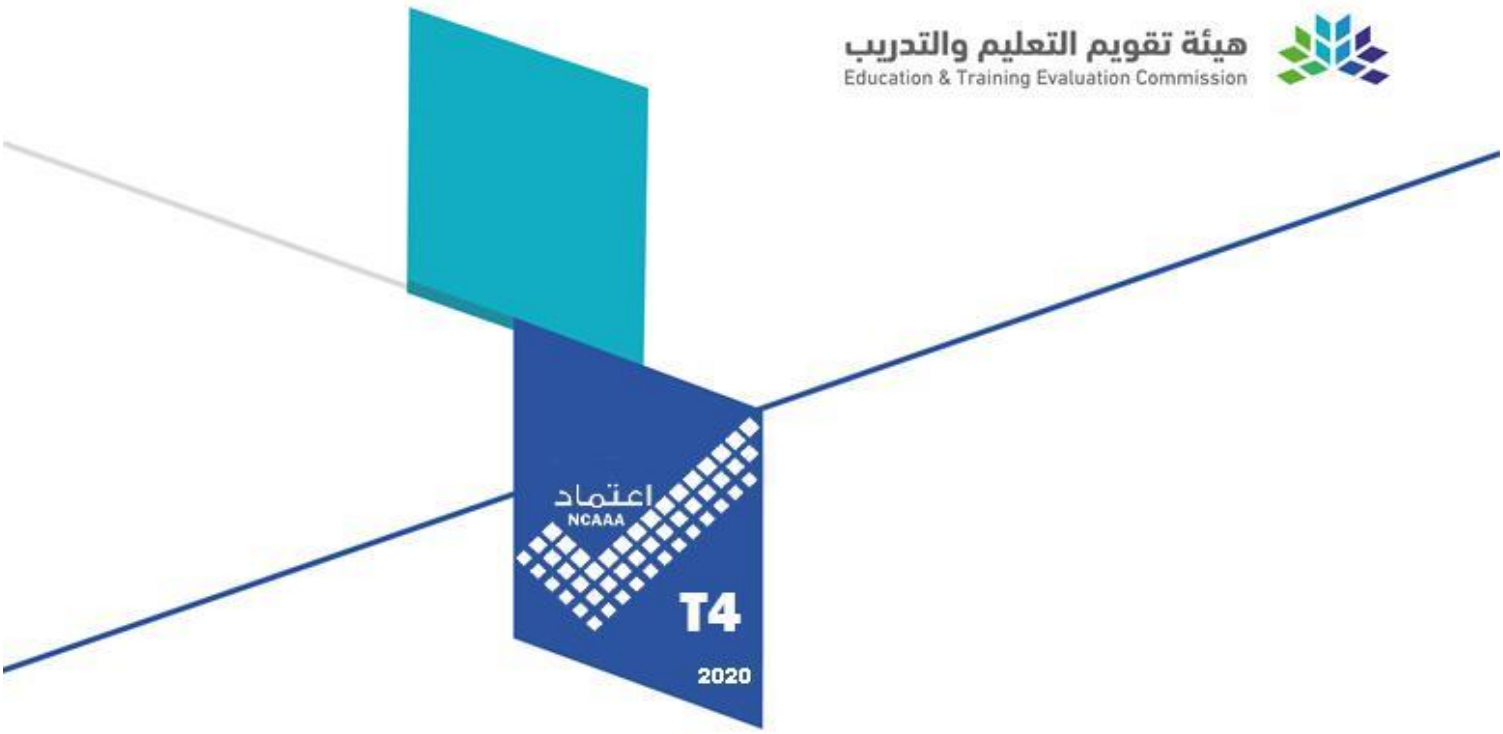
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	Embedded Systems
Course Code:	503432-3
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: 8 / 4
4. Pre-requisites for this course (if any)**:** Microprocessors (503431-3)
5. Co-requisites for this course (if any)**:** Non

6. Mode of Instruction (mark all that apply)

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

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	45
2	**Laboratory/Studio**	30
3	**Tutorial**	
4	**Others** (specify)	
	Total	75

B. Course Objectives and Learning Outcomes

1. Course Description

This course introduces students to the fundamentals of the hardware and firmware architecture of embedded systems and their applications. It includes a comprehensive overview of the PIC and AVR microcontrollers, their architecture, interfacing, programming, and usage. In addition, the course provides students with an insight of embedded systems, real-time operating systems, development boards, sensors and actuators, embedded systems in real time, and embedded systems applications (IoT).

2. Course Main Objective

1. Understand embedded systems and their architecture.
2. Understand the architecture and interfacing of microprocessor/microcontroller in embedded systems.
3. Use common microcontrollers in embedded systems.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Describe the basics and architecture of an embedded system.	K1
1.2	Describe the basics and architecture of common microcontrollers.	K1
2	**Skills:**	
2.1	Design embedded systems and real-time systems to solve real life engineering problems.	S1
2.2	Experiment microcontrollers in embedded systems.	S3
3	**Values:**	
3.1		

C. Course Content

No	List of Topics	Contact Hours
1	Introduction and Overview of Embedded Systems and MicroControllers	5
3	Interfacing: Interrupts - Communication and protocols	5
4	Embedded System memory and peripherals	3
2	PIC Microcontrollers	7
5	Midterm-exam	2
6	AVR MicroControllers	5
7	Development boards – Arduino	8
8	Sensors and Actuators	3
9	Real-time Embedded Systems - Operating Systems and Design	2
10	Wireless and Internet Embedded Systems: IoT	3
11	Revision	2
12	Labs	30
Total		75

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	Describe the basics and architecture of an embedded system.	Lecture Discussion	Written Exams Quizzes
1.2	Describe the basics and architecture of common microcontrollers.	Lecture Discussion	Written Exams Quizzes Assignments
2.0	**Skills**		
2.1	Design embedded systems and real-time systems to solve real life engineering problems.	Lecture Discussion Brainstorming Problem Solving Projects	Written Exams Quizzes Assignments Project Practical Test

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		Lab	
2.2	Experiment microcontrollers in embedded systems.	Lecture Group Work Self-Learning Problem Solving Projects Lab	Written Exams Assignments Project Practical Test
…			
3.0	**Values**		
3.1			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Lab Exam	14	15%
2	Midterm Exam	7	20%
3	Assignments	Continues	5%
4	Quizzes	Continues	10%
5	Project	Continues	10%
6	Final Exam	16	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	- Embedded System Design: A Unified Hardware/Software Introduction- Frank Vahid and Tony Givargis, John Wiley & Sons; ISBN: 0471386782. 2002 - Microcontroller Theory and Applications with the PIC18F, M. Rafiquzzaman, Wiley; 2nd edition (January 11, 2018), ISBN-10 : 1119448417, ISBN-13 : 978-1119448419
Essential References Materials	- Edward Ashford Lee, Sanjit Arunkumar Seshia ` Introduction to -Embedded Systems - A Cyber-Physical Systems Approach` Publisher: UC Berkeley 1st Edition 2013 - Exploring Arduino “Tools and Techniques for Engineering Wizardrye” by Jeremy Blum 2019, ISBN 1119405351 Ed John Wiley and Sons.
Electronic Materials	

Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Traditional Classrooms, Laboratory
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)	

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	Indirect (Survey)
Extent of achievement of course learning outcomes	Faculty	Course Report (Includes Direct and Indirect assessment results)

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	Computer Engineering Council / Curriculum Committee
Reference No.	16
Date	01/12/2020

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