

EE 567: Communication Systems

Fall 2019

Lecture: Tuesday 6:40-9:20 p.m. in RTH 109

Instructor: Christopher Wayne Walker, Ph.D.

Office: EEB 114

Office Hours: Tuesday 5:00-6:30 p.m. in EEB 110

Daytime phone: (310) 812-5176 (voicemail available)

email: chrwalke@usc.edu

TA: Runzhou Zhang, email: runzhou@usc.edu

Course web page: <http://www.cwwphd.com>

Texts:

Recommended: Modern Digital and Analog Communication Systems, 4th edition.

Authors: B.P. Lathi and Zhi Ding;

Recommended: Digital Communications, 2nd edition. Author: Bernard Sklar

First Lecture: Tuesday, August 27

Last Lecture: Tuesday, December 3

Course Grading Policy:

Method	Date	Weight
Homework	As assigned in class	25%
Project	Due Dec. 3	25%
Midterm	Tuesday, October 28, 6:40-8:00 p.m.	25%
Final	Tuesday, Dec. 17, 7-9 p.m.	25%

Notes: One 8 ½ x 11 sheet of notes (front and back) is allowed on the Midterm. Two such sheets are allowed on the Final. Calculators are allowed on all exams. No computers or cell phones are allowed on exams nor is any device allowed that has internet capability.

Contact Information: You are welcome to consult with me or your TA during office hours. Please consult with the TA only during his office hours (he is busy with studies like you are). If my office hours are not convenient for you or else you have a question that needs addressing before you can see me then you are welcome to call or email me. Email is the preferred method of contact if I can answer your question with an email response, but if we need to have more interaction then you are welcome to call me at my office. If you call and I cannot speak with you immediately then I will set up a time to call you back to discuss any issues or concerns you may have. I want this course to be a positive learning experience for you so please make sure you get all your questions answered.

Homework: Homework will be assigned regularly. You may work with others on the homework assignments but the work you hand in must be your own and not copied from another student. Homework is due at 6:40 p.m. on the due date. Late homework will be accepted for up to 2 days with 20% penalty.

Project: A project will be assigned and will be due at 6:40 p.m. on Dec. 3 (the last lecture before the final). The project is to be an individual effort. You may consult with only me or the TA with questions related to the project.

Statement for Students with Disabilities. Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Academic Integrity - Cheating

Cheating or plagiarism will not be tolerated on homework or exams. You may discuss homework problems among yourselves, but each person must do their own work and submit individual solutions written in their own hand. Copying or turning in identical homework sets is cheating. The penalty ranges from F on the homework or exam, to an F in the course, to recommended expulsion. See:

<https://viterbischool.usc.edu/academic-integrity/>
<http://sjacs.usc.edu/students/academic-integrity/>
<https://libraries.usc.edu/research/reference-tutorials>

If you have any questions regarding academic integrity - see the instructor.

USC Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include: the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. SCampus, the Student Guidebook, (www.usc.edu/scampus or <http://scampus.usc.edu>) contains the University Student Conduct Code (see University Governance, Section 11.00)

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, "Behavior Violating University Standards" <https://policy.usc.edu/scampus-part-b/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Support Systems:

Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

<https://engemannshc.usc.edu/counseling/>

National Suicide Prevention Lifeline - 1-800-273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

<http://www.suicidepreventionlifeline.org>

Relationship & Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender- based harm.

<https://engemannshc.usc.edu/rsvp/>

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: <http://sarc.usc.edu/>

Office of Equity and Diversity (OED)/Title IX compliance – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. <https://equity.usc.edu/>

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. <https://studentaffairs.usc.edu/bias-assessment-response-support/>

Student Support & Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic.

<https://studentaffairs.usc.edu/ssa/>

Diversity at USC

Tab for Events, Programs and Training, Task Force (including representatives for each school), Chronology, Participate, Resources for Students.

<https://diversity.usc.edu/>

EE 567 Outline

Fall 2019

Inst: C.W. Walker

Section	Title
1.0	Review of Fourier Transforms
2.0	Introduction to Communication Systems
	Transmitter
	Channel
	Receiver
3.0	Signaling Techniques
	Analog Communications
	Digital Communication
	Baseband Systems
4.0	Spectral Concepts
	Bandwidth
	SNR
	Frequency Bands
	Lowpass and Bandpass Signals
	Bandpass Systems
	Representation of Bandpass Systems
	Representation of Linear Bandpass Systems
	Response of a Bandpass System to a Bandpass Signal
5.0	Analog Modulation and Demodulation Techniques
	Amplitude Modulation
	Bandwidth Efficient Amplitude Modulation
	Frequency Division Multiplexing
	Angle Modulation
	Phase Modulation
	Frequency Modulation
	Bandwidth of FM Waves
	Generation of FM Waves
	Demodulation of FM Signals
	Frequency Discrimination
	Phase-Locked Loop Demodulation
6.0	Bandpass Systems
	Representation of Bandpass Systems
	Representation of Linear Bandpass Systems
	Response of a Bandpass System to a Bandpass Signal

7.0	Probability and Random Processes
	Probability and Random Processes in Communication Systems
	Noise in Communication Systems
	Spectral Analysis
8.0	Basic Antenna Concepts
9.0	Sampling and A/D Conversion
10.0	Digital Signaling Techniques and Performance
	AWGN Channel
	BPSK, QPSK, MPSK Modulation
	FSK, MSK, QAM Modulation
	Chaos Communications
	Effect of Coding on BER Performance
11.0	Receiver Design
	Carrier Acquisition and Tracking with Phase-Locked Loops
	Synchronization
	Scramblers
	Noise Figure
12.0	Signal Detection Techniques
	Correlation Detection
	Matched Filter Detection
	Square Law Detection/Radiometer
	M of N Detection
13.0	Spread Spectrum Communications and Multiple Access Channels
	PN Spreading Codes
	DS-CDMA
	TDMA
	FDMA
	Chaotic Waveforms
14.0	Miscellaneous Topics
	Link Budgets
	Channel Capacity
	TDOA/FDOA
	Intersymbol Interference
	Jamming and Anti-jamming Techniques
	Fading Channel
	Channelizers
	Channel Equalization
	Geolocation

The above outline is tentative and may change at the discretion of the instructor.