Master Course Syllabus for EEL 4514

1. **Department:** ELECTRICAL AND COMPUTER ENGINEERING

2. **Title:** COMMUNICATION SYSTEMS and COMPONENTS; **Credits:** 3

3. **Course Designation as Elective or Required:** Required.

4. **Catalog Description:** Theory of communication, and applications to radio, television, telephone, satellite, cellular telephone, spread spectrum and computer communication systems.

5. **Prerequisite(s):**

   EEL 3112 Analysis of continuous-time signals and linear systems.
   EEL 3135 Analysis of discrete-time signals and linear systems.
   EGM 4313 all with grade C or better.

6. **Textbook(s) and/or Other Required Materials:**


7. **Course Objectives:**

   1. To develop the signal processing theory involved in the analysis and design of analog and digital communication systems.
   2. To analyze basic analog and digital modulation signals and systems, their bandwidth requirements, and their signal-to-noise ratio performance.
   3. To analyze common communication system components, especially mixers and phase-locked loops.
   4. To discuss applications to radio, television, cellular telephone, etc.

8. **Student Learning Outcomes:**

   - Analyze communications systems in the time and frequency domains using tools such as the Z transform, Fourier transform, and Discrete Fourier transform.
   - Design basic communications systems at a top level to meet prescribed specifications.
   - Apply the software package MATLAB to simulate communications systems. In this course students solve problems involving the design, implementation, and operation of communications systems and components that meet performance requirements.

9. **Topics Covered:**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Classes</th>
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<tr>
<td>1. Review of Fourier analysis, Power Spectral Density, Linear Systems, and Signal Distortion.</td>
<td>2 classes</td>
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<td>2. Frequency Translation Techniques: Heterodyning and Modulation.</td>
<td>2 classes</td>
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<tr>
<td>3. Double-Sideband Suppressed Carrier (DSBSC) and Amplitude Modulation (AM).</td>
<td>2 classes</td>
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</tbody>
</table>
4. Introduction to Communication Networks. 1 class
5. Time and Frequency Allocation Techniques: FDMA, TDMA, and CDMA. 2 classes
6. Frequency Modulation (FM). 1 class
7. Orthogonal Digital Codes; and Introduction to Digital Communications. 2 classes
8. Digital Modulation Techniques: FSK, BPSK, QPSK, QAM, etc. 3 classes
9. Link Budget Analysis; including Effects of Noise in Communication Systems. 3 classes
10. Propagation Effects: Multipath Fading and Doppler Shift. 2 classes
11. Impulse Response of Communication Channels. 1 class
12. Equalization Techniques: FIR and IIR Filters. 2 classes
13. Shannon’s Information Theory and Channel Capacity. 2 classes
14. Channel Coding and Error Correction Techniques. 2 classes
15. Introduction to Satellite Communications. 1 class
In-term Exams 2 classes
Total 30 Classes

Computer Resources: MATLAB is used extensively for numerical, symbolic, and graphical analysis. Schematics/PSpice is used for circuit analysis and simulation.

10. Class/Laboratory Schedule: Two classes of 75 minutes per week. The separate laboratory course EEL 4514L is closely coordinated with this course.

11. Contribution to Meeting Professional Component:

This course applies signal and system analysis techniques to the analysis and design of communication systems. The students are made to consider the cost, performance, and societal impact of various system designs. They are introduced to the regulatory and standards functions of the FCC and the CCITT.

Design/Science Content:

ABET Science: 2.5 credits or 83%
ABET Design: 0.5 credit or 17%

12. Relationship to Program Objectives:

| # | Program Objectives | Check if related |
1a. Develop electrical engineering solutions individually and through interdisciplinary teams within a global and societal context.

1b. Develop computer engineering solutions individually and through interdisciplinary teams and act accordingly within a global and societal context.

2. Professionally and ethically, engage in technical or business activity through engineering ability, communication skills, and knowledge.

3. Continue professional growth through post-graduate education, continuing education, or professional activity.

4. Contribute to the Northwest Florida regional economic development.

### Relationship to Program outcomes:

<table>
<thead>
<tr>
<th>#</th>
<th>Program Outcomes</th>
<th>How do you achieve the outcomes?</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Mathematics through differential and integral calculus, and advanced topics differential equations, linear algebra, and complex variables.</td>
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<tr>
<td>2</td>
<td>Core electrical and computer engineering topics.</td>
<td>Exams of electrical engineering topics</td>
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<tr>
<td>3</td>
<td>Use the techniques, skills, and modern engineering tools.</td>
<td>Matlab software simulations</td>
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<tr>
<td>4</td>
<td>Apply knowledge of mathematics, science, and engineering.</td>
<td>Exams and design projects for applying basic techniques and mathematical skills to analyze and design communications systems.</td>
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<tr>
<td>5</td>
<td>Design and conduct experiments, as well as to analyze and interpret data.</td>
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<td>6</td>
<td>Probability and statistics, including applications.</td>
<td>Noise Analysis of communications systems and power spectrum calculation of random digital signals.</td>
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<tr>
<td>7a</td>
<td>Identify, formulate, and solve engineering problems.</td>
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<tr>
<td>7b</td>
<td>Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability</td>
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<tr>
<td>Prof. Comp</td>
<td>Major design experience based on the knowledge and skills acquired in earlier course work</td>
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<td>8</td>
<td>Function on multi-disciplinary teams.</td>
<td><em>It requires ability with different skills defined by the task and include communication skills, technical skills, technical expertise and conflict resolution skills.</em></td>
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<td>9</td>
<td>Professional and ethical responsibility.</td>
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<td>10</td>
<td>Communicate effectively.</td>
<td>Project reports</td>
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<tr>
<td>11a</td>
<td>Contemporary issues.</td>
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<tr>
<td>11b</td>
<td>The impact of engineering solutions in a global, economic, environmental, and societal context</td>
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It requires one paper on how engineering can impact some recent event.

| 12. | Recognition of the need for, and an ability to engage in life-long learning.  
     | It requires ability to use library, critique journals articles, synthesize materials from different sources, and figure out where to go for new information.  
     |  
| 14 | Fundamental theory and practice of science and engineering, as it applies to hardware and software, and identify the interaction between hardware and software.  
| 15 | Design a complete system (hardware and software)  

14. **Expectations for Academic Conduct/Plagiarism Policy:**
   - Academic Conduct Policy: [http://uwf.edu/cas/aasr/academic_conduct.pdf](http://uwf.edu/cas/aasr/academic_conduct.pdf)
   - Plagiarism Policy: [http://uwf.edu/cas/aasr/Plagiarism.pdf](http://uwf.edu/cas/aasr/Plagiarism.pdf)
   - Student Handbook: [http://www.uwf.edu/uwfmain/stuHandbk/](http://www.uwf.edu/uwfmain/stuHandbk/)

15. **Assistance:**
    Students with special needs who require specific examination-related or other course-related accommodations should contact Barbara Fitzpatrick, Director of Disabled Student Services (DSS), dss@uwf.edu, (850) 474-2387. DSS will provide the student with a letter for the instructor that will specify any recommended accommodations.

16. **Prepared by:** Dr. Steve Gorman  
    **Date:** Dec. 2, 2006  
    **Revised by:** Dr. Ezzat Bakhoum  
    **Date:** Oct. 10, 2008