هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	**Microprocessors and Embedded Systems**
Course Code:	**CEN 1406**
Program:	**Bachelor in Computer Engineering**
Department:	**Computer Engineering**
College:	**Faculty of Computers and Information Technology**
Institution:	**University of Tabuk**
Version:	**1.0**
Last Revision Date:	**27 July 2022**

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A. General information about the course:

1. Course Identification

1. Credit hours: (4 CH)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (8th Level/4th year)					
4. Course general Description:					
The major theme of this course is on models and their relationship to realizations of systems. The discussed models are primarily about dynamics, the evolution of a system state in time. The course demonstrates how to model and design the joint dynamics of software, networks, and physical processes.					
5. Pre-requirements for this course (if any)**:**					
CEN 1403					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					
1. **Obtain a broad understanding of the technologies and applications for the emerging and exciting embedded microprocessor systems.** 2. **Have an in-depth knowledge of interfacing peripherals** 3. **Get in-depth hands-on experience in designing and developing a real operational embedded system.** 4. Design and develop foundational systems software.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning	0	
3	Hybrid • Traditional classroom	0	

No	Mode of Instruction	Contact Hours	Percentage
	• E-learning		
4	Distance learning	0	

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Laboratory/Studio**	30
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		75

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Understand the technologies and applications for the emerging and exciting embedded microprocessor systems	K_1	Lecture, Lab sessions	Mid-term Exams Home Works Final Exams
1.2	Understand the Modeling concepts of physical systems	K_1, K_4	Lecture, Lab sessions	Mid-term Exams Home Works Final Exams
1.3	Know interfacing peripherals concepts and techniques	K_4, K_5	Lecture, Lab sessions	Mid-term Exams Home Works LabWorks Final Exams

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.4	Understand software implication on the system	K_4, K_5	Lecture, Lab sessions	Mid-term Exams Home Works LabWorks Final Exams
2.0	**Skills**			
2.1	Utilize Systems modeling tools	S_1	Lecture, Lab sessions	Mid-term Exams HomeWorks LabWorks Final Exams
2.2	Design and develop a real operational embedded system.	S_2 , S_3	Lecture Laboratory	Mid-term Exams HomeWorks project Final Exams
2.3	Selection of appropriate components	S_4	Lecture, Lab sessions	Mid-term Exams HomeWorks project Final Exams
3.0	**Values, autonomy, and responsibility**			
3.1	Develop realistic constraints that implement engineering standards with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	V_2	Lecture, Lab sessions	Mid-term Exams HomeWorks project Final Exams
3.2	Verify the component/system/process design against the design specifications and constraints	V_2	Lecture, Lab sessions	Mid-term Exams HomeWorks project Final Exams

C. Course Content

No	List of Topics	Contact Hours
1	Cyber-physical Systems and Model Based Design Lab: Implementation of Cyber-physical Systems and Model Based Design	5
2	Sensors and Actuators Lab: Implementation of Sensors and Actuators	5
3	Embedded Microprocessors	5

	Lab: Implementation of Embedded Microprocessors	
4	Modeling Physical Dynamics – part 1 Lab: Implementation of Modeling Physical Dynamics – part 1	5
5	Modeling Physical Dynamics – part 2 Lab: Implementation of Modeling Physical Dynamics – part 2	5
6	Discrete Dynamics – part 1 Lab: Implementation of Discrete Dynamics – part 1	5
7	Discrete Dynamics – part 2 Lab: Implementation of Discrete Dynamics – part 2	5
8	Extended and Timed Automata Lab: Implementation of Extended and Timed Automata	5
9	Composition of State Machines Lab: Implementation of Composition of State Machines	5
10	Hierarchical State Machines Lab: Implementation of Hierarchical State Machines	5
11	Models of Computation: Synchronous/Reactive and Discrete events Lab: Implementation of Computation of Computation	5
12	Memory Architectures – part 1 Lab: Implementation of Memory Architectures – part 1	5
13	Memory Architectures – part 2 Lab: Implementation of Memory Architectures – part 2	5
14	Input and Output, Interrupts – part 1 Lab: Implementation of Input and Output, Interrupts – part 1	5
15	Input and Output, Interrupts – part 2 Lab: Implementation of Input and Output, Interrupts – part 2	3
Total		**75**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Final Exams	17	40%
2.	Mid-term Exams	6,11	30%
3.	Project	5, 12	20%
4.	HomeWorks, Labworks	1-15	10%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	**Edward A. Lee and Sanjit A. Seshia, *Introduction to Embedded Systems, A Cyber-Physical Systems Approach*, Second Edition, MIT Press, ISBN 978-0-262-53381-2, 2023.**
Supportive References	**Daniele Lacamera, *Embedded Systems Architecture: Explore architectural concepts, pragmatic design patterns, and best practices to produce robust systems*, Packt Publishing (May 30, 2018, ISBN 978-1788832502**
Electronic Materials	**PowerPoint Presentations, Educational Videos (Youtube)**
Other Learning Materials	**N/A**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, Laboratory
Technology equipment (projector, smart board, software)	Smart Board - Data-Show – Whiteboard - Wifi Connection. Multimeter, soldering Iron, soldering wires & Soldering Iron holders. (Student use their own laptops.)
Other equipment (depending on the nature of the specialty)	Microcontroller Development kit for each student

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of Teaching	Faculty, Program Leaders, and Advisory Board	Both Direct and Indirect
	Students	Indirect
Effectiveness of Students Assessment	Faculty, Program Leaders, Advisory Board, and Independent Opinion	Both Direct and Indirect
Quality of Learning Resources	Faculty, Students, and Advisory Board	Indirect
The Extent to which CLOs have been Achieved	Faculty, Program Leaders, Advisory Board, and Independent Opinion	Direct (as in section B) and Indirect/Surveys
	Students	Indirect
Other	-	-

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	