Philadelphia University

Faculty of Engineering and Technology
Mechatronics Engineering Department
First Semester 2020/2021

Course Details:

Title:	Digital Control (0640441), Fourth Year.
Prerequisite:	Automatic Control Systems (0640344).
Credit Hours:	3-credit hours (16 weeks per semester, approximately 45 contact hours).
Class Time:	9:10 – 10.00 Sun, Tues, Thur.
Text Book:	Digital Control Systems by Benjamin C. Kuo, 1995.
References:	1. Discrete-Time Control Systems, 2nd-ed, K Ogata, Prentice-Hall, Inc., 1995. 2. Digital Control Engineering, 2nd Edition, M. Sami Fadali Antonio Visioli, 2012.
Description:	Digital Control course will give the necessary acknowledge for implementation of digital techniques for system applications and control design. The course has been prepared taking into account the needs of the student for understanding the design of high performance control models for microcontroller systems.
Website:	http://www.philadelphia.edu.jo/academics/jghaeb/
Instructor:	Prof. Jasim Ghaeb, Email: jghaeb@philadelphia.edu.jo Office: Mechatronic building, room 6407, ext: 2590. Office hours: Sun, Tues, Thurs: 10:10-11:00, Mon, Wed: 9:00 -10:00.

Course Outlines:

Week	Basic and support material to be covered	Assignments
(1)	Introduction, Review of continuous control.	
(2)	Concept of discrete control systems.	
(3)	Sampling theory, Quantization procedure, Quantization error.	
(4)	Analog to digital and digital to analog conversion, Digital signals and coding.	
(5)	Sampled and Hold device, Mathematical model, Laplace transform of discrete-signals.	Assignment No.1
(6)	Laplace transform of discrete signals, Fourier transform.	

(7)	The sampling frequency, Reconstruction of sampling signal, Z-O-H.	Assignment No.2
(8)	Discrete- time systems, Transform methods, Z- transform, Properties of Z-transform	
(9)	Relation between s-plane and z-planes, Mapping method, Z- Transfer function for open-loop system.	
(10)	Z- Transfer function for closed- loop system, Characteristic equation q(*z*), Determination of T.Fs using MATLAB.	Assignment No.3
(11)	Stability analysis techniques, Routh Hurwitz criterion for digital systems, Jury stability test.	
(12)	Root- Locus in z-plane of digital control system, Asymptotes, Break away point, The gain parameter.	
(13)	Stability in frequency domain, Nyquist stability criterion, Mapping of counters	
(14)	Frequency response, Bode plot.	
(15)	Building and simulating of digital control systems using MATLAB.	Assignment No.4
(16)	Case study of digital control systems.	

Course Learning Outcomes with reference to ABET Student Outcomes:

Upon successful completion of this course, student should:

1.	Understand fundamentals of discrete- data systems by applying principles of engineering and mathematics..	[1]
2.	Carry out the data conversion, sampling process and quantization, Study the discrete-time system operation based on Z-transform.	[1]
4.	Practice design and response of digital control systems for different applications applying Matrix Laboratory (MATLAB).	[6]

Assessment Guidance:

Evaluation of the student performance during the semester (total final mark) will be conducted according to the following activities:

Sub-Exams: The students will be subjected to two scheduled written exams, first exam and second exam during the semester. Each exam will cover materials given in lectures in the previous 3-4 weeks.

Quizzes: 4-quizzes of10-minutes will be conducted during the semester. The materials of the quizzes are set by the lecturer.

Homework and projects: Tutorials sheets will be handed out to the students and homework should be solved individually and submitted before or on a set agreed date. Student may be assigned to present project(s).

Final Exam: The students will undergo a scheduled final exam at the end of the semester covering the whole materials taught in the course.

Grading policy:

First Exam	20%
Second Exam	20%
Quizzes, projects and homework	20%
Final Exam	40%
Total:	100%

Attendance policy:

The semester has in total 45 credit hours. Total absence hours from classes and tutorials must not exceed 15% of the total credit hours. Exceeding this limit without a medical or emergency excuse approved by the deanship will prohibit the student from sitting the final exam and a zero mark will be recorded for the course.

Student Outcomes
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.