ENTs 622 Introduction to Digital Communications - Fall 2019 Syllabus

Course Description: Principles of analog and digital communication systems design. This includes analysis of the performance and relative merits of different modulation such as PSK, QAM, and GMSK, spectral analysis, signal processing techniques, filtering, frequency selective fading channels and coherence bandwidth, time varying channels and Doppler spread, and optimum receivers. Also provides hands-on labs where students learn to work with the Ettus B210 software-defined radio, using GnuRadio; for example, students will generate digital signals, and perform pulse-shaping, synchronization, and equalization for different digital modulation schemes. Homework will include Matlab problems.

Prerequisites: Successful completion of a technical undergraduate degree, including successful completion of courses in differential and integral calculus, signals & systems (including Fourier series, Fourier transforms, convolution, properties of linear time-invariant systems), and probability theory (including random variables, cumulative distribution functions, probability density functions, functions of random variables, and moments of random variables). Knowledge of Matlab, Python, or GnuRadio are not prerequisites.

Lecture: Section 010x: Monday • 5:30pm • 8:15pm • ITV 1100

Lab sessions: Section 0101: Friday • 5:30pm-8:15pm • AVW 1362 •
Section 0102: Tuesday • 9am-11:45am • AVW 1362 •
Sections 0103: Thursday • 2pm-4:45pm • AVW 1362 •

Instructor:
Name: Alejandra Mercado E-Mail Address: mercado@umd.edu Office Location: AVW 1365
Regular Office Hours: Mon 4PM-5PM & Thu 1PM-2PM (always set up appointment online, here)

TA Office Hours (email first to schedule an appointment):
Name: Ms. Gholami
Name: Mr. Talagala
Email address: a.anoosheh@yahoo.com
Email address: rtalagal@umd.edu
Hours: T & Th 11:45-12:15 and T 5pm-6pm
Hours: M 4:45-5:15, T 2pm-3pm, W 5-5:30pm
Office Location for T: AVW 1301
Office Location for T: KEB 1115

Logging in to the Course for announcements, documents, etc.:
Go to http://elms.umd.edu. Login with your Maryland Directory ID and password.

Texts and Supplies
• Required Textbook:
  o “Communication Systems” by Haykin and Moher; Publisher: Wiley; 5 edition (March 16, 2009); ISBN-10: 0471697907
• Supporting References for course material:
  o “Communications Systems” by Simon Haykin (UMCP Engineering and Physical Sciences Library Stacks TK5101 .H37 1994 on reserve for course)
  o “Digital Communications” by John Proakis (UMCP Engineering and Physical Sciences Library Stacks TK5103.7 .P76 2001 on reserve for course)
  o “Principles of Communication Engineering” by Wozencraft and Jacobs (UMCP Engineering and Physical Sciences Library Stacks TK5101 .W62 )
• Supporting References for background review:
Grading
Attendance Quiz (first day) 4%
Midterm exam: 20%
Problem quizzes: 23%
Lab quizzes: 23%
Homework: 10%
Final Exam: 20%
Total 100%

Final Grading will be determined using the following scale based on the overall average score:

- Threshold for A-, A, A+ 90 %
- Threshold for C-, C, C+ 70 %
- Threshold for D-, D, D+ 60 %
- Threshold for F everything else

A± denotes excellent mastery of the subject and outstanding scholarship.
B± denotes good mastery of the subject and good scholarship.
C± denotes acceptable mastery of the subject and the usual achievement expected.
D± denotes borderline understanding of the subject and marginal performance.
F denotes unsatisfactory performance.
XF denotes failure due to academic dishonesty.

Tentative Course Schedule
The instructor reserves the right to make schedule changes based on class progress, weather-related closures, or other factors.

<table>
<thead>
<tr>
<th>Week #</th>
<th>Week beginning Monday</th>
<th>Monday’s Lecture Topic from text</th>
<th>USRP Lab</th>
<th>Problem Solving Session</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lab Quiz</td>
<td>Problem Quiz (late arrivals will receive 0%)</td>
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<tr>
<td>1</td>
<td>Aug 26</td>
<td>Introduction to the course. Chapters 1 &amp; ATTENDANCE QUIZ (late arrivals will be counted as 0%)</td>
<td>AVW 1362: Introduction to B210 and GnuRadio, Signal generation, sampling rate, scope, spectral analysis, aliasing Lab quiz on lab material</td>
<td>AVW 1458: Lecture Chapter 2 Problem Quiz: covers “Communications System Overview” from Lecture 1</td>
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<tr>
<td>2</td>
<td>Sept 2</td>
<td>Sept 2 is Labor Day (uni closed on Monday): attend Lab in AVW 1458 for lecture Chapter 2</td>
<td>AVW 1458: Problem Solving Session Problem Quiz: chapter 2 seen in class</td>
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<tr>
<td>3</td>
<td>Sept 9</td>
<td>Chapter 3</td>
<td>AVW 1362: AM and clipping, envelope detector and envelope distortion Lab quiz on lab material</td>
<td>AVW 1458:</td>
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<tr>
<td>4</td>
<td>Sept 16</td>
<td>Chapter 4</td>
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<td>AVW 1458:</td>
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ENTS 622: Intro. To Digital Communications
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics</th>
<th>Notes</th>
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<tbody>
<tr>
<td>5</td>
<td>Sept 23</td>
<td>Chapter 5</td>
<td>AVW 1458: Problem Solving Session</td>
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<td>Problem Quiz: one of the problems seen in lab of week 3</td>
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<tr>
<td>6</td>
<td>Sept 30</td>
<td>Zig-Bee &amp; Chapter 6</td>
<td>AVW 1362:</td>
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<td>Noise floor, PAM</td>
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<td>Lab quiz on lab material</td>
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<tr>
<td>7</td>
<td>Oct 7</td>
<td>Zig-Bee &amp; Chapter 6</td>
<td>AVW 1458: Problem Solving Session</td>
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<td>Problem Quiz: one of the problems seen in lab of week 5</td>
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<td>8</td>
<td>Oct 14</td>
<td>midterm exam</td>
<td>AVW 1362:</td>
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<td>BPSK, PSK</td>
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<td>Lab quiz on lab material</td>
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<tr>
<td>9</td>
<td>Oct 21</td>
<td>Chapter 7</td>
<td>AVW 1458: Problem Solving Session</td>
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<td>Problem Quiz: one of the problems seen in lab of week 7</td>
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<tr>
<td>10</td>
<td>Oct 28</td>
<td>Chapter 7</td>
<td>AVW 1362:</td>
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<td>QAM, equalization</td>
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<td>Lab quiz on lab material</td>
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<tr>
<td>11</td>
<td>Nov 4</td>
<td>Chapter 8</td>
<td>AVW 1458: Problem Solving Session</td>
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<td>Problem Quiz: one of the problems seen in lab of week 9</td>
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<td>12</td>
<td>Nov 11</td>
<td>Chapter 8</td>
<td>AVW 1362:</td>
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<td></td>
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<td>synchronization</td>
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<td>Lab quiz on lab material</td>
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<tr>
<td>13</td>
<td>Nov 18</td>
<td>Chapter 9</td>
<td>AVW 1458: Problem Solving Session</td>
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<td>Problem Quiz: one of the problems seen in lab of week 11</td>
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<td>14</td>
<td>Nov 25</td>
<td>Chapter 9</td>
<td>No Labs: Happy Thanksgiving!</td>
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<td>No Labs: Happy Thanksgiving!</td>
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<tr>
<td>15</td>
<td>Dec 2</td>
<td>Chapter 10</td>
<td>AVW 1362:</td>
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<td>Python coding blocks for GnuRadio</td>
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<td>Lab quiz on lab material</td>
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<tr>
<td>16</td>
<td>Dec 9</td>
<td>Chapter 10</td>
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<td>Dec 10</td>
<td>Reading Day</td>
<td>No labs</td>
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<tr>
<td>17</td>
<td>Dec 11 - 17</td>
<td>Finals week</td>
<td>No labs</td>
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A. Requirements
Students are expected to be on time, attend all class meetings and lab sessions, and complete all assignments and all assessments of their knowledge and understanding of the class material.

B. Assignments
Any assignment that is turned in should be complete, and represent the student's individual and original work. Turn in your assignment at the beginning of the class. Late assignments will not be accepted, as this would place an unfair burden on students who hand in their work in a timely manner.

C. Make-up Policy
In the case of an excused absence (such as a disabling medical emergency with a letter from a physician on official letterhead, or a death in the immediate family with proper documentation), the instructor will redefine the grading distribution in accordance with what assessment was lost.
Excused Absence: If you miss an assessment (test or project), contact me as soon as possible. You may receive an excused absence for such things as: medical emergencies, or death of an immediate relative. Unexcused absences will result in a grade of zero for the missed assessment.

Religious Observance: The student should inform the instructor at the beginning of the semester about any absences due to religious observances. We will make appropriate arrangements for the missed assessment. This must be NO LATER than the second week of classes.

D. Audit Policy
Audit students must participate fully in the course and follow all policies and procedures to audit the course. Exception: exams and reports are not required.

E. Academic Integrity
The maintenance of the highest standards of intellectual honesty is the concern of every student and faculty member at the University of Maryland. Plagiarism, which is defined as appropriating or closely imitating another person's work or ideas and representing them as one's own original work, is strictly prohibited. Use of phones, tablets or other electronic devices during a test is not allowed. Talking or whispering during exams or quizzes is never allowed.
Academic Dishonesty or Misconduct can occur in many ways. Some examples are:
   a) Plagiarizing from written, video, or Internet resources
   b) Forgery
   c) Submitting materials that are not the student's own work, such as homework or Matlab code
   d) Taking examinations in the place of another student, including assessment tests
   e) Assisting others in committing academic dishonesty
   f) Copying from another student during an examination or on a homework assignment.
Failure to abide by the rules of Academic Integrity (which, in addition to the described above is detailed in http://www.president.umd.edu/policies/docs/III-100A.pdf) will result, at the very least, in a grade of XF: the grade appears on the student's transcript with the notation "Failure due to academic dishonesty," as well as further disciplinary actions.

F. Taping and/or Distributing Course Materials Forbidden
All course materials (lecture slides and other materials provided to you) are to be considered copyrighted by the University of Maryland – and may not be reproduced for anything other than personal use without written permission from your instructor and the College Dean. Video-taping or audio-taping lectures is forbidden. If you publicly post or share course materials, and especially any solutions for homework, exams, quizzes, project, etc., you will be in violation of U.S. Copyright Law, University of Maryland policies, as well as the Code of Academic Integrity.

G. Support Services
Disability Support Services (DSS): Any student who may need an accommodation due to a disability should contact DSS offices at 0106 Shoemaker Building (301.314.7682) A letter from DSS authorizing your accommodations will be needed. For a complete list of other student support services, please refer to the Student Handbook.
H. Cancellation of Classes
If inclement weather forces the campus to suspend classes or close, public service announcements will be provided to local radio and television stations as early as possible. Assume that classes will be held unless you read or hear otherwise from the university web page or radio or television.

You may also call check the UMCP web page at [http://prepare.umd.edu/weather](http://prepare.umd.edu/weather)

Check the [canvas](https://canvas.umd.edu) (ELMS) course site frequently and always before coming to campus for lecture, as instructor will post announcements there about class cancellations or other course-related matter.

**CONTACTS:**
Students learn best from each other when studying together. Get together to work on the homework (use the Canvas/ELMS *Discussion* to arrange study-groups).

Also, class contacts are useful to copy lecture or lab notes in the event you miss a class. I *strongly* encourage you to meet your neighbors, and get some contact information.

Name: __________________________    Name: __________________________

Email: __________________________    Email: __________________________

Phone: __________________________    Phone: __________________________

Name: __________________________    Name: __________________________

Email: __________________________    Email: __________________________

Phone: __________________________    Phone: __________________________

Contact the instructor: The best ways to reach me is via email. Please only use your UM email address; due to privacy issues I will not read mail from personal email addresses.

**VETERANS**
If you are a veteran or on active or reserve status and you are interested in information regarding opportunities, programs and/or services, please visit the University of Maryland Veterans Program Office website at [http://registrar.umd.edu/veteran-benefits.html](http://registrar.umd.edu/veteran-benefits.html)

**QUESTIONS ABOUT GRADUATE SCHOOL POLICIES?**
You can view University of Maryland Graduate School policies and practices in the Graduate Catalog, here: [http://apps.gradschool.umd.edu/Catalog/policy.php](http://apps.gradschool.umd.edu/Catalog/policy.php)