**King Saud University**

**College of Computer and Information Sciences**

**Department of Computer Engineering**

1. Course number and name: **CEN455, Introduction to Digital Control**

2. Credits and contact hours: **3 (3, 0, 1)**

3. Instructor’s or course coordinator’s name: Dr. Nassim Ammour

4. Text book, title, author, and year:

***Control System Engineering***, Nise, N. S., 6th Edition, 2008, John Wiley & Sons.

a. other supplemental materials:

*Digital control of dynamic systems,* Franklin, G. F., Powell, J.D., and Worlman, M., 3rd Ed., 1998, Addison-Wesley.

*Digital Control Engineering,* Fadali, M. S. and Visioli, A., 2009, Academic Press.

5. Specific course information

a. Course description (catalog)

*Continuous Systems:* Review of mathematical representation of systems (transfer functions) modeling and parameter identification, system analysis in time domain, system stability, steady state error and compensator design. *Discrete Systems:* System modeling and parametric identification; Difference equations; review of Z transform; Review of sampling and reconstruction; Stability analysis; steady state error; Design of discrete-time control systems.

b. prerequisites or co-requisites: CEN352 (prerequisite).

c. Required, elective, or selected elective course: Required.

6. Specific goals for the course

a. Course Learning Outcomes: This course requires the student to demonstrate the following

# Introduction to control systems and MATLAB simulation

# Mathematical representation of systems in frequency domain

# Time response, and steady state errors

# Stability analysis using root locus

# Compensation design using Root Locus and pole placement

# Real-time implementation of analogue and digital controllers.

b. Relationship of Course to Student Outcomes

|  |  |  |
| --- | --- | --- |
| **Outcome** | **Student Outcome Description** | **Contribution** |
| (a) | an ability to apply knowledge of mathematics, science, and engineering | √ |
| (b) | an ability to design and conduct experiments, as well as to analyze and interpret data | √ |
| (c) | an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability |  |
| (d) | an ability to function on multidisciplinary teams |  |
| (e) | an ability to identify, formulate, and solve engineering problems | √ |
| (f) | an understanding of professional and ethical responsibility |  |
| (g) | an ability to communicate effectively |  |
| (h) | the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context |  |
| (i) | a recognition of the need for, and an ability to engage in life-long learning |  |
| (j) | a knowledge of contemporary issues |  |
| (k) | an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. | √ |

7. Brief list of topics to be covered and schedule in weeks

Introduction to Control Systems and MATLAB, Mathematical representation of systems

(differential equations, transfer function) 2

System analysis in time domains (time response, steady state error, stability) 3

Root-Locus analysis and compensator design (PID) 3

Digital Control: introduction, digitization, effect of sampling, stability 3

Discrete models of sampled data systems with Root-Locus 3

Review and evaluation 1

8. Assessment Plan for the Course

Quizzes 20%

Midterm Exams (2) 40%

Final Exam 40%

**Total 100%**

**Midterm exam dates:**

Midterm 1: Tuesday 16/10/2018.

Midterm 2: Tuesday 13/11/2018.

**Course Policies:**

* Cheating or plagiarism in any form will not be tolerated. A grade of zero will be registered for any infraction.
* **Attendance in the lecture is a must.** Students failed to achieve more than 75% attendance will be reported to the concerned authority; excuse should be directly submitted to the concerned authority; excuses of absence are accepted no later than one week of the absence.
* **All the exams are closed book.**

Contribution of Course to Meeting Curriculum Disciplines:

|  |  |
| --- | --- |
| **Curriculum Discipline** | **Percentage** |
| Mathematics and Basic Science | 30 |
| Engineering Science | 60 |
| Engineering Design | 10 |
| General Education |  |

Current Instructors, Department, Office Hours and Date:

Dr. Nassim Ammour

Department of Computer Engineering

ALISR, Office phone: 4676945

Office Hours: Sun 8-12 AM and by appointments

Email: [nammour@ksu.edu.sa](mailto:nammour@ksu.edu.sa)

Webpage: <http://faculty.ksu.edu.sa/nammour>