University of Colorado at Denver
School of Engineering and Applied Sciences
EE 4247 Communication Theory
Fall 2009

Instructor: Joseph E. Beaini
Office: NC 2622.
Office Hours: M+W: 5:00 pm – 5:20 pm or by appointment.
Phone: (303) 517-8158
E-mail: joseph.beaini@cudenver.edu or jbeaini@ieee.org

Textbook:
Modern Digital and Analog Communication Systems, 4th Edition (Hardcover), by B. P. Lathi and Zhi Ding. **Publisher:** Oxford University Press, **ISBN-10:** 0195331451, **ISBN-13:** 978-0195331455

Supplementary Texts:
- J. G. Proakis and M. Salehi, *Fundamentals of Communication Systems*. Prentice Hall, 2005.
- S. Haykin, *Communication Systems,* 4nd Ed. New York: Wiley, 2001.
- L. W. Couch II, *Digital and Analog Communication Systems*, 7th Ed. Englewood Cli®s, NJ: Prentice-Hall, 2006.
- Principles of Communication: Systems, Modulation and Noise, 5th Edition (Hardcover), by R. E. Ziemer and, W. H. Tranter, Wiley, 2001

MATLAB References
http://www.math.ufl.edu/help/matlab-tutorial/index.html#SEC1
http://www.mathworks.com/access/helpdesk/help/helpdesk.html
http://www.cyclismo.org/tutorial/matlab/

Course objective:
The main objective of this course is to provide an introduction to the underlying theory and principles of operation of communication systems both analog and digital. In addition, the course will emphasize the analytical and simulation tools required to simulate and analyze the operation and performance of these systems. Finally, this course will introduce to the student some of the most recent communication trends that the research community is working on in the areas of digital modulation techniques and their applications.

This course is particularly useful for those students who would like to gain an analytical and quantitative understanding of the principles of operation of communication systems. It is highly recommended to students who will chose careers in this hot area as well as those who would like to advanced degrees in this area. Students are expected to have a strong base in calculus, an understanding of probability theory, and a good understanding of linear systems.

Learning Objectives
- Demonstrate an ability to communicate this knowledge in written form;
- Demonstrate a basic knowledge of the full range of modulation techniques and standards used in analog and digital communication systems which can then be applied to the design of communication systems.

Course Catalog Description:
E E 4247-3. Communication Theory. Introduces the principles of analog and digital communication systems. Application of transforms and signals. The sampling theorem. Stochastic principles and noise. Linear systems and Fourier analysis. Design of transmitters and receivers: modulation and demodulation schemes. Error performance under the influence of noise. Source coding, channel coding, channel capacity and performance measures.

Prerequisites:
EE3316, EE 3817, CSC 4535 or equivalent (Random Processes).

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Homework/Projects/Exams:

Topic	Grade Weight:
Student needs to pass three in semester written exams and one final exam. The first exam covers the topics discussed during the first tier of the course and will be given after the 6th lecture. The second exam covers the topics discussed during the second tier of the course and will be given after the 14th lecture. The third exam covers the topics discussed during the second tier of the course and will be given after the 20th lecture. The final exam will be given during the CUD official week for exams.	**20/20//30 respectively for a total of 70% of final grade**
Homework will be given to test student's knowledge and understanding of the covered topics. Projects will be assigned to facilitate the application and understanding of some topical concepts. Projects will be solved using MATLAB currently installed on all machines in the Raytheon Lab. MATLAB can be used to solve homework as well, especially when the object of the homework problem requires analysis of signals.	**HW - 15%** **Projects – 15%**

Homework, projects, and written exams must be individually done by each student without collaboration with others.

ATTENDANCE REQUIREMENTS:
Attendance at all assigned class times is expected. While attendance at prescribed classes is not a component of assessment in any subject, past experiences has showed there is a high correlation between non-attendance and failure in the subject. You are responsible for all information (both technical and administrative) presented during class times. You should establish informal study groups and one function of these is to give you access to information, if for any reason, you miss a class session. Students auditing this subject must attend ***all*** scheduled sessions.

Topic(s)	Chapter(s)	Estimated Date	Assignment
Review of Transforms and Linear System	1, 2	8/17, 8/19, 8/24	1 Set
Signal Analysis - vectors	3	8/26, 8/31, 9/2	2 Sets
Overview of Probability	8	9/9, 9/14	1 Set
Matlab Project 1 due		9/16	
Amplitude Modulations and Demodulations	4	9/16, 9/21, 9/23	2 Sets
Angle Modulation and Demodulation.	5	9/28, 9/28, 9/30, 10/5,	2 Sets
Project 2 Due, Review		10/7	
Test 1		10/12	
Sampling and Analog to Digital Conversion	6, 7	10/14, 10/19, 10/21	2 Sets
Principles of Digital Data Transmission	7	10/26, 10/28	1 Set
Random Processes and Spectral Analysis	9, 10	11/2, 11/4, 11/9, 11/11	2 Sets
Test 2		11/16	
Performance Analysis of Modulated Communication Systems Under Noise	10, 11	11/18, 11/30	1 Set
Fall Break			
Performance Analysis of Digital Communication Systems	11	12/2, 12/4	1 Set
Project 3 Due, Review			
Final Exam		12/12	

This schedule is not etched in stone as it can vary with time depending on student rate of comprehension of material.

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UC Denver – Downtown
Dates and Deadlines*
ACADEMIC CALENDAR
Fall 2009

Students are accountable for knowing and following these deadlines.

- Students **must** use and regularly check their UC Denver assigned **e-mail address**; University communication will be sent to your UC Denver assigned **e-mail address**.

April 6	- First day to register, check S.M.A.R.T. for your registration date and time. Before registration, all students must pay a $200 registration advance payment which will be applied to your tuition and fees. See billing information below. - First day to apply for fall graduation. See your advisor.
August 16 **By 5:00pm**	- **Last day to withdraw from all classes and receive refund of $200 advance payment** and no tuition assessed.
August 17	- First day of Fall semester classes. - First day faculty/staff may register with a tuition waiver. - Last day to petition for resident tuition status.
August 23	**LAST DAY TO:** - **Add courses and waitlist using S.M.A.R.T** - If you are on the waitlist, read waitlist "How to" - NOTE: if your course does not appear as "enrolled" on your schedule by Census Date, you are not enrolled in the course.
August 24	- **No adds permitted today.** - **Last day to drop a course without a $100 drop charge.**
August 25	- First day instructor may approve a request to add a student to a closed course using a Schedule Adjustment Form.
August 25	**Between August 25 and September 2:** - Courses may be added using a Schedule Adjustment Form with instructor's approval and signature. - Independent study, internship, thesis, and dissertation credit may be added with required signature approvals using a Special Processing Form. - Late starting module or intensive courses may be added up until the first day of the class. After that, those courses may be **added with instructor's approval and signature.**
September 2 CENSUS DATE **By 5:00 PM**	**LAST DAY TO:** - **DROP** full-term courses (possible financial adjustment). - After this date, dropped courses **require instructor's approval and signature** and *will appear* on your transcript. - **Withdraw from the term.** After this date, complete withdrawal (all courses dropped) requires the signature of your dean (no tuition adjustment). Signature of financial aid required if student has financial aid (loans, grants, or scholarships). - **ADD** full term courses (except thesis, independent study and internships). **After this date**, student will be charged the **full tuition amount** for additional course(s) added - College Opportunity Fund hours will not be deducted from eligible student's lifetime hours. - Request a No Credit or pass/fail grade for a course. - Register as candidate for degree. - **Apply for fall graduation.** - Petition for reduction in dissertation hours. - **Submit faculty/staff tuition waiver forms.**
September 7	- Labor Day Holiday (campus closed/no classes)
October 27	- First day Registrar's Office **requires** dean's signature to drop or withdraw. NOTE: your college may require dean's approval prior to this date; please see your advisor.
November 23-29	- Fall Break (no classes; campus open)
November 26	- Thanksgiving Day Holiday (campus closed/no classes)
December 1	- Last day to authorize for College Opportunity Fund (COF) via S.M.A.R.T. Students may continue to authorize through finals at the Registrar's Office.
December 7-12	- Finals Week.
December 12	- End of semester. Commencement.
December 22	- Fall Final grades available on S.M.A.R.T.
January 28	- Degrees posted on S.M.A.R.T. (tentative).

* Extended Studies/Continuing and Professional Education student Dates & Deadlines may vary – see your advisor.

INTENSIVE AND MODULE COURSES:

Intensive courses are short format (less than five weeks). They require the same number of classroom hours, and the same amount of work as a full-term class, per credit.

Module courses are classes lasting five or more weeks but less than the full term. They require the same number of classroom hours, and the same amount of work as full-term courses. Module courses meet:

First five weeks:	August 17 - September 19
Second five weeks:	September 21 - October 24
Third five weeks:	October 26 – December 5

Adds after 1st class to start of 3rd class **require** instructor signature; drops after 2nd class to start of 3rd class **require** instructor signature. **Drop charges apply the first day of class or later.** Drops or withdrawal after 3rd class meeting require special approval from student's dean; no tuition adjustment.

ACADEMIC CALENDAR 2010

Spring 2010 (tentative)

Martin Luther King Day - No classes; campus open	Jan 18
Classes Begin	Jan 19
Spring Break – No classes; campus open	March 22-28
End of Term	May 15

Summer 2010 (tentative)

Memorial Day Holiday-Campus closed	May 31
Classes Begin	June 7
Independence Day Holiday – No classes; campus closed	July 4
Independence Day Holiday (observation) – No classes; campus closed	July 5
End of term	July 31

BILLING INFORMATION

(Check S.M.A.R.T. or CU Access portal for your current account balance)

- **Please be aware there is a required registration advance payment of $200.00.** This payment must be made before you can register. The ONLY exception to this requirement is if the Financial Aid Office has received your FAFSA data and you have completed the University Application for Financial Aid.
- 1st day of the term through the following Monday – If the student withdraws from all classes for the term, he/she will forfeit $200, which corresponds to the $200 registration advance payment.
- Beginning the second Tuesday of the fall and spring terms until census date. If a student drops a course, a $100 drop charge will be assessed. If a student withdraws during this time frame (therefore dropping all classes), all tuition and other fees will be removed, but a drop charge of $100 will be assessed for each course.

STUDENTS ARE RESPONSIBLE FOR COMPLYING WITH TUITION/FEES DEADLINES. UNPAID TUITION WILL BE SUBJECT TO 1.75% SERVICE CHARGE. ADDITIONALLY, PAST DUE ACCOUNTS MAY BE ASSESSED A 20% INTERNAL COLLECTION FEE ON THE UNPAID BALANCE FOR DETAILED INFORMATION ON PAYMENT DATES AND POLICIES, CALL 303-556-2710 or visit Student Billing.

The University of Colorado Denver has implemented an official E-Bill (electronic billing) program. Beginning with the Fall 2008 Term, UC Denver no longer mails paper billing statements to students. All registered students must access their student account bill through the CU Access portal .