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

Embedded System Fundamentals Course Definition Form

1- Basic Information:

Course Name	Embedded System Fundamentals
Course ID	CCS404
Contact Hours (Registered Sessions)	30
Contact Hours (Synchronized Sessions)	18
Mid Term Exam	None
Exam	1.5
Registered Sessions Work Load	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.

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	Type	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	2.5	1.5	☒ Exercises ☐ Assignments ☐ Seminars ☐ Projects ☐ Practices ☐ Others	
ILO2	**Basics of Logic Circuits** Combinational Logic Sequential Logic	2.5	1.5	☒ Exercises ☐ Assignments ☐ Seminars ☐ Projects ☐ Practices ☐ Others	
ILO3	**Custom Single-Purpose Processors** Custom Single-Purpose Processor Design	2.5	1.5	☒ Exercises ☐ Assignments ☐ Seminars	

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

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

6- Assessment Criteria (Related to ILOs)

ISC	Interactive Synchronized Collaboration		Ex	Exams		Rpt	Reports
PF2F	Presentations and Face-to-Face Assessments		PW	Practice Work			

ILO Code	ILO	Intended Results	Assessment Type				
			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.