Ministry of Higher Education and Scientific Research

وزارة التعليم العالي والبحث العلمي

جمهورية مصر العربية

SH. A.

أكاديمــية الشـروق

المعهد العالي للحاسبات وتكنولوجيا المعلومات

مدينة الشروق ـ القاهرة

شعبة علوم الحاسب

Course specification

Course Code: CS 463

Course Title: Introduction to Embedded Systems

Academic Year: /

Course specification
(CS 463: Introduction to Embedded Systems)

Course Outline	
Faculty:	*HICIT- (Higher Institute for Computers & Information Technology-El Shorouk Academy)*
Programme(s) on which the course is given:	Undergraduate program in Computer Science
Major or minor element of programme:	Compulsory
Department offering the program	Department of Computer Science
Department offering the course:	Department of Computer Science
Level	**4**st Year – 2nd semester
Date of specification approval	/ /2023

Basic Information			
Code: CS 463	*Title:*	Introduction to Embedded Systems	
Prerequisites:	**CS 220** Computer Organization		
Weekly Hours:			
Lecture: 2	**Exercise:**	**Practical: 2**	**Total: 3**

Professional Information
Course Aims:
This course is considered as the portal to the Embedded Systems world to understand the main required concepts of the Embedded Systems field and how to start your path as an Embedded Software Engineer. An introduction to micro controllers and the design of embedded systems, with an emphasis on understanding the interaction between hardware, software, and the physical world. Also include embedded programming languages, interrupts, I/O, concurrency management, scheduling, resource management, and real-time constraints.

Program ILOs Covered by Course			
Knowledge and understanding	Intellectual Skills	Professional and practical skills	General and Transferable skills
A8, A9, A10, A15, A20	B1, B10, B11, B12, B13	C1 , C16	D2, D12

Intended learning outcomes of course (ILOs)

A. Knowledge and Under-Standing:

a1- Introduction to the unique characteristics and requirements of embedded systems [A8, A9,A10]

a2- To give students an understanding of the embedded system architecture [A8, A9, A10]

a3- To make students familiar with the basic concepts and terminology of the embedded systems design flow (Software and hardware components of an embedded system). [A8, A9, A10, A15]

a4-. Hardware Software Codesign [A8, A9, A15]

a5- To understand real-time operating systems [A15]

a6- To explain students with methods of executive device control and to give them opportunity to apply and test those methods in practice; [A8, A9, A10, A20]

B. Intellectual Skills:

b1- Students will emerge from the class with a cutting-edge education on this rapidly emerging technology segment, and with the confidence to carry out tasks they will commonly encounter in industrial settings. [B1,B10, B11]

b2- Determine the optimal composition and characteristics of an embedded system; [B1,B11,B13]

b3- Design and program an embedded system at the basic level; [B10,B11,B12]

C. Professional and practical skills

c1- An appreciation of the interplay between the different requirements in a complex embedded software design, involving issues such as concurrency, reliability and adherence to timing constraints. [C1, C16]

c2- Comparison of features in high-level languages intended for embedded software, [C1, C16]

D. General and transferable skills

d1- Methods to evaluate design trade-offs between different technology choices [D2, D12]

d2- Technology capabilities and limitations of the hardware, software components [D2, D12]

d3- Work as a part of a team to produce report. [D12]

Contents

Topic	Contact Hours	
	lecture	Lab
Introduction to embedded systems. Terms definition, features, characteristics, application, design route.	3	3
Embedded System VS General Computer Systems	4	3
Embedded Firmware Design & Development Approaches	5	4
Embedded System Interrupts	5	3
ANCI C programming	6	3
Embedded System Partitioning, Accelerator based Embedded Systems	4	4
Fault-tolerant Embedded Systems	3	5

Real-time Operating Systems	6	2
Embedded System Case Studies	4	5

Teaching and learning methods

Teaching and learning methods	Used
Lectures	√
Tutorial Exercises	√
Practical Lab	√
Discussions.	√
Self – Learning (Reading material, Websites search,)	
Self-studies	
Group work	
Presentation	
Problem solving/problem solving learning based	
Case study	
Synchronous E-Learning	
Video lectures	√
Asynchronous E-Learning	√

Student assessment methods & Schedule

Methods	Used	Week#
Midterm Exam	√	**8**
Final Exam	√	**16**
Course Project	√	**3-14**
Course Work & Quizzes	√	**2-14**
Practical Exam	√	**15**

Assessment Weight

Assessment	Weight %
Mid Term Exam	10%
Practical Exam and Project	10%
Final Exam	70%
Course Work & Quizzes	10%
Total	100

Course Work &Quizzes

Short Exams, Assignments, Research, Reports, Presentations
Class/Project discussion

List of references

Essential books (textbooks)	
Course notes	E-Learning Portal
Recommended books	

Periodicals, website	
Videos link	

Required Facilities

Tools & SW (Technology facilities):	- ANCI C Paython,	
Teaching facilities:	Whiteboard	√
	Computer Lab	√
	Data show	√
	E-Learning	√
	Videos	√
	Website	√

Learning Method /ILOs Matrix

Learning Methods	Knowledge and understanding						Intellectual skills			Professional and practical skills			General		
	a1	a2	a3	a4	a5	a6	b1	b2	b3	c1	c2	c3	d1	d2	d3
Lectures	√	√	√	√	√	√			√			√			√
Tutorial Exercises							√	√	√	√	√	√	√		√
Practical Lab							√	√		√	√	√	√		√
Discussions.							√	√	√	√	√	√	√		√

Course Content/ILO Matrix

Course Contents	Knowledge & understanding						Intellectual skills			Professional and practical skills			General		
	a1	a2	a3	a4	a5	a6	b1	b2	b3	c1	c2	c3	d1	d2	d3
Introduction to embedded systems. Terms definition, features, characteristics, application, design route.	√														
Embedded System VS General Computer Systems		√													√
Embedded Firmware Design & Development Approaches				√								√			
Embedded System Interrupts						√		√				√			
ANCI C programming							√	√				√			
Embedded System Partitioning, Accelerator based Embedded Systems							√	√							√
Fault-tolerant Embedded Systems							√	√							
Real-time Operating Systems							√	√							√
Embedded System Case Studies							√	√							

Assessment Methods /ILOs Matrix

Learning Methods	Knowledge and understanding						Intellectual skills			Professional and practical skills			General		
	a1	a2	a3	a4	a5	a6	b1	b2	b3	c1	c2	c3	d1	d2	d3
Mid Term Exam	√	√	√	√	√	√	√	√	√	√	√	√			√
Final Exam	√	√	√	√	√	√	√	√	√	√	√	√	√		√
Course Work &Quizzes			√		√	√	√	√		√	√	√	√		√
Practical Exam			√		√		√	√	√	√	√	√	√		√

Course ILOs Vs Program ILOs

Prog ILOs / Course ILOs		Knowledge and understanding					Intellectual skills					Professional and practical skills		General	
		A8	A9	A10	A15	A20	A1	B10	B11	B12	B13	C1	C16	D2	D12
Knowledge and Understanding	a1	x	x												
	a2	x													
	a3	x			x										
	a4	x													
	a5	x	x	x											
	a6	x		x		x									
Intellectual skills	b1						x	x	x		x				
	b2						x		x						
	b3							x	x	x	x				
Professional and practical skills	c1											x			
	c2											x	x		
General skills	d1													x	
	d2													x	x
	d3													x	x

Course Coordinator : (   )
Head of Department : Dr. Ahmed El-Abbassy **(   )**
Date: --/--/2023