# ENGS-320: Instrumentation & Control System
## Fall 2024

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| Meeting Space: Lucas Hall 217 | Time: MWF 1:10 – 2:50 pm |
| Instructor: Dr. Avijit Sarker | Office: Trexler 266B |
| Email: sarker@roanoke.edu | Office hours: TBD |
| Course Site: Roanoke College | Laboratory hours: THU, 8:30 – 11:30 am |
| Phone: 662-380-1775 (cell); 540-375-2320(office) | |

**Prerequisites:** ENGS 220 or ENGS 302

**Co-requisite:** ENGS 320L

**Course Materials:**

**Required Book:**

- Control Systems: An Introduction, Hassan K. Khalil

https://ebin.pub/control-systems-an-introduction-9781607858263-9781607858270.html

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

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| Homework (7~10x) | 20% |
| Quizzes (7~10x) | 10% |
| In-class participation | 10% |
| Unit Exams (3x) | 30% |
| Final Exam | 15% |
| Final Project | 15% |

**Homework:** There will be approximately one set of problems each week. 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.

**Quizzes:** These will be about 10 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**: This will be an active class with many hands-on activities. You are expected to be in-class and actively engaged in activities and discussions.

**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 Friday December 13th 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.

**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.

**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**: Accessible Education Services (AES) is located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library. 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 Laura Leonard, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 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 Laura Leonard at your earliest convenience to schedule an appointment.

**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.