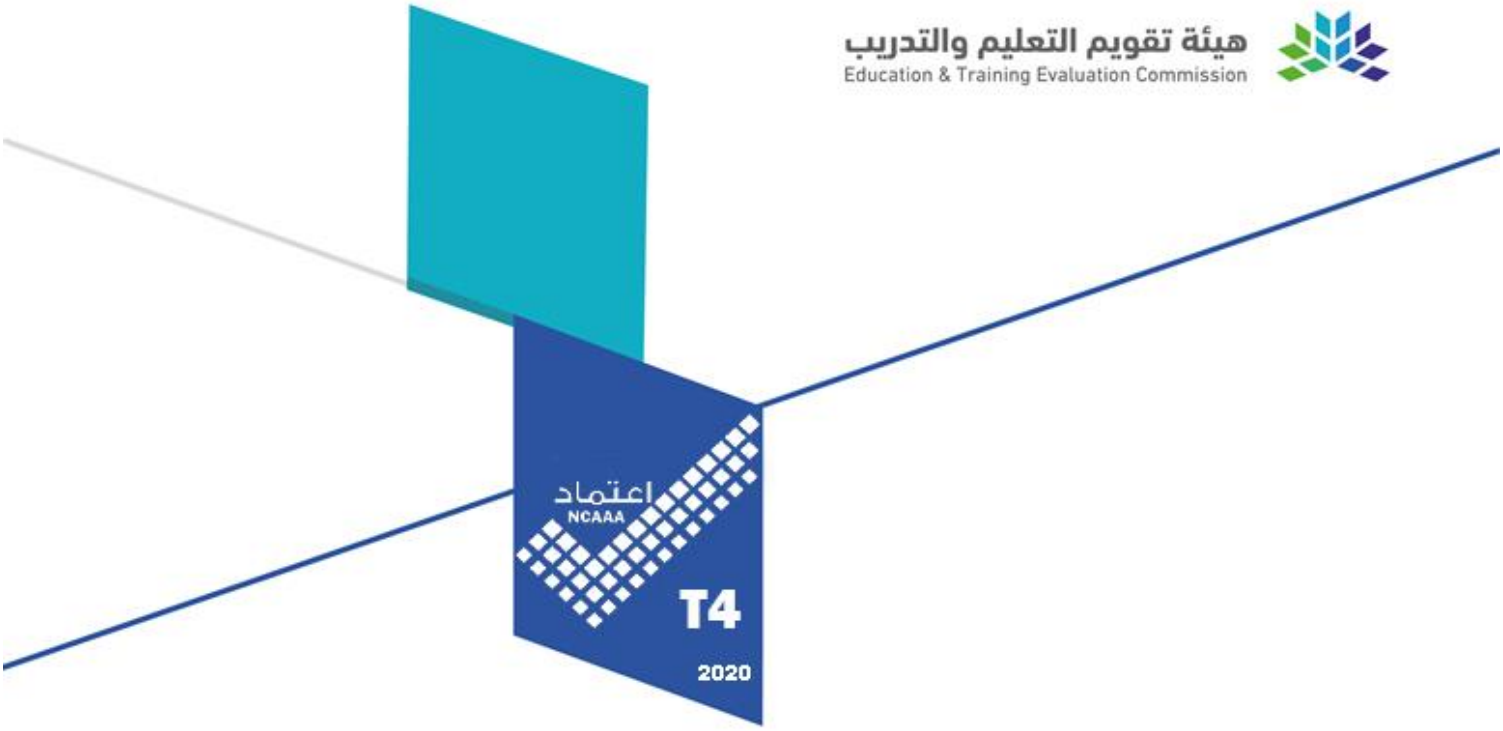
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	Control Engineering
Course Code:	503575-4
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: 4
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ■ Elective ☐
3. Level/year at which this course is offered: 12/4
4. Pre-requisites for this course (if any)**:** Digital Signal Processing (503474-3)
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**	8	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**	50
2	**Laboratory/Studio**	30
3	**Tutorial**	0
4	**Others** (specify)	0
	Total	80

B. Course Objectives and Learning Outcomes

1. Course Description

This course focuses on techniques used for the analysis and design of LTI feedback control systems, starting with the mathematical modeling, passing through the analysis, and ending with the design of LTI feedback control systems. The main topics include modeling of electrical, mechanical, and electromechanical systems as differential equations, transfer functions, and state-space; block diagram reduction and signal flow graph representation of LTI control systems; analysis of stability of open-loop and closed-loop systems; time and frequency domain analysis of LTI systems; design of controllers for enhancing the performance of LTI control systems.

2. Course Main Objective

The main objective of this course is to derive a mathematical model of a physical system using different techniques, then to analyze the obtained model both in time and frequency domains and finally to design a controller to enhance the performance of the system.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding:**	
1.1	Derive a mathematical model for a LTI dynamic system using different approaches: differential equations, transfer functions, and state space representation.	K1
1.2	Apply block diagram reduction algebra and signal flow graph to simplify a complex system and derive its input/output relationship.	K1
1.3	Derive expressions and calculate steady state errors for step ramp and quadratic inputs according to system type.	K1
2	**Skills:**	
2.1	Analyze the transient response of 1st and 2nd order systems to impulse, step, ramp, and quadratic input functions.	S1
2.2	Evaluate the relative stability of LTI control systems and calculate the parameters of the unit step response.	S1
2.3	Analyze the behavior of LTI control systems: overshoot, settling time, peak time, and rise time and design controllers that enhance their performance.	S3
3	**Values:**	

C. Course Content

No	List of Topics	Contact Hours
1	Introduction: control systems, basic components of a control System, types of control systems, LTI dynamic systems, feedback control systems.	5
2	Representation of LTI dynamic systems differential equations, impulse response, transfer functions, state space representation.	5
3	Block diagrams, signal flow graphs, transformation between different representations of LTI dynamic systems.	5
4	Mathematical modeling of physical systems electrical systems, mechanical systems, electromechanical systems, error sensing devices in control systems, tachometers, DC motors.	5
5	Time domain analysis of LTI control systems typical test signals, time domain performance of CSs, steady state response.	5
6	Transient response: transient response of second order systems.	5
7	Steady state response and steady state errors of LTI systems.	5
8	Stability of LTI control systems methods of determining stability of LCSs Routh-Hurwitz Criterion.	5
9	Root Locus Techniques.	5
10	Frequency domain analysis of CSs using root locus and controller design.	5
11	Lab	30
Total		80

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	Derive a mathematical model for an LTI dynamic system using different approaches: differential equations, transfer functions, and state space representation.	Lecture Discussion Problem Solving	Written Exams Quizzes Assignments
1.2	Apply block diagram reduction algebra and signal flow graph to simplify a complex system and derive its input/output relationship.	Lecture Discussion Problem Solving	Written Exams Quizzes Assignments
1.3	Derive expressions and calculate steady state errors for step ramp and quadratic inputs according to system type.	Lecture Discussion Problem Solving	Written Exams Quizzes Assignments
2.0	**Skills**		
2.1	Analyze the transient response of 1st and 2nd order systems to impulse, step, ramp, and quadratic input functions.	Lecture Discussion Problem Solving	Written Exams Quizzes Assignments
2.2	Evaluate the relative stability of LTI control systems and calculate the parameters of the unit step response.	Lecture Discussion Problem Solving	Written Exams Quizzes Assignments
2.3	Analyze the behavior of LTI control systems: overshoot, settling time, peak time, and rise time and design controllers that enhance their performance.	Lecture Discussion Problem Solving	Written Exams Quizzes Assignments Practical Test
3.0	**Values**		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments	3, 5, 7, 9	10%
2	Quizzes	4, 8	10%
3	Lab	11	20%
4	Midterm Exam	6	20%
5	Final Exam	12	40%

***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.
- Consultation can also be done 24 hours/ 7days through university Edugate (Tawasol).

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Modern Control Engineering, K. Ogata, latest edition.
Essential References Materials	• Analysis and Design of Control Systems with MATLAB, Rao V. Dukkipati, latest edition. • Automatic Control Systems, Benjamin C. Kuo and Farid Golnaraghi, 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, Blackboard system.
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
Effectiveness of teaching and assessment	Students	Indirect (Survey)
Extent of achievement of course learning outcomes	Students Faculty Curriculum committee	Indirect (Survey) Direct (Course Report) Direct
Quality of learning resources	Program leaders Staff members Students	Direct Indirect (Survey)

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