

## EC5950: Communication Systems, Fall 2009

<b>WMU Catalog:</b>	<p>Introduction to Advanced Topics: Communication Systems (3-0) 3 Hrs.</p> <p>Introduction to digital and analog communication systems. Design constraints of noise and bandwidth, comparison of various modulation techniques, and statistical methods. Information and channel capacity. Credit: 3 hours</p> <p>Prerequisites: ECE 3800 or equivalent Advised: ECE 3100, ECE 3710</p>
<b>Class Schedule:</b>	MWF 10:30-11:20 AM, CEAS D-202
<b>Instructor:</b>	<p>Dr. Bradley J. Bazuin, Assistant Professor, ECE CEAS A-241 <a href="mailto:brad.bazuin@wmich.edu">brad.bazuin@wmich.edu</a> <a href="http://homepages.wmich.edu/~bazuin/">http://homepages.wmich.edu/~bazuin/</a></p>
<b>Required Textbook and Materials:</b>	<ol style="list-style-type: none"> <li>1. A. Bruce Carlson, P.B. Crilly, J.C. Rutledge, Communication Systems, 4th ed., McGraw-Hill, 2002. ISBN: 0-07-011127-8.</li> <li>2. MATLAB, Student Edition</li> <li>3. MATLAB Signal Processing Toolbox</li> <li>4. LTSpice/IV – Linear Technology <a href="http://www.linear.com/designtools/software/index.jsp">http://www.linear.com/designtools/software/index.jsp</a></li> </ol>
<b>Supplemental Textbooks/Materials:</b>	<ol style="list-style-type: none"> <li>1. Leon W. Couch II, Digital and Analog Communication Systems, 7th ed. Prentice Hall, 2007. ISBN: 0-13-142492-0.</li> <li>2. John G. Proakis and Masoud Salehi, Communication Systems Engineering, 2nd ed. Prentice Hall, 2002. ISBN: 0-13-061793-8.</li> <li>3. B.P Lathi, Zhi Ding, Modern Digital and Analog Communication Systems, Oxford Univ. Press, 2009. ISBN: 978-0-19-533145-5.</li> </ol>

### Prerequisites by topic:

1. Probability, Random variables and processes.
2. Operation, construction, analysis and design of electronic circuits with discrete diodes, transistors.

### **Course Topics (Expected):**

- Course Introduction and Overview
- Review of selected topics from Fourier transforms, linear systems, convolution and filtering.
- Amplitude Modulation, Signal, Spectrum and Circuits.
- Phase and Frequency Modulation, Signals, Spectrum, Circuits, Bessel Functions, Phase-locked loops.
- Noise in analog modulation.
- Digital Communications, Amplitude Shift Keying, Phase Shift Keying, Optimum Receiver, Decision Regions.
- Noise in digital communications
- Selected advance topics from Information theory, Channel Coding, or Coded Modulation

### **Course Objectives:**

To give students the ability to analyze analog and digital communication systems performance, and design subsystems and circuits.

To provide communications fundamentals required for careers related to communications and/or more advanced communications courses.

### **Homework:**

Homework will be assigned on a regular basis. It will be due on the date specified, typically two to three class periods after the assignment. Homework assignments and the expected due dates are posted on the class web site. Late homework will not be accepted.

Every assignment will include significant MATLAB simulation, design, and/or verification graphs. LTSpice simulation of prototype circuits will be also be required. The LTSpice IV freeware software will need to be downloaded, installed and execute.

Therefore, it is **strongly** advised that you have “home/homework study area” access to MATALB, MATLAB Signal Processing Toolbox, SwCAD III, and the Internet.

It is your responsibility to get the assignments and complete them.

### **Quizzes:**

There will be a few pop quizzes. All quizzes are closed book and closed notes. They will be 5-10 minutes in length, typically at the beginning of the class period. If you miss a quiz, it cannot be made up and you will not receive credit for the points.

### **Computer Simulation Project:**

A semester project will be assigned, with each student pursuing a unique topic and simulation. A written report, including mathematical derivations and descriptions and Matlab simulation, validation and performance verification, will be required. A written proposal of the project will be required before each person's topic is accepted. The written reports are due by the end of class on Friday, 11 December.

Failure to successfully present and submit a project will result in an X grade for the course.

### **Exams:**

There will be two midterm exams and a two-hour final exam. The midterm exams will consist of a 1 hour in-class exam and a take-home Matlab simulation exam. The midterm exams are tentatively scheduled for Wednesday, 7 October and Monday, 9 November with the take-home sections due one week later at the beginning of the class period.

The Final Exam will consist of a 2 hour in-class exam and a take-home Matlab simulation exam. The in-class exam will be on Thursday, 17 December from 10:15 am to 12:15 pm. The take-home will be due 11 December by noon.

Students are required to attend all in-class exams as scheduled and submit take-home exams when due; failure to do so may result in an X grade for the course.

### **Grading Policy:**

Grades will be determined on the following basis:

Homework Problems –	0 %
Homework MATLAB/Spice –	5 %
Homework Submission –	10 % (10 x % of HW Problems Attempted)
Quizzes –	10%
Exam 1 –	17.5 %
Exam 2 –	17.5 %
Computer Project –	10 %
Final Exam –	30 %

The class performance distribution will be taken into account for assigning letter grades.

Permission to miss any due date may be granted by the instructor under extreme circumstances or university policy. If permission is desired, a request must be made before the due date and should include either a signed doctor's explanation, a written explanation signed by an appropriate WMU officer, or documentation of the university policy basis.

**Codes, Policies, Processes and Procedures:**

The WMU Graduate College Codes, Processes and Procedures and WMU College of Engineering and Applied Sciences Honesty Code will apply in this course.

You are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate Catalogs that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. [The policies can be found at [www.wmich.edu/catalog](http://www.wmich.edu/catalog) under Academic Policies, Student Rights and Responsibilities.] If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with me if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test.