Course Number and Title: ELC 236 Analog Electronics III

Campus Location:
Georgetown, Dover, Stanton

Effective Date:
2022-51

Prerequisite:
ELC 226

Co-Requisites:
none

Course Credits and Hours:
4.00 credits
3.00 lecture hours/week
2.00 lab hours/week

Course Description:
This course covers an advanced study of electronic communications systems that includes signal analysis and synthesis of electrical noise, Fourier series, modulation and demodulation, transmission and reception of amplitude modulated (AM) and frequency modulated (FM) signals, digital communication, transmission lines, wave propagation, antenna theory, microwaves, lasers, and fiber optics.

Required Text(s):
Obtain current textbook information by viewing the campus bookstore - https://www.dtcc.edu/bookstores online or visit a campus bookstore. Check your course schedule for the course number and section.

Additional Materials:
Electronics Parts Kit, Digital Multimeter, TI-84+ or TI-89 Calculator

Schedule Type:
Classroom Course

Disclaimer:
None

Core Course Performance Objectives (CCPOs):

1. Describe the components of electronic communications systems and how modulation and multiplexing facilitate signal transmission. (CCC 1, 2, 5, 6; PGC 1, 2, 3, 4)
2. Describe the characteristics of the electromagnetic (EM) spectrum. (CCC 1, 2, 5, 6; PGC 1, 2, 3, 4)
3. Describe the different domains of electrical signals, noise sources, noise reduction techniques, and signal-to-noise ratios for communications systems. (CCC 1, 2, 5, 6; PGC 1, 2, 3, 4)
4. Describe the technique of amplitude modulation, including domain analysis, power, efficiency, and spectrum analyzer measures. (CCC 1, 2, 5, 6; PGC 1, 2, 3, 4)
5. Describe the characteristics of wave and field propagation, transmission lines, and antennas. (CCC 1, 2, 5, 6; PGC 1, 2, 3, 4)
6. Describe the characteristics of AM transmitters/receivers, including radio frequency (RF) transmitters, modulators, super-heterodyne receiver analysis, and measurement techniques. (CCC 1, 2, 5, 6; PGC 1, 2, 3, 4)
7. Describe the characteristics of FM transmitters/receivers, including signal analysis, detection, alignment, and measurements. (CCC 1, 2, 5, 6; PGC 1, 2, 3, 4)
8. Describe the applications for fiber-optics and laser technology in communications systems. (CCC 1, 2, 5, 6; PGC 1, 2, 3, 4)
9. Describe the characteristics of digital communication systems. (CCC 1, 2, 5, 6; PGC 1, 2, 3, 4)

See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.

Measurable Performance Objectives (MPOs):
Upon completion of this course, the student will:

1. Describe the components of electronic communications systems and how modulation and multiplexing facilitate signal transmission.
    1. Identify the components of an electronic communications transmitter.
    2. Identify the components of an electronic communications receiver.
    3. Discuss the role of modulation and multiplexing in facilitating signal transmission.
2. Describe the characteristics of the electromagnetic (EM) spectrum.
    1. Describe the difference between audio frequency (AF) and radio frequency (RF).
    2. Discuss the EM spectrum, and explain signal characteristics and applications for each segment.
    3. Explain the relationship among frequency range, bandwidth, and wavelength.
3. Describe the different domains of electrical signals, noise sources, noise reduction techniques, and signal-to-noise ratios for communications systems.
    1. Identify the characteristics of an electrical signal defined in the time domain system.
    2. Identify the characteristics of an electrical signal defined in the frequency domain system.
    3. Identify sources of electrical noise and methods of noise reduction.
    4. Calculate and test the signal-to-noise characteristics of an electrical communications system.
4. Describe the technique of amplitude modulation, including domain analysis, power, efficiency, and spectrum analyzer measures.
    1. Identify the components of an amplitude modulation system.
    2. Describe the characteristics generated in a domain analysis of the modulated wave given the carrier and intelligence waves used in an amplitude modulation system.
    3. Calculate power and efficiency.
    4. Illustrate an AM waveform with various modulation indexes.
    5. Compile an AM waveform analysis using acceptable industry standards and the tools and equipment required in the work environment.
    6. Analyze complex repetitive waveforms using the Fourier analysis method.
5. Describe the characteristics of wave and field propagation, transmission lines, and antennas.
    1. Describe the characteristics of a radio wave.
    2. Explain basic wave propagation, including near field, ground wave, ionospheric reflection, line of sight, and fading.
    3. Describe actual and secondary effect transmission lines.
    4. Identify and describe the operation of basic antenna types such as ground plane, dipole, and Yagi.
    5. Describe ways in which antenna design can be modified to produce an optimal match between the impedances of a transmitter and an antenna.
6. Describe the characteristics of AM transmitters/receivers, including radio frequency (RF) transmitters, modulators, super-heterodyne receiver analysis, and measurement techniques.
    1. Discuss the methods used to produce an AM signal.
    2. Discuss the methods used to recover the intelligence of an AM signal.
    3. Describe the function for each section of a super-heterodyne receiver.
    4. Describe the methods used to measure the performance of an AM receiver.
7. Describe the characteristics of FM transmitters/receivers, including signal analysis, detection, alignment, and measurements.
    1. Discuss the methods used to produce an FM signal.
    2. Discuss the methods used to recover the intelligence of an FM signal.
    3. Describe various methods of FM detection.
    4. Describe the method used to align an FM receiver.
8. Describe the applications for fiber-optics and laser technology in communications systems.
    1. Describe the construction of fiber optic cable.
    2. Describe the propagation modes of fiber optic cable.
    3. Predict the dispersion and effective bandwidth of a multimode fiber.
    4. Describe the operation of light-emitting diode (LED) and laser light sources and their associated drive circuitry.
    5. Use electrical and optical test equipment to troubleshoot fiber-optic systems.
9. Describe the characteristics of digital communications systems.
    1. Describe methods and characteristics of pulse modulation, demodulation, and multiplexing.
    2. Explain coding, sampling rate, Nyquist frequency, error correction, and basic digital signal processing (DSP) principles.
    3. Explain the relationship among system optimization, noise performance, spectral efficiency, bandwidth, and filtering.
    4. Describe the characteristics of various wireless communications systems such as Worldwide Interoperability for Microwave Access (WiMAX), Bluetooth, and cellular.
    5. Identify propagation behaviors of the various wireless frequencies and bands.
    6. Explain the principles of trunked radio systems, spread spectrum, and software defined radio.
    7. Describe the basic operation of a digital wire line system.

Evaluation Criteria/Policies:
The grade will be determined using the Delaware Tech grading system:

90	–	100	=	A
80	–	89	=	B
70	–	79	=	C
0	–	69	=	F

Students should refer to the Student Handbook - https://www.dtcc.edu/handbook for information on the Academic Standing Policy, the Academic Integrity Policy, Student Rights and Responsibilities, and other policies relevant to their academic progress.

Final Course Grade:
Calculated using the following weighted average

Evaluation Measure	Percentage of final grade
Summative: Four Tests (equally weighted)	50%
Formative: 8-12 Laboratory Experiments (equally weighted)	30%
Formative: Homework/Pop Quizzes (equally weighted)	10%
Formative: Quizzes (equally weighted)	10%
TOTAL	100%

Core Curriculum Competencies (CCCs are the competencies every graduate will develop):

1. Apply clear and effective communication skills.
2. Use critical thinking to solve problems.
3. Collaborate to achieve a common goal.
4. Demonstrate professional and ethical conduct.
5. Use information literacy for effective vocational and/or academic research.
6. Apply quantitative reasoning and/or scientific inquiry to solve practical problems.

Program Graduate Competencies (PGCs are the competencies every graduate will develop specific to his or her major):

1. Perform the duties of an entry-level technician using the skills, modern tools, theory, and techniques of the electronics engineering technology.
2. Apply a knowledge of mathematics, science, engineering, and technology to electronics engineering technology problems that require limited application of principles but extensive practical knowledge.
3. Conduct, analyze, and interpret experiments using analysis tools and troubleshooting methods.
4. Identify, analyze and solve narrowly defined electronics engineering technology problems.
5. Explain the importance of engaging in self-directed continuing professional development.
6. Demonstrate basic management, organizational, and leadership skills which commit to quality, timeliness and continuous improvement.

Disabilities Support Statement:
The College is committed to providing reasonable accommodations for students with disabilities. Students are encouraged to schedule an appointment with the campus Disabilities Support Counselor to request an accommodation needed due to a disability. A listing of campus Disabilities Support Counselors and contact information can be found at the disabilities services - https://www.dtcc.edu/disabilitysupport web page or visit the campus Advising Center.