EN.525. 202 section 81 Syllabus

Signals and Systems

Course Information

Course Information:

Signals and Systems
EN.525. 202 81 (3.0 Credits)
Fall 2023 [AE Fall 2023]

Description
This course will provide students with foundational knowledge in signals and systems essential for graduate study in electrical and computer engineering, and other related disciplines. Signal and system representations and analysis tools in both continuous time and discrete time are studied. Linear time-invariant systems are defined and analyzed. The Fourier transform, the Laplace transform, and the z-transform are treated along with the sampling theorem. Finally, fundamental concepts in probability, statistics, and random processes are considered. Prerequisite(s): Two or more semesters of calculus and differential equations. Familiarity with computer programming is beneficial.

Department: PE Electrical and Computer Engineering
College: Engineering and Applied Science Programs for Professionals

Instructor Information:

Instructors

Brian Jennison
bjennis1@jhu.edu

Clint Edwards
clint@jhu.edu

Course Location:

Online

Communication Policy:

We encourage students to contact us email. We will make every effort to respond within 24 hours.

Office Hours:

This course will use Zoom to facilitate weekly, synchronous office sessions. You are not required to participate in office sessions; however, you may find them very beneficial for receiving more timely answers to questions related to the course content and assignments. *For more information regarding Zoom, please see the Zoom Student Quick Start Guide.*

Course Structure:

The course content is divided into Modules. Modules can be accessed by clicking Modules on the left menu of the Canvas site. A module will have several sections including the overview, content, readings, discussions, and assignments. Students are encouraged to preview all sections of the module before starting. Most modules run for a period of seven (7) days, exceptions are noted. Students should regularly check the Calendar and Announcements for assignment due dates.

Course Topics:

Course topics include the following:

- Linear Time-Invariant (LTI) Systems
- Convolution in continuous-time and discrete-time
- Fourier Series
- Fourier Transforms
- Sampling
- Laplace Transforms
- z-Transforms
- Concepts of Probability
- Random Variables
- Random Processes

Course Goals:

To prepare students for graduate study in engineering disciplines requiring knowledge of signal and system fundamental concepts. Topics of interest include continuous-time and discrete-time signal and system representations and analysis tools in time and frequency; Fourier analysis in continuous-time and discrete-time; and fundamental concepts in probability, statistics, and random processes.

Course Learning Outcomes (CLOs):

Identify and classify continuous-time and discrete-time signals and systems

Analyze linear time-invariant (LTI) systems using both time-domain techniques and frequency-domain techniques

- Utilize frequency-domain tools such as the Fourier Series and the Fourier Transform for signals characterization and systems analysis
- Apply Fourier techniques to analyze communication systems that use Amplitude Modulation (AM)
- Determine when a continuous-time signal can be represented by its sample values and calculate the required sampling rate
- Compute and interpret the frequency-content of a discrete-time signal using the discrete Fourier transform
- Assess LTI system stability using the Laplace transform and the z-transform

Required Text and Other Materials

Textbooks:

- S. K. Mitra, *Signals and Systems* (Oxford, 2015).
- Lipschutz, S. & Lipson, M. (2021) Schaum's Outline of Probability, 3rd Ed.

Access to textbooks via the JHU Libraries:

EP students may access electronic versions of textbooks through the Sheridan Libraries. Instructions on how to search for available textbooks are accessible through this link: Browse Electronic Textbook Instructions

Other Materials & Online Resources:

Other References for Signals and Systems topics:

- Hsu, H. *Schaum's Outline of Signals and Systems*, (2nd, 3rd, or 4th Ed). New York, McGraw-Hill
- J. H. McClellan, R. W. Schafer, M. A. Yoder, *DSP First* (Prentice-Hall, 2015).
- S. Haykin and B. Van Veen, *Signals and Systems*, 2nd Edition (Wiley, 2002).
- A. Oppenheim and A. Willsky, *Signals and Systems*, 2nd Edition (Pearson, 1996).

Required Software:

The software application MATLAB will be used throughout this course. A license is provided at no cost to you, through JHU.

Instructions for accessing MATLAB are at Accessing-Matlab-at-JHU.

Technical Requirements:

You should refer to General Technical Requirements for guidance on system requirements. Access support resources from the **Help** menu if you encounter any technical issues.

Evaluation and Grading

Student Coursework Requirements:

- **Weekly Assignments:** Each module will contain a graded assignment that students will complete individually. Weekly assignments will vary depending on module learning objectives and may include analysis and visualization using a programming language such as MATLAB. (70% of total grade)
- **Discussion Activities:** Periodic discussion activities where students will be asked to participate in asynchronous discussions on topics related to the module learning objectives. (15% of total grade)
- **Mini project:** Each student will investigate a signal and/or system that they have encountered in their job, prior academic experience, or in their day-to-day lives. The signal or system should be analyzed using the tools developed in this course. The results of the investigation will be documented in a presentation no longer than 5-minutes and posted on the course site. Each student will be expected to view at least 3 of their fellow classmates' recordings and comment on it. (15% of grade).
- Brief, ungraded self-check problems will be provided in most of the modules.

Grading Policy:

The following grading scale will be used.

100%–90% = A
89%–80% = B
79%–70% = C
69%-60% = D
<60% = F

Policies

Additional Resources:

Personal Wellbeing
If you are struggling with anxiety, stress, depression or other mental health related concerns, please consider connecting with the Johns Hopkins Student Assistance Program (JHSAP). If you are concerned about a friend, please encourage that person to seek out our services. JHSAP can be reached at 443-287-7000 or https://jhsap.org/

Tutoring Website

Johns Hopkins Engineering for Professionals offers a tutoring connection network that allows students to connect with other Johns Hopkins Engineering students or alumni for tutoring services. This service allows students to search a list of courses to "Find a Tutor" or complete a profile to "Become a Tutor." More information about this service can be found

on the tutoring website (https://tutor.ep.jhu.edu/).

Privacy Policies:

To learn more about how to protect your data and privacy, visit Instructure's privacy policy (Canvas) and JHU's privacy policy.

Canvas Accessibility:

Online courses are taught in the Canvas learning management system. To learn more about how Canvas is designed to be accessible, visit Canvas's accessibility standards

Academic Policies:

Deadlines for Adding, Dropping and Withdrawing from Courses

Students may add a course up to one week after the start of the term for that particular course. Students may drop courses according to the drop deadlines outlined in the EP academic calendar (https://ep.jhu.edu/student-services/academic-calendar/). Between the 6th week of the class and prior to the final withdrawal deadline, a student may withdraw from a course with a W on their academic record. A record of the course will remain on the academic record with a W appearing in the grade column to indicate that the student registered and withdrew from the course.

Academic Misconduct Policy

All students are required to read, know, and comply with the Johns Hopkins University Krieger School of Arts and Sciences (KSAS) / Whiting School of Engineering (WSE) Procedures for Handling Allegations of Misconduct by Full-Time and Part-Time Graduate Students.

This policy prohibits academic misconduct, including but not limited to the following: cheating or facilitating cheating; plagiarism; reuse of assignments; unauthorized collaboration; alteration of graded assignments; and unfair competition. Course materials (old assignments, texts, or examinations, etc.) should not be shared unless authorized by the course instructor. Any questions related to this policy should be directed to EP's academic integrity officer at ep-academic-integrity@jhu.edu.

Students with Disabilities - Accommodations and Accessibility

Johns Hopkins University values diversity and inclusion. We are committed to providing welcoming, equitable, and accessible educational experiences for all students. Students with disabilities (including those with psychological conditions, medical conditions and temporary disabilities) can request accommodations for this course by providing an Accommodation Letter issued by Student Disability Services (SDS). Please request accommodations for this course as early as possible to provide time for effective communication and arrangements.

For further information or to start the process of requesting accommodations, please contact Student Disability Services at Engineering for Professionals, ep-disability-svcs@jhu.edu.

Student Conduct Code

The fundamental purpose of the JHU regulation of student conduct is to promote and to protect the health, safety, welfare, property, and rights of all members of the University community as well as to promote the orderly operation of the University and to safeguard its property and facilities. As members of the University community, students accept certain responsibilities which support the educational mission and create an environment in which all students are afforded the same opportunity to succeed academically.

For a full description of the code please visit the following website: https://studentaffairs.jhu.edu/policies-guidelines/student-code/

Classroom Climate

JHU is committed to creating a classroom environment that values the diversity of experiences and perspectives that all students bring. Everyone has the right to be treated with dignity and respect. Fostering an inclusive climate is important. Research and experience show that students who interact with peers who are different from themselves learn new things and experience tangible educational outcomes. At no time in this learning process should someone be singled out or treated unequally on the basis of any seen or unseen part of their identity.

If you have concerns in this course about harassment, discrimination, or any unequal treatment, or if you seek accommodations or resources, please reach out to the course instructor directly. Reporting will never impact your course grade. You may also share concerns with your program chair, the Assistant Dean for Diversity and Inclusion, or the Office of Institutional Equity. In handling reports, people will protect your privacy as much as possible, but faculty and staff are required to officially report information for some cases (e.g. sexual harassment).

Course Auditing

When a student enrolls in an EP course with “audit” status, the student must reach an understanding with the instructor as to what is required to earn the “audit.” If the student does not meet those expectations, the instructor must notify the EP Registration Team [EP-Registration@exchange.johnshopkins.edu] in order for the student to be retroactively dropped or withdrawn from the course (depending on when the "audit" was requested and in accordance with EP registration deadlines). All lecture content will remain accessible to auditing students, but access to all other course material is left to the discretion of the instructor.