

# **Embedded System Fundamentals Course Definition Form**

## **1- Basic Information:**

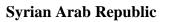
Course Name	Embedded System Fundamentals
Course ID	CCS404
<b>Contact Hours (Registered Sessions)</b>	30
<b>Contact Hours (Synchronized Sessions)</b>	18
Mid Term Exam	None
Exam	1.5
<b>Registered Sessions Work Load</b>	30
Synchronized Session Work Load	18
Credit Hours	5

### 2- Pre-Requisites:

Course	ID
Microprocessors and Microcontrollers	CEE307

## **3-** Course General Objectives:

This course defines the fundamentals and design of embedded systems using a modern methodology. The course defines the basic components of embedded systems, especially the various types of processors, which include the single-purpose processors, the applications-specific processors and general purpose processors. This is in addition to learning the basics of Verilog language used in the design of single-purpose processors. We also introduce the various types of memory, and input and output equipment which are necessary to build embedded systems and how to deal with them. Then we identify the communication protocols using buses or wirelessly to ensure the processor connection with peripherals or with other systems. Finally, we demonstrate the role of real-time operating systems in accelerating the development of embedded system applications and the characteristics they must achieve to ensure that they can meet the needs of these applications.



Ministry of Higher Education



الجمهورية العربية السورية

وزارة التعليم العالمي

الجامعة الافتراضية السورية

Syrian Virtual University

## 4- Intended Learning Outcomes (ILO):

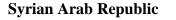
Code	Intended Learning Outcomes			
ILO1	Identify embedded systems and their properties.			
ILO2	Reminder of the fundamentals of logical and sequential logic circuits.			
ILO3	Understand how custom single-purpose processors are designed.			
ILO4	Identify the basics of Verilog HDL at logic gates level.			
ILO5	Identify the basics of Verilog's for combinational circuits.			
ILO6	Identify the basics of the Verilog for sequential circuits.			
ILO7	Identify the basic components of general purpose processors.			
ILO8	Identify some commonly used standard Peripherals.			
ILO9	Identifying types of memories, their properties and methods of composing memories.			
ILO10	Understand methods of interfacing processors using buses.			
ILO11	Identify the protocols of parallel, serial and wireless communication.			
ILO12	Identify real-time operating systems and their properties.			

## 5- Course Syllabus (18 hours of total synchronized sessions)

• RS: Recorded Sessions; SS: Synchronized Sessions;

ILO	Course Syllabus	RS	SS	Туре	Additional Notes
ILO1	Introduction to the Embedded Systems Characteristics of Embedded Systems Design challenge and Optimizing Design Metrics Embedded Processors Technology ICs Technology Design Technology		1.5	<ul> <li>Exercises</li> <li>Assignments</li> <li>Seminars</li> <li>Projects</li> <li>Practices</li> <li>Others</li> </ul>	
ILO2	<b>Basics of Logic Circuits</b> Combinational Logic Sequential Logic	2.5	1.5	<ul> <li>Exercises</li> <li>Assignments</li> <li>Seminars</li> <li>Projects</li> <li>Practices</li> <li>Others</li> </ul>	
ILO3	Custom Single-Purpose ProcessorsCustomSingle-PurposeProcessorDesign	2.5	1.5	<ul><li>Exercises</li><li>Assignments</li><li>Seminars</li></ul>	

الجمهورية العربية السورية



Ministry of Higher Education

Syrian Virtual University



وزارة التعليم العالمي

الجامعة الافتراضية السورية

#### Custom Single-Purpose Optimizing Projects Processor Design Practices $\square$ Others Verilog Hardware Description **E** Exercises Language □ Assignments Brief history of Verilog □ Seminars **Design Levels** ILO4 2.5 1.5 $\Box$ Projects Verilog Hardware Description Language Program Skeleton Practices Testbench Others Verilog: Combinational circuits **E** Exercises Operations □ Assignments "Always" Block for Combinational Seminars Circuit ILO5 2.5 1.5 Routing Network $\Box$ Projects Seven-Segments Decoder Practices **Design Guidelines** Others Verilog: Sequential circuits **E** Exercises Flip-Flop and register □ Assignments Synchronous System □ Seminars ILO6 2.5 1.5 **Types of Sequential Circuits** □ Projects Practices Others **General-Purpose Processors E** Exercises **Basic Architecture** □ Assignments Operation □ Seminars ILO7 Programing the Processor 2.5 1.5 □ Projects Application-Specific-Instruction-Set Practices Processors ASIP $\square$ Others Standard Single-Purpose Processors: **E** Exercises **Peripherals** □ Assignments Timers and Counters Seminars ILO8 Universal Asynchronous Receiver-2.5 1.5 □ Projects Transmitter (UART) Practices Pulse Width Modulator (PWM) $\square$ Others LCD Controllers

Syrian Arab Republic		الجمهورية العربية السورية
Ministry of Higher Education	SVU	وزارة التعليم العالمي
Syrian Virtual University	الجامعة الإفتراضية السورية Syrian Virtual University	الجامعة الافتراضية السورية

	Keypad controller Real-Time Clock (RTC)			
ILO9	Memory Memory Classification Common Memory Types Composing Memory Memory Management Unit (MMU)	2.5	1.5	<ul> <li>Exercises</li> <li>Assignments</li> <li>Seminars</li> <li>Projects</li> <li>Practices</li> <li>Others</li> </ul>
ILO10	<b>Interfacing Using Buses</b> Communication Basics Basic Protocol Concepts Microprocessor Interfacing Arbitration Multilevel Bus Architectures	2.5	1.5	<ul> <li>Exercises</li> <li>Assignments</li> <li>Seminars</li> <li>Projects</li> <li>Practices</li> <li>Others</li> </ul>
ILO11	Communication Protocols Communication Types Basic Notions in Communications Serial Protocols Parallel Protocols Wireless Protocols	2.5	1.5	<ul> <li>Exercises</li> <li>Assignments</li> <li>Seminars</li> <li>Projects</li> <li>Practices</li> <li>Others</li> </ul>
ILO12	Real-Time Operating Systems Brief History of OS Definition of RTOS Scheduler Objects Services RTOS Characteristics Some of RTOS	2.5	1.5	<ul> <li>Exercises</li> <li>Assignments</li> <li>Seminars</li> <li>Projects</li> <li>Practices</li> <li>Others</li> </ul>

# 6- Assessment Criteria (Related to ILOs)

Ministry of Higher Education

Syrian Virtual University

Syrian Arab Republic



وزارة التعليم العالمي

الجامعة الافتراضية السورية

ISCInteractive Synchronized CollaborationExExamsRptReportsPF2FPresentations and Face-to-Face AssessmentsPWPractice WorkFace-to-Face Assessments

ILO		Intended	Assessment Type					
Code	ILO	Results	ISC	PW	Ex	PF2F	Rpt	
ILO1	Identify embedded systems and their properties.		X		X			
ILO2	Reminder of the fundamentals of logical and sequential logic circuits.		X		X			
ILO3	Understand how custom single-purpose processors are designed.		X		X			
ILO4	Identify the basics of Verilog HDL at logic gates level.		X		X			
ILO5	Identify the basics of Verilog's for combinational circuits.		X		X			
ILO6	Identify the basics of the Verilog for sequential circuits.		X		X			
ILO7	Identify the basic components of general purpose processors.		X		X			
ILO8	Identify some commonly used standard Peripherals.		X		X			
ILO9	Identifying types of memories, their properties and methods of composing memories.		X		X			
ILO10	Understand methods of interfacing processors using buses.		X		X			
ILO11	Identify the protocols of parallel, serial and wireless communication.		X		X			
ILO12	Identify real-time operating systems and their properties.		X		X			

## **7- Practice Tools:**

Tool Name	Description

## 8- Main References



1- Frank Vahid, Tony D. Givargis, **Embedded System Design: A Unified Hardware/Software Introduction**, Jhon Wiley & Sons, 2005.

2- Pong P. Chu, **FPGA Prototyping by Verilog Examples Xilinx Spartan-3 Version**, Jhon Wiley & Sons, 2008.

## 9- Additional References

3- Qing Li and Carolyn Yao, Real-Time Concepts for Embedded Systems, CMP Books 2003.