ENGS-320: Instrumentation & Control System
Fall 2025

Meeting Space: Miller Hall 013	Time: MWF 9:40 – 10:40 am
Instructor: Dr. Avijit Sarker	Office: Trexler 266B
Email: sarker@roanoke.edu	Office hours: MWF 2.00-3.00, or by appointment
Course Site: Roanoke College	Laboratory hours: THU, 8:30 – 11:30 am
Phone: 662-380-1775 (cell); 540-375-2320(office)	Meeting Space for Lab: Trexler Hall 272

Prerequisites: ENGS 220 or ENGS 302

Co-requisite: ENGS 320L

Course Materials:
Required Book:

- Control Systems: An Introduction, Hassan K. Khalil

https://services.publishing.umich.edu/Books/Electrical-Engineering-Textbooks#control-systems

- Control Systems Engineering, Norman S. Nise, 8th Edition, John Wiley and Sons, Inc, Hoboken, NJ, 2022.
- Class Lecture
- Video Lecture

Course Overview: An introduction to the theory and application of feedback systems to improve transient and steady state control systems. Topics include time and frequency domain, stability, root locus techniques, programmable logic controller and proportional-integral-derivative controller. The students will be able to identify, set up and solve engineering problems using fundamental principles of control theory.

Learning Outcomes: Upon completion of this course, successful students will be able to

- Demonstrate an understanding of the feedback concept.
- Establish mathematical model of simple systems from a text-based description of the systems.
- Develop transfer function of the systems from their physical descriptions.
- Analyze internal and external stability of control systems.
- Apply root locus methods for analyzing stability and performance of control systems
- Program microcontrollers using Arduino.
- Apply their knowledge of control theory to design specific projects using Arduino boards and sensors.

Time Commitment: Students are expected to put in approximately 12 hours per week of work in order to successfully complete this course, including class time. The exact amount of time each student needs to devote to this class to be successful will vary, but 12 hours is a reasonable amount of time to budget for this class.

Attendance: Attendance and participation are essential for achieving the planned learning outcomes of this class. You are required to attend every class and attendance will be taken daily. If you show up 10 minutes late, you will be marked absent. I understand that some absences are unavoidable. Any planned absences should be communicated with me in advance (~2 days in advance). Unexpected absences should be communicated with me as soon as possible. It is your responsibility to make up for the work that you missed.

Grading: Grades for this course will be based on homework assignments, tests, quizzes, participation, and a project. Grades will be assigned using the following scale: A 100-93, A- 92.9-90.0, B+ 89.9-87.0, B 86.9-83, B- 82.9-80.0, C+ 79.9-77.0, C 76.9-73, C- 72.9-70.0, D+ 69.9-67.0, D 66.9-63, D- 62.9-60.0, F 59.9-0. The approximate grading distribution is in the table below.

Homework (5~6x)	15%
Quizzes (5~6x) & In-Class participation	15%
In-Lab participation	10%
Unit Exams (3x)	30%
Final Exam	15%
Final Project	15%

Homework: There will be one set of problems assigned approximately every two weeks. The homework sets will be posted on Inquire. Assigned homework must be submitted by the indicated due date. See the late work policy below for more details.

Homework Assistance: Homework is assigned to provide you with additional structured practice solving the types of problems that you will encounter on exams. If you get stuck on a problem, you should get help learning to solve the problem prior to the due date so that you will be better prepared for the next exam. Copying an answer from another student, a generative artificial intelligence platform (e.g., ChatGPT), or another source may help you get the right answer on the homework but will not help you to learn the material. The homework should be used to help you learn the content so you will be prepared exams which make up 45% of your grade in the class.

Quizzes: These will be about 15 to 20 minutes long and will be held during the lecture time. The quiz date will be announced during one lecture period prior to the quiz date. Quizzes can only be made-up for excused absences.

In-Class Participation: You will also be required to complete problems assigned in class. Participation in class discussions is also an important aspect of learning the material.

In-Lab Participation: This will be lab activities per week with many hands-on activities. You are expected to be in the lab and actively engaged in activities and submit reports.

Unit Exams: There will be three-unit exams during the semester. Each exam will cover the material listed on the syllabus or as informed by me in class.

Final Exam: There will be a cumulative final exam at the end of the semester. It is an in-class exam and will take place Wednesday December 10th from 8:30 to 11:30 am.

Laboratory: Please note that this class has a required lab and a significant portion of the course work is dedicated to lab work. This is an opportunity to put into practice many of the techniques and principles that are introduced within the classroom. While we have a weekly lab meeting, many lecture days will also include hands-on activities. Final Exam on lab or project is due on the last day of the lab.

Late Work: All work should be submitted by the assigned deadline. If you have extenuating circumstances that prevent you from submitting work on-time, please communicate with me in advance. Late work may be accepted, but for reduced credit. After two weeks past the originally-assigned due date, no credit will be awarded for the assignment.

Make-up Exams: Make-up exams may only be allowed prior approval or documented extenuating circumstances. I reserve the right to give an alternative exam, which may include different questions and/or a different format.

Office Hours: Feel free to text me to set up a meeting, or simply stop by my office. If I'm unavailable, we can arrange a Zoom meeting instead.

Electronic Devices in Lecture: Cell phones should be put away during class time, except at the direction of the instructor.

Class Disruption: All students are entitled to a professional learning environment. Students should not act in a manner which will distract and disrupt the class learning experience. Cell phones or any other electronic communication/entertainment devices, except for tablets/laptops used for taking notes, must be either turned off or silenced at all times during the lecture period.

Academic Integrity: Maintaining academic integrity is a mutual responsibility for all of us. I will be respectful of your time and make sure I am available during my office hours and will communicate with you in a timely manner. I expect the same in terms of your timeliness, honesty and sustained effort. Plagiarism and cheating are unacceptable and also violate RC policies. Refer to the "Academic Integrity" page on the RC website– https://www.roanoke.edu/inside/a-z_index/academic_integrity included here is an explanation of how violations of the College's academic integrity policy are handled.

Accessible Education Services (AES) is located on the first floor of the Bank Building. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Dustin Persinger, Assistant Director of Academic Services for Accessible Education, at 540-375-2248 or by e-mail at aes@roanoke.edu to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Dustin Persinger at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester. The testing center, also located on the first floor of the Bank Building, can be reached at 540-375-2247.

Student Health & Counseling Services supports students through in-person health appointments, in-person counseling, 24/7 telehealth (TimelyCare), Therapy Assistance Online, as well as resources related to general wellness, LGBTQ+, sexual assault, substance abuse, and suicide prevention. Unmet health needs can negatively impact your performance in this course. Student Health & Counseling Services can help. Please see https://www.roanoke.edu/shcs for more information and to access services.

Diversity: I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

Name/Pronouns: I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.