

Course Name:	ECE 54400 Introduction to Digital Communications
Credit and contact hours:	(3 cr.) Class 3
Course coordinator's name	Lauren Christopher
Textbook	<p><i>Simon Haykin</i> Digital Communication Systems: First Edition. Wiley 2013, ISBN 978-0471647355</p> <p>Other reference texts: <i>Michael Pursley</i>, Introduction to Digital Communications, Prentice Hall 2004. ISBN 9780201184938</p>
Course Information	<p>2021-22 IUPUI Campus Bulletin description: ECE 54400 Digital Communications (3 cr.) P: ECE 44000 or Graduate Standing. Class 3. Introduction to digital communication systems and spread spectrum communications. Analog message digitization, signal space representation of digital signals, binary and M-ary signaling methods, detection of binary and M-ary signals, comparison of digital communication systems in terms of signal energy and signal bandwidth requirements. The principal types of spread-spectrum systems are analyzed and compared. Application of spread spectrum to multiple-access systems and to secure communication systems is discussed.</p> <p>Prerequisites/ CoRequisite P: ECE 44000 or graduate standing</p> <p>Indicate whether a required, elective, or selected elective course in the program</p>
Goals for the course	<p>Upon successful completion of the course, students should be able to</p> <ol style="list-style-type: none"> 1. Determine the frequency content of any signal, that is, the student should be capable of obtaining the signal's Fourier series and/or its Fourier Transform. [1] 2. Determine the low pass equivalent or a given narrowband bandpass signal. [1] 3. Determine whether a mathematical representation of a signal is a PAM, a PPM signal, a PFM, a QAM, a simplex FM signal, or a multidimensional signal. [1] 4. Determine the signal space representation of a PAM, a PPM signal, a PFM, a QAM, a simplex FM signal, and a multidimensional signal. [1] 5. Determine whether a visual representation of the signal space representation is that of a PAM, a PPM signal, a PFM, a QAM, a simplex FM signal, or a multidimensional signal. [6] 6. Determine the appropriate matched filter after determining

	<p>the nature of the signal to be demodulated. [1, 2]</p> <p>7. Given the mathematical representation of a modulated signal, determine the power spectrum. [1]</p> <p>8. Given the visual representation of a modulated signal and/or of its signal space representation, determine its power spectrum after determining the nature of a modulated signal. [1, 6]</p> <p>9. Determine the probability of error committed by a decoder given the probability distribution of the corrupting noise and the a priori probabilities of the signal for a given ASK, PSK, or FSK signal. [1]</p> <p>10. Determine the Signal-to-Noise ratio of the output of the demodulator when the modulated signal has been corrupted by additive noise. [1]</p> <p>11. Design signal pulses for bandlimited channels. [1]</p> <p>12. Choosing modulation codes for spectrum shaping. [1, 2]</p>
List of topics to be covered	<p>1. Overview Elements of a Digital Communication System (1 class)</p> <p>2. Representation of Bandpass Signals and Systems (3 classes)</p> <p>3. Signal Space Representation (2 classes)</p> <p>4. Representation of Digitally Modulated Signals (4 classes)</p> <p>5. Power Spectra of Digitally Modulated Signals (2 classes)</p> <p>6. Optimum Receivers for Signals Corrupted by AWGN (4 classes)</p> <p>7. Performance of Optimum Receivers for Memoryless Modulation (2 classes)</p> <p>8. Noncoherent Demodulation (2 classes)</p> <p>9. Signal Design for Communication Through Bandlimited Channels (3 classes)</p> <p>10. Introduction to Spread Spectrum Communications (4 classes)</p> <p>11. Review and exams (3 classes)</p>
Syllabi Approved by	Lauren Christopher
Date of Approval	12/07/2021