also includes setting up the scikit-dsp-comm package and pyaudio\_helper for real-time DSP in a Jupyter notebook.

**Optionally Download and Install** Microsoft Visual Studio Code (VS Code): <https://code.visualstudio.com/> or PyCharm Community Edition IDE for Python: <https://www.jetbrains.com/pycharm/>. VS Code now has an extension available for debugging and editing Jupyter notebooks, which worked well for many in late Fall 2021.

**Optionally Download and Install** the distributed version control application git: <https://git-scm.com/> on Windows systems (included on macOS and Linux). VS Code has Git integrated to make working with code repositories easy.

## Optional Jupyter Notebook to PDF Conversion

The Jupyter notebook in a Web browser or using VS Code extensions, is the perfect place to write code, document code, write text using markdown, import figures, and typeset math equations using L<sup>A</sup>T<sub>E</sub>X syntax. To render a Jupyter notebook as a PDF document a few more open source software components are needed:

- **Install Pandoc** for file conversion to LaTeX and other formats: <https://pandoc.org/index.html>
- **Install MikTeX** for converting LaTeX documents to PDF on *Windows*: <https://miktex.org/>. Be sure to choose the option to automatically download needed LaTeX packages on-the-fly
- **Install TeXLive** for converting LaTeX documents to PDF on *Windows*, *macOS*, and *Linux*: <https://www.tug.org/texlive/>
- **Install Inkscape** for converting embedded SVG graphics in Jupyter notebooks via Pandoc to LaTeX and then PDF: <https://inkscape.org/en/release/1.1.1/>. This gives you the ability to have nice looking graphics in the notebook and easily convert to a PDF, using just the File: Download Notebook menu item. On macOS and Windows little if any tweaking was required to get the notebook conversion process working. When this is finally set up it is great.
- **Install Typora** (no longer free): As an alternative to installing LaTeX (MikTeX or TeXLive), install the markdown editor Typora: <https://typora.io/>. Now you can export 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. The ECE 4670 Lab readers were all created using Typora!