ME 475-675 Automatic Controls
NDSU Spring 2024

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Course Text:

- "Feedback and Control Systems", Third Edition, DiStefano et al
- Additional materials will be used to supplement the course. The instructor will notify class participants of when, where, and how to pick up the supplemental materials (if not supplied directly).

Course Description and Topics:

Introduction to industrial automatic controls. Theory and applications of pneumatic control, continuous process control, and programmable logic control. Demonstrations and discussion of the current industrial practice.

Prerequisites: MATH 266 and admission to professional program. {Also offered for graduate credit - see ME 675.}

- transfer functions and block diagrams
- first and second order systems – time and frequency domain
- proportional-integral-derivative (PID) controllers
- state logic
- sensors and actuators (types, uses, and applications)
- basic PLC operation and implementation
- practical aspects of implementing industrial control

Course Objective:

Upon completion of the course the student must be able to:

- demonstrate an understanding of feedback control systems (theory, practice, practical implementation)
- implement or describe the implementation of such systems in a real-world environment
- design and document a control strategy and system

Course Objectives and Outcomes:

Outcome	Implementation Strategies	Assessment Methods
Given a description or physical implementation of components, graduates must have the ability to create a system model.	Understand of and the ability to model practical systems is fundamental to creating control strategies. Understanding techniques to model systems if a necessary fundamental skill.	Homework problems are regularly assigned and collected which require students to mathematically analyze the system. Exams that measure the student's skill at such analysis will also be periodically administered.
Given a system model, graduates must have the ability to identify the system order and its expected physical response characteristics.	The analysis of systems will be discussed. Realistic examples of systems are used to illustrate methods for modeling with mathematical representations.	Homework problems are regularly assigned and collected which require students to mathematically analyze the system. Exams that measure the student's skill at such analysis will also be periodically administered.
Graduates must have an understanding of the purpose and operation of various control systems and devices encountered in the industrial environment.	The analysis of systems and their interactions is discussed. Case studies of systems are used to illustrate methods for design and modeling.	Homework problems are regularly assigned and collected which require students to mathematically analyze the system. Exams that measure the student's skill at such analysis will also be periodically administered.

ATTENDANCE STATEMENT
"According to NDSU Policy 333 (www.ndsu.edu/fileadmin/policy/333.pdf), attendance in classes is expected." See NDSU Policy 333 for faculty and student responsibilities related to attendance, including for university-sponsored activities.

"Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders."

AMERICANS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT
"Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the Disability Services Office (www.ndsu.edu/disabilityservices) as soon as possible."

APPROVED ACADEMIC HONESTY STATEMENT
"The academic community is operated on the basis of honesty, integrity, and fair play. NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

Informational resources about academic honesty for students and instructional staff members can be found at www.ndsu.edu/academichonesty."

In addition to the above, a statement of a college honor code, if applicable, should be included.
All work in this course must be completed in a manner consistent with NDSU University Senate Policy, Section 335: Code of Academic Responsibility and Conduct.

The program must have documented student outcomes that support the program educational objectives. Attainment of these outcomes prepares graduates to enter the professional practice of engineering. Student outcomes are outcomes (1) through (7), plus any additional outcomes that may be articulated by the program.

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
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.