



American University of Ras Al Khaimah

## AURAK Syllabus

**Course Title: Signals and Systems I**

**Course Code: ECEN 220**

**Section I: Monday and Wednesday from 9:30 a.m.-10:45 a.m. in classroom: H215**

**Credit Hours: 3**

**Semester and Academic Year: Fall 2019**

**Prerequisite course(s) and/or co-requisite courses, if applicable: Pre-requisite: MATH 113, Co-requisite: ECEN 221.**

**Faculty Name: Dr. Beza Negash Getu**

**Contact Information and Office Hours: G334, +971 7 2210900 ext. 1106**

[bgetu@aurak.ac.ae](mailto:bgetu@aurak.ac.ae)

**Office Hours: 2:00 p.m. to 3:00 p.m. (daily except Thursday), Thursday: 11:00 a.m.-12:00 p.m.**

### **Course Description:**

(3:3:0) First of two-semester sequence of courses providing mathematical background for many ECE courses taken in junior, senior years. Introduces methods of representing continuous-time signals and systems, and interaction between signals and systems. Covers analysis of signals and systems via differential equations and transform methods; Laplace and Fourier transforms as convenient analysis tools; frequency response of systems; and stability of systems in time and frequency domains. Presents application examples from communications, circuits, control, and signal processing.

### **Course Textbooks and Materials:**

- Signals and Systems, 2nd Edition, 1997, by Oppenheim, Willsky and Nawab, Prentice-Hall. ISBN-10: 0138147574.
- Signals, Systems and Transforms. 4th Ed., 2008, Charles L. Phillips, John M. Parr, Eve A. Riskin.. Prentice Hall, ISBN-10: 0-13-198923-5.

### **Other Resources:**

- Computer Explorations in Signals and Systems Using MATLAB by Buck, Daniel and Singer, 2nd Edition, 2001, Prentice-Hall ISBN: 0-13-042155-3.

- Signals and Systems, 2nd Edition, Simon Haykin, Barry Van Veen, John Wiley & Sons, 2003, ISBN-10: 0471164747.

**Web Resources:**

- <http://www.mathwork.com>
- <https://www.mccormick.northwestern.edu/documents/students/undergraduate/introducti-on-to-matlab.pdf>
- <https://www.tutorialspoint.com/matlab/>

**Course Learning Outcomes (CLOs)**

<b>Course Learning Outcomes</b> At the end of this course, students should be able to:	
<b>CLO 1</b>	Provide introduction to signals and systems, identify and describe methods of representing continuous-time signals and systems, and interaction between signals and systems, identify different types of signals and systems (ABET PO 1)
<b>CLO 2</b>	Discuss with examples the analysis of signals and systems via differential equations and transform methods such as Fourier and Laplace and analysis tools (ABET PO 1).
<b>CLO 3</b>	Discuss frequency response of systems, and properties of systems such as linearity, time invariance, stability and causality in time and frequency domains (ABET PO 1).
<b>CLO 4</b>	Describe application of examples of signal and systems from communications, circuits, control, and signal processing (ABET PO 1).
<b>CLO 5</b>	Ability to perform design, analyze, simulate and present results using the MATLAB programming language (ABET PO 1).

**Assessment Activities**

The dates for quizzes, exams, and submission of assignments are specified in the schedule. You will be graded in this class based on the number of points you earn for quizzes, exams written assignments, or other activities, including your class participation. Keep track of your scores in Blackboard.

<b>Assessment Activities and Grading Weight</b>	<b>(4) Course Activities / Assignments 10%</b>	<b>(4) Quizzes 25%</b>	<b>(1) Mid-term Exam 20%</b>	<b>(6) (LAB Assessments) 15%</b>	<b>(1) Final Exam 30%</b>
<b>CLO 1</b>	X	X	X	X	X
<b>CLO 2</b>	X	X	X	X	X

<b>CLO 3</b>	X	X	X	X	X
<b>CLO 4</b>	X	X	X	X	X
<b>CLO 5</b>	X	X		X	

**Mapping Course to Program Outcomes: (PO)**

<i>ABET Standards (1-7)</i>	<i>Program Outcomes</i>	<i>Program Outcomes Addressed in Course</i>
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	X
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	
3	An ability to communicate effectively with a range of audiences.	
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	

**Grading Scale:**

The grading system and scale for AURAK, as established by the Board of Trustees, is as follows:

<b>AURAK Grading System and Scale</b>		
<b>Grade</b>	<b>Percentage Scores</b>	<b>Grade Points</b>
<b>A</b>	<b>95-100</b>	<b>4</b>
<b>A-</b>	<b>90-94</b>	<b>3.7</b>
<b>B+</b>	<b>86-89</b>	<b>3.3</b>
<b>B</b>	<b>83-85</b>	<b>3</b>

<b>B-</b>	<b>80-82</b>	<b>2.7</b>
<b>C+</b>	<b>76-79</b>	<b>2.3</b>
<b>C</b>	<b>73-75</b>	<b>2</b>
<b>C-</b>	<b>70-72</b>	<b>1.7</b>
<b>D+</b>	<b>66-69</b>	<b>1.3</b>
<b>D</b>	<b>60-65</b>	<b>1</b>
<b>F</b>	<b>0-59</b>	<b>0</b>

<b>Schedule of Course Topics, Required Reading, and Assignments and Assessments</b>				
<b>Week</b>	<b>Topic</b>	<b>Required Readings</b>	<b>Assignment, Assessment (with grade weighting) &amp; Due Date</b>	<b>Mapping of CLSLO's to Assessments</b>
1	Signals and Systems: continuous time and discrete time signals, signal energy and power, transformation of the independent variable	Oppenheim, Ch. 1, Phillips, Ch. 2		1
2	Periodic, Complex, Sinusoidal & Exponential Signals, Continuous Unit Impulse and Step Signals, Systems and system properties	Oppenheim, Ch. 1 (cont.), Phillips, Ch. 2 (cont.)	<b>Assignment I (10% Total)</b>	1
3	Linear Time Invariant systems: Representation of CT Signals Using Unit Impulses, Response of CT LTI Systems and CT Convolution	Oppenheim, Ch. 2, Phillips, Ch. 3, Haykin Ch. 2	---	1, 2, 3
	<b>Quiz I will cover on introduction to Signals &amp; Systems</b>	<b>Quiz I will cover all readings on the topic</b>	<b>Quiz I (25% Total)</b>	1
4	Properties of Convolution, The Unit Impulse and Other Singularity Functions	Oppenheim, Ch. 2 (cont.), Phillips, Ch. 3 (cont.), Haykin Ch. 2 (cont.)	---	1, 2, 3

5	Differential equation characterization and solution	Oppenheim, Ch. 2 (cont.), Phillips, Ch. 3 (cont.), Haykin Ch. 2 (cont.)	<b>Assignment II (10% Total)</b>	1, 2
6	Fourier Series Representation of CT Periodic Signals: Why is Fourier Theory Important?, Eigenfunctions and their Properties, Complex Exponentials as Eigenfunctions of LTI Systems,	Oppenheim, Ch. 3, Buck Ch. 3, Phillips Ch.4	---	1, 2
	<b>Quiz II will cover LTI systems and Convolution</b>	<b>Quiz II will cover all readings on the topic</b>	<b>Quiz II (25% Total)</b>	1, 2, 3
7	Fourier Series representation of CT periodic signals, Convergence of Fourier Series, Properties of Fourier Series	Oppenheim, Ch. 3 (cont.), Buck Ch. 3 (cont.), Phillips Ch.4 (cont.)	---	1, 2, 3
8	<b>Midterm Exam - Will cover all topics covered since the beginning of the semester.</b>	<b>All reading to date</b>	<b>Midterm (20% Total)</b>	<b>1, 2, 3, 4</b>
9	Fourier Series and LTI Systems, Filtering, Examples of CT Filters described by Differential Equations (Use the Web MATLAB Resources for Assignment III)	Oppenheim, Ch. 3 (cont.), Buck Ch. 3 (cont.), Phillips Ch.4 (cont.)	<b>Assignment III (10% Total)</b>	1, 2, 3, 4
10	The Continuous Time Fourier Transform: From Fourier Series to Fourier Transform, Fourier Transform of Periodic Signals	Oppenheim, Ch. 4, Phillips, Ch. 5	---	1, 2
11	Properties of Continuous Time Fourier Transform	Oppenheim, Ch. 4 (cont.), Phillips, Ch. 5 (cont.)	---	1, 2, 4
	<b>Quiz III will cover Fourier Series and LTI Systems</b>	<b>Quiz III will cover all readings on the topic</b>	<b>Quiz III (25% Total)</b>	1, 2, 3

12	Systems Characterized by Constant Coefficient Differential Equations (LCCDEs)	Oppenheim, Ch. 4, Haykin Ch. 2	---	1, 2, 4
13	Systems Characterized by Constant Coefficient Differential Equations (LCCDEs) <b>(Use the Web MATLAB Resources for Assignment IV)</b>	Oppenheim, Ch. 4 (cont.), Haykin Ch. 2 (cont.)	<b>Assignment IV (10% Total)</b>	1, 2, 4
14	The Laplace Transform: Laplace transform, Examples of Laplace Transforms, Regions of Convergence (ROCs) for Laplace Transforms	Oppenheim, Ch. 9, Phillips, Ch. 7, Haykin Ch. 6	---	1, 2, 4
15	The Inverse Laplace Transform, Properties of Laplace Transform, System functions and Block Diagram Representations, LTI systems Described LCCDEs	Oppenheim, Ch. 9 (cont.), Phillips, Ch. 7 (cont.), Haykin Ch. 6 (cont.)	---	1, 2, 4
	<b>Quiz IV will cover Laplace transform and its applications</b>	<b>Quiz IV will cover all readings on the topic</b>	<b>Quiz IV (25% Total)</b>	1, 2, 4
16	<b>Course Review &amp; Final Exam, 11:00-13:00, Sunday, December 15, 2019</b>	<b>All reading to date</b>	<b>Final Exam (30%)</b>	<b>1, 2, 3, 4</b>

## Attendance Policy

University policy is that students are to attend all classes and to arrive on time. Students are required to:

- Attend all learning and teaching sessions associated with their program of study.
- Notify their course instructors in advance (in person, by phone or e-mail) that they will be absent from time-tabled class sessions.
- Obtain prior permission from their instructor or course manager, for planned absences of two or more consecutive class sessions during the semester.
- Provide a medical certificate or other corroborating evidence to explain their absence, if required by the University.

Unsatisfactory student attendance includes failure to regularly attend learning and teaching sessions without providing a satisfactory reason to instructors for absence and/or persistent late arrival at, or early departure from, learning and teaching sessions. Where a student fails to attend classes for **four or more weeks cumulatively**, or where a recurring pattern of non-attendance is observed over the course of the semester, the instructor has the option of deeming that the student has failed the course, in which case that student may receive an "F (Fail)" or "U (Unsatisfactory)" grade, as appropriate. At this point, and at the instructor's recommendation, the dean also has the authority to instruct the registrar to remove or withdraw the student from the course.

## **Disability Accommodations**

Students with disabilities may find they require additional support, services, or considerations. AURAK will endeavor to support students with disabilities or special needs where resources are available. Accommodations will be provided, for students with verified needs, allowing equal access to educational facilities, programs, services, and activities at AURAK. Disability Accommodations are never applied retroactively – only students who have previously requested and have been approved for supporting accommodations can have them apply to a given academic semester/course. Students needing support must make the request from the Department of Counseling, Testing, and Disability Services located in Building H.

## **Other Relevant Policies**

### **A. Academic Integrity**

#### **The Honor Code**

The American University of Ras Al Khaimah strongly supports the concept of academic integrity and expects students and all other members of the AURAK community to be honest in all academic endeavors. The AURAK Honor Code can be found in the AURAK Student Handbook.

The role of the Honor Code and associated Academic Integrity Policy is to protect the academic integrity of the university, encourage consistent ethical behavior among students, and foster a climate of honorable academic achievement. The Honor Code is an integral part of university life and students are responsible, therefore, for understanding and abiding by the code's provisions. While a student's commitment to honesty and personal integrity is assumed and expected, this Code and associated policy and procedures provides clarity of expectations.

#### **Expectations**

Cheating, plagiarism, and all other forms of academic fraud are unacceptable; they are serious violations of university policy. AURAK expects all students to be familiar with university policies on academic integrity. The university will not accept a claim of ignorance – either of

the policy itself or of what constitutes academic fraud – as a valid defense against such a charge.

### **Violations of Academic Integrity**

Violations of academic integrity constitute academic fraud. Academic fraud consists of any actions that serves to undermine the integrity of the academic process or that gives the student an unfair advantage, including:

- Inspecting, duplicating or distributing test materials without authorization.
- Cheating, attempting to cheat, or assisting others to cheat – relevant here is the prohibition on being in possession of a mobile telephone or similar electronic device during a test or examination. In case such devices are found with a student, the student will be deemed to have attempted to cheat and will be subject to disciplinary action under the Student Academic Integrity Policy.
- Altering work after it has been submitted for a grade.
- Plagiarizing.
- Using or attempting to use anything that constitutes unauthorized assistance.
- Fabricating, falsifying, distorting, or inventing any information, documentation, or citation.

### **Plagiarism**

One of the most common violations of academic integrity is plagiarism. Plagiarism can be intentional or unintentional. However, since each student is responsible for knowing what constitutes plagiarism, unintentional plagiarism is as unacceptable as intentional plagiarism and thus will bring the same penalties.

Plagiarism – submitting the work of others as one’s own - is a serious offense. In the academic world, plagiarism is theft. Information from sources – whether quoted, paraphrased, or summarized – must be given credit through specific citations. When a student paraphrases a work, it is still necessary to cite the original source. Merely rearranging a sentence or changing a few words is not sufficient. The citation style should be appropriate for the discipline and should clearly indicate the beginning and ending of the referenced material. All sources used in the preparation of an academic paper must also be listed with full bibliographic details at the end of the paper, as appropriate in the discipline.

### **Faculty and Student Expectations**

- Every student, faculty member, and administrator is responsible for upholding the highest standards of academic integrity. Every member of the AURAK community shall honor the spirit of this policy by refusing to tolerate academic fraud.
- It is the responsibility of the instructor to provide students with additional guidelines for what constitutes “authorized” and “unauthorized” assistance.
- It is the responsibility of every student to see clarification if in doubt about what constitutes “authorized” and “unauthorized” assistance. In cases involving collaborative



work, all students within the collaborative group may be help responsible for violating the code if any member of the group receives, accepts, or utilizes "unauthorized" assistance.

- Students are required to obtain permission prior to submitting work, any part of which was previously or will be submitted in another course. The instructor has the option of accepting, rejecting, or requiring modification of the content of previously or simultaneously submitted work.

A student who suspects that a violation of academic integrity has occurred should report the violation to the dean or to the Office of the Provost. In this report, the student should describe any action taken, such as talking with the person involved or with a faculty or staff member. Every effort will be made to preserve the anonymity of the student reporting the incident;

Possible penalties for academic fraud include: Formal warning, Reduction in grade for the assignment, Reduction in the grade for the course, A failing grade for the assignment, A failing grade (F) in the course, and/or Dismissal or Expulsion from the University.

Please refer to the relevant section in the *Student Handbook* and ensure a clear understanding of the provisions of the University Honor Code and the Student Academic Integrity Policy.

## **B. Concerns about Grades or Other Course Matters**

Students are responsible for their learning experiences. If you are concerned about a class matter, first discuss it with the instructor. If the matter is not resolved, the next step is to meet with the Chair of the department in which the course is taught. If you still have a concern, meet with the Dean of the school in which the course is taught. The matter is likely to be resolved before it reaches that point, but if it is not, then visit the Associate Provost for Academic and Student Affairs. Students who decide to “jump to the top” will be referred “back” to the appropriate next step.

## **C. Assignments**

University policy is that assignments are due on the date assigned. Instructors may refuse to accept late assignments or lower the grade that would be otherwise given.

## **D. Mobile Phones**

All mobile phones, pagers and/or other communication devices should be turned off before entering the classroom. Students may NOT have mobile telephone or other electronic devices in their possession while completing examinations. Any violation will be deemed as having attempted to cheat.

## **E. Diversity and the Use of English**

English is the common language of the AURAK campus for everyone. It is the only language to be used in the classroom. AURAK brings together students and faculty from diverse cultural and linguistic backgrounds, which is one of the strengths of the university. This diversity provides an opportunity to share our different experiences and enlarge our understanding of the world.