

Syllabus for ECE 4803 – Software Defined Radios

Lecture Location: TBD

Lectures Hours: TBD

Studio Location: TBD

Studio Hours: TBD

Instructor: James ‘Trip’ Humphries, Ph.D.

Office: ???

Office Hours: ???

Telephone: ???

E-Mail: james.humphries@gtri.gatech.edu

Course Outcomes

- Program and test software defined radio (SDR) transceivers
- Process baseband signals in GNU Radio, Matlab, Python, or C++
- Implement timing, frequency, and frame synchronization
- Analyze physical and data-layer features of various wireless protocols

Student Outcomes

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Prerequisites

- Coding: (ECE 2036 [min C] or ECE 3090 [min C] or CS 1331 [min C]) and
- DSP: (ECE 2026 [min C]) and
- Signals and Systems (CEE/ISYE/MATH 3770 [min C] or ISYE 2027 [min C] or ECE 3077 [min C])

Grading Criteria

Your final grade will be assigned as a letter grade according to the following scale:

- A: 90-100%
- B: 80-89%
- C: 70-79%
- D: 60-69%
- F: 0-59%

Homeworks and projects will be equally weighted and will count 70% toward your final grade. The final exam/project will count 30% to your final grade.

Attendance Policy

Attendance will not be taken, but demonstrations of homeworks and projects will occur during class. At least one member from your team must be present to demonstrate your homework.

Required Textbook and Resources

Books:

- Travis F. Collins, Robin Getz, Di Pu, and Alexander M. Wyglinski, “Software-Defined Radio for Engineers,” Artech House, 2018 (<https://www.analog.com/en/education/education-library/software-defined-radio-for-engineers.html>) FREE DOWNLOAD

SDRs:

- ADALM-PLUTO Active Learning Module
- Available on Digikey / Mouser / Arrow and Others (Roughly \$150)
- Either purchase one or check one out from the ECE lab.

Computer and Software:

- You will need to setup your own computer for this class. Ubuntu 20.04 or variant recommended for software compatibility. Install as Main or Dual Boot OS preferred, VirtualBox VM can also work.

Academic Integrity

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404) 894-2563 or <http://disabilityservices.gatech.edu/>, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student Use of Mobile Devices in the Classroom

I may issue grading penalties to student(s) whose use of any mobile device in the classroom becomes disruptive for any reason.

Schedule

	Date	Class Type	Topic	Homework
1	23 Aug 2021	Lecture	Welcome, Syllabus, Intro to SDR	Start HW1: Computer / SDR Setup
2	25 Aug 2021	Lecture	Intro to SDR	
3	27 Aug 2021	Studio	Computer / SDR Setup	
4	30 Aug 2021	Lecture	SDR Processing Frameworks and Methods	Start HW2: GNU Radio Block Programming
5	01 Sep 2021	Lecture	SDR Processing Frameworks and Methods	
6	02 Sep 2021	Studio	GNU Radio Programming	
7	06 Sep 2021	Lecture	Signals and Systems	Start HW2: Digital Filters
8	08 Sep 2021	Lecture	Signals and Systems	
9	10 Sep 2021	Studio	Signals and Systems	
10	13 Sep 2021	Lecture	Digital Modulation	Start HW3: Digital Modulators
11	15 Sep 2021	Lecture	Digital Modulation	
12	17 Sep 2021	Studio	Digital Modulation	
13	20 Sep 2021	Lecture	SDR Hardware	Start HW4: AM Transceiver
14	22 Sep 2021	Lecture	SDR Hardware	
15	24 Sep 2021	Studio	SDR Hardware	
16	27 Sep 2021	Lecture	Timing Synchronization	Start HW5: Timing Synchronizers
17	29 Sep 2021	Lecture	Timing Synchronization	

18	01 Oct 2021	Studio	Timing Synchronization	
19	04 Oct 2021	Lecture	Carrier Synchronization	Start HW6: Carrier Synchronizers
20	06 Oct 2021	Lecture	Carrier Synchronization	
21	08 Oct 2021	Studio	Carrier Synchronization	
22	11 Oct 2021	None	Fall Break – No Class	
23	13 Oct 2021	Lecture	Guest Lecture	
24	15 Oct 2021	Studio	Carrier Synchronization	
25	18 Oct 2021	Lecture	Frame Synchronization	Start HW7: Frame Synchronizers
26	20 Oct 2021	Lecture	Frame Synchronization	
27	22 Oct 2021	Studio	Frame Synchronization	
28	25 Oct 2021	Lecture	Channel Estimation and Equalization	Start HW8: MQAM Transceiver
29	27 Oct 2021	Lecture	Channel Estimation and Equalization	
30	29 Oct 2021	Studio	Channel Estimation and Equalization	
31	01 Nov 2021	Lecture	OFDM	Start HW9: OFDM
32	03 Nov 2021	Lecture	OFDM	
33	05 Nov 2021	Studio	OFDM	
34	08 Nov 2021	Lecture	OFDM	
35	10 Nov 2021	Lecture	Guest Lecture	
36	12 Nov 2021	Studio	OFDM	
37	15 Nov 2021	Lecture	WiFi	Start HW10: WiFi
38	17 Nov 2021	Lecture	WiFi	
39	19 Nov 2021	Studio	WiFi	
40	22 Nov 2021	Lecture	Guest Lecture	
41	24 Nov 2021	None	Thanksgiving Break – No Class	
42	26 Nov 2021	None	Thanksgiving Break – No Class	
43	29 Nov 2021	Lecture	WiFi	
44	01 Dec 2021	Lecture	WiFi	
45	03 Dec 2021	Studio	WiFi	
46	06 Dec 2021	Review	Review Day	