هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	Digital Control Systems
Course Code:	503577-3
Program:	Bachelor in Computer Engineering
Department:	Department of Computer Engineering
College:	College of Computers and Information Technology
Institution:	Taif University

Table of Contents

A. Course Identification

1. Credit hours:3
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ☐ Elective ■
3. Level/year at which this course is offered: 10/5
4. Pre-requisites for this course (if any)**:** Control Engineering 503575-4
5. Co-requisites for this course (if any)**:** None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	3	100%
2	**Blended**	0	0
3	**E-learning**	0	0
4	**Distance learning**	0	0
5	**Other**	0	0

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	45
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify)	0
	Total	45

B. Course Objectives and Learning Outcomes

1. Course Description

This course focuses on the techniques used for analysis and design of the digital control systems. It identifies different aspects of digital control systems. The course covers: Z-transform and its inverse to represent and analyze discrete-time system, pulse transfer function, block diagram, signal flow graph, state space, bilinear transformation, stability analysis, transient response and steady state errors, design of digital controllers and evaluation of systems performance.

2. Course Main Objective

- Apply the Z-Transform and its inverse to represent and analyze discrete-time systems.
- Modeling of sampled data systems using difference equations, transfer functions, and state space, as well as block diagrams and SFG
- Investigation of the stability of discrete-time control systems
- Analysis of discrete-time control systems in time domain (transient and steady state responses).
- Design of digital controllers and evaluation of systems performance.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Identify and calculate the steady state error of the discrete-time control systems	K1
2	**Skills:**	
2.1	Apply the Z-Transform and its inverse to represent and analyze discrete-time control systems	S1
2.2	Evaluate the absolute and relative stability for discrete-time control systems	S1
2.3	Model sampled data systems using difference equations, pulse transfer functions and state space as well as block diagrams and signal flow graphs	S1
2.4	Design of digital control systems using conventional methods, root locus and frequency response methods	S1
3	**Values:**	

C. Course Content

No	List of Topics	Contact Hours
1	Digital control systems, introduction, S/H, ADC, DAC, quantizing and coding.	4
2	Z-transform, important properties and theorems of Z-Transform, the inverse of Z-Transform	4
3	Mathematical modeling of the discrete-time control systems, the pulse transfer function, pulse transfer functions of a closed-loop system	4
4	Pulse transfer functions of a digital PID controller	4
5	State space representation of the discrete-time control systems	4
6	Stability analysis of discrete-time systems (Jury stability criterion), stability analysis of discrete-time systems by use of the bilinear transformation and Routh stability criterion	5
7	Analysis of time response (discrete-time control systems)	5
8	Steady state error analysis (discrete-time control Systems)	5
9	Design of discrete-time control systems using root locus method	5

10	Design of discrete-time control systems using frequency response method.	5
Total		50

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	Identify and calculate the steady state error of the discrete-time control systems	Lecture Discussion Problem Solving	Written Exams Quizzes Assignments Oral Test
2.0	**Skills**		
2.1	Apply the Z-Transform and its inverse to represent and analyze discrete-time control systems	Lecture Discussion Problem Solving	Written Exams Quizzes Assignments Oral Test
2.2	Evaluate the absolute and relative stability for discrete-Time control systems	Lecture Discussion Problem Solving	Written Exams Quizzes Assignments Oral Test
2.3	Model sampled data systems using difference equations, pulse transfer functions and state space as well as block diagrams and signal flow graphs	Lecture Discussion Problem Solving	Written Exams Quizzes Assignments Oral Test
2.4	Design of digital control systems using conventional methods, root locus and frequency response methods	Lecture Discussion Problem Solving	Written Exams Quizzes Assignments Oral Test
3.0	**Values**		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments	Continues	5%
2	Midterm Exam	8	20%
3	Project	11	15%
4	Quizzes	Continues	10%
5	Final Exam	16	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

Teaching staff provide at least 6 office hours for students to help them in the course as well as in any other academic issues.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Benjamin C. Kuo,'Digital Control Systems', Oxford, latest edition.
Essential References Materials	G.F. Franklin, J.D. Powell, 'Digital Control of Dynamic Systems', latest edition.
Electronic Materials	None
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Traditional Classrooms, Laboratories
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of achievement of course learning outcomes	Students	Indirect (Survey)
Effectiveness of teaching and assessment	Students	Indirect (Survey)
Extent of achievement of course learning outcomes	Faculty	Course Report

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date