

ENGR 4323/5323 Digital and Analog Communication

Course Catalog Description: This course addresses selected theoretical and practical aspects of digital and analog communications systems such as amplitude modulation, frequency modulation, pulse code modulation, and multiplexing. It develops the engineering mathematics and techniques to describe the physical transmission of information over point-to-point links, taking account of channel characteristics and the presence of noise and distortion.

Course Prerequisites: ENGR 3323

Prerequisites by Topic: Complex Number, Fourier Transform

Textbook: “Modern Digital and Analog Communications Systems”, 5th edition by B. P. Lathi.

Course Website: <http://www.engineering.uco.edu/~mbingabr>

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Course Meeting Time: TR 4:00 – 5:15,

Course Meeting Location: Howell Hall 205

Office Hours: M 11:00 to 11:59 am, TR 3:00 – 4:00 pm, and by appointment.

Overall Education Objective: Understand and analyze the physical transmission of information over point-to-point links, taking account of channel characteristics and the presence of noise and distortion.

Course Learning Objective: At the end of this course, students should be able to:

1. Signal and transmission system analysis.
2. Convert an analog signal to a digital signal by sampling, quantization, and pulse code modulation (PCM);
3. Signal transmission by amplitude modulations.
4. Signal transmission by analog modulations.
5. Principle of data transmission and noise impact on transmission.

Topics Covered:

Subject	Reading
Review of Syllabus and Introduction -Communication System, Analog and Digital Messages, Signal-to-Noise Ratio, Channel Bandwidth, and the rate of Communication, Modulation, Randomness, Redundancy, and Coding.	Ch 1
Introduction to Signals -Size of signal, Classification of signals, Unit Impulse Function, Signal and Vectors, Signal Representation by Orthogonal Signal Set, Trigonometric Fourier Series, Exponential Fourier Series	Ch 2
Analysis and Transmission of Signals -Aperiodic Signal Representation by Fourier Integral, Properties of Fourier Transform, Signal Transmission through a Linear System, Ideal and Practical Filters, Signal Distortion over a Communication Channel, Signal Energy and Energy Spectral Density, Signal Power and Power Spectral Density TEST 1	Ch 3
Angle (Exponential) Modulation and Demodulation - Baseband and Carrier Communication, Amplitude Modulation: Double Sideband (DSB), Amplitude Modulation (AM), Superheterodyne AM Receiver, Television - Concept of Instantaneous Frequency, Bandwidth of Angle-Modulation Waves, Generation of FM Waves, Demodulation of FM, Interference in Angle-Modulation Systems, FM Receiver TEST 2	Ch 4

Sampling and Pulse Code Modulation -Sampling Theorem, Pulse-Code Modulation (PCM), Differential Pulse Code Modulation (DPCM), Delta Modulation	Ch 5
Principles of Digital Data Transmission -A Digital Communication System, Line Coding, Pulse Shaping, Scrambling, Regenerative Repeater, Detection-Error Probability, M-array Communication, Digital Carrier Systems, Digital Multiplexing	Ch 6
Fundamentals of Probability Theory - Random Variables and statistical Means, Linear Mean Square Estimation - Central Limit Theorem Final	Ch 7

Distribution of Points:

Attendance	10 %	Homework	10 %
Quizzes	30 %	2 Tests	30 %
Final Exam	20 %		

Grading Scale: A: 90-100; B: 80-89; C: 70-79; D: 60-69; F: 0-59

COURSE EXPECTATION & CONDUCT:

It is expected that each student will actually spend a total of 6 hours per week on the course (not including lecture times). I don't expect you to memorize formulas but I expect you to understand them. So, you will be allowed to bring to the exam formula sheets that contain any relative formulas you might need, but make sure you know how to use them conceptually and not just mechanically. Should you miss a quiz or test due to illness or an emergency, you will be required to give advance notice or provide a doctor's excuse in order to be allowed to make-up on the tests and quizzes you missed. Make-up tests and quizzes are usually harder than the regular tests and quizzes given during the class.

HOMEWORK:

The reality is this: you will not truly understand the technical concepts by just paying attention to lectures and reading the materials and examples in the textbook. To truly understand engineering concepts you have to solve the homework problems yourself even if you are struggling solving them. For this reason, regular homework assignments will be made. The quizzes will be similar to homework problems. You will receive only 50% of the grade for late homework submission if it is submitted within a week.

ADA Statement:

The University of Central Oklahoma complies with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990. Students with disabilities who need special accommodations must make their requests by contacting Disability Support Services, at (405) 974-2516. The DSS Office is located in the Nigh University Center, Room 305. Students should also notify the instructor of special accommodation needs as soon as possible. Per Title IX of the Education Amendments of 1972 ("Title IX"), pregnant and parenting students may request adjustments by contacting the Title IX Coordinator, at (405) 974-3377 or TitleIX@uco.edu. The Title IX Office is located in the Lillard Administration Building, Room 114D.

Statement on Sex and Gender-Based Discrimination: Title IX prohibits sex-based discrimination against any participant in an educational program or activity that receives federal funds. Any person who experiences sexual misconduct (including sexual harassment, sexual assault, stalking, domestic/dating violence or any other form of sex-based discrimination) is encouraged to report the matter to the UCO Title IX Coordinator, Ms. Adrienne Martinez, at 405-974-3377 or TitleIX@uco.edu. For more information about your options, including reporting and confidential resources, please visit: <http://www.uco.edu/central/title-ix/index.asp>.

Prepared by:	Mohamed G. Bingabr, Professor of Engineering.
Date:	January 14, 2025

