Undergraduate Program

SYLLABUS

- 1. Course name: Embedded Systems
- 2. Course code: EMSY435664
- 3. Credits: 3 (3/0/6)

Duration: 15 weeks (45h main course and 90h self-study)

- 4. Instructors:
 - 1- PhD. Truong Ngoc Son
 - 2- M.Eng. Truong Quang Phuc
 - 3- M.Eng. Huynh Hoang Ha

5. Course conditions

Prerequisites: Basic Electronics

Co-requisites: N/A

6. Course description

This course provides a comprehensive introduction to the embedded system. This course focuses on the basic knowledge of the embedded system, such as the design, interface, configuration, and the programming of the embedded system. In this course, students will learn how to develop an embedded system in hardware and software approaches. The practice part of this course is also conducted with a specific embedded system which is based on MCU. At the end of the course, students will be able to design and program an embedded system at the basic level, develop software, custom an application of embedded system with the use of the existing embedded systems.

7. Course Goals

Goals	Goal description (This course provides students:)	ELOs
G1	Basic knowledge of the embedded system, MCU, sensors, executive structure, communication, programming, and interface.	1.1, 1.2
G2	An ability to design and develop an embedded system (including hardware and software) for practical application	2.2, 1.3
G3	An ability to use hardware/software development techniques and computer skills to solve problems.	3.2, 4.4

* Note: High: H; Medium: M; Low: L

8. Course Learning Outcomes (CLOs)

CLOs		Description	
		(After completing this course, students can have:)	
C1	G1.1	The ability to identify the requirements and design constraints of the embedded system.	1.1, 1.2
GI	G1.2	The ability to program a modern microprocessor using assembly language.	1.1, 1.2

	G1.3	The ability to recognize the embedded system's components with different processors and peripheral devices.	1.1, 1.2
G2	G2.1	The ability to design and program an embedded system based on microcontroller for specific applications	2.2, 1.3
G3	G3.1	The ability to develop the embedded system	3.2, 4.4

9. Study materials

- Textbooks:

[1] Marilyn Wolf, Computers as Components, Third Edition: Principles of Embedded Computing System Design, 3rd ed. Morgan Kaufmann, 2012.

- References:

- [2] David Russell, Introduction to Embedded Systems, 2010.
- [3] Edward Lee and Sanjit Seshia, Introduction to Embedded Systems, A Cyber-Physical systems Approach, 2011

10. Student Assessments

- Grading points: 10
- Planning for students assessment is followed:

Туре	Contents	Time- line	Assessment techniques	CLOs	Rates (%)
	Assignments				10
Q.1	Assignments/LMS		quizzes	G1	10
	Midterms				40
M.1	Program the microprocessor to control the peripheral devices	Week 6	Paper-based assessment	G1	20
M.2	Interrupt programming, communication between microprocessors using serial protocols	Week 11	Paper-based assessment	G1	20
Final exam					50
Р	Design an embedded system based on a microprocessor		Report		50

11. Course details:

Weeks	Contents	CLOs
	Chapter 1. Introduction of embedded system (3/0/6)	
	Contents: (3)	
	1.1 Introduction of embedded system	
	1.2 Embedded system design flow	
1	1.3 Characteristics of embedded systems	G1.1
	Teaching methods:	
	+ Lecture	
	+ Discussion	
	+ Presentation	

+ State machine Chapter 2. Embedded system architecture (3/0/6) Contents: (3) 2.1 Core and memory 2.2 Sensors and inputs and outputs 2.3 Firmware 2.4 Real-time operating system 2.4 Real-time operating system 2 2.5 Other peripheral devices Teaching methods: (6) + Lecture + Discussion + Presentation Self-study contents: (6) Self-study contents: (3) 3.1 Characteristics of embedded system and real-time system (3/0/6) Contents: (3) 3.1 Characteristics of Embedded system 3.2 Design constraints 3.3 Real-time system 3.3 Real-time system G1 4 Presentation Self-study contents: (6) (6) + Contents: (3) 3.1 Sharacteristics of Embedded system 3.3 Dedicating methods: (6) + Discussion + Presentation Self-study contents: (6) (6) + Contents: (3) 3.1 Shingle purpose processor 3.3 Dedicated processor. 4 Teaching methods: (6) + Lecture (6) + Lecture (6) + Lecture (6)		<i>B</i> /Self-study contents: (6) + Digital logic and logic devices		
Chapter 2. Embedded system architecture (3/0/6) Contents: (3) 2.1 Core and memory 2.2 Sensors and inputs and outputs 2.3 Firmware 2.4 Real-time operating system 2.5 Other peripheral devices Teaching methods: + Lecture + Discussion + Presentation Self-study contents: (6) + Von Neuman architecture Chapter 3. Characteristics of Embedded system and real-time system (3/0/6) Contents: (3) 3.1 Characteristics of Embedded system 3.2 Design constraints 3.3 Real-time system 3 Teaching methods: + Lecture + Discussion + Presentation Self-study contents: (6) + C programming laguage Chapter 4. MCU (3/0/6) Contents: (3) 3.1 Single purpose processor 3.3 Dedicated processor. 3.1 Single purpose processor 3.3 Dedicated processor. 4 Teaching methods: + Lecture + Discussion + Presentation Self-study c		+ State machine		
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	Contents: (3)	
	5.1 I/O	
	5.2 Sensors	
	5.3 Interrupt	
	Teaching methods:	~ .
	+ Lecture	G1
	+ Discussion	
	+ Presentation	
	Self- study contents: (6)	
	+ Pulse width modulation	
	Chapter 6. Embedded software (3/0/6)	
	Contents: (3)	
	6.1 Interrupt programming	
	6.2 Debugging techniques	
6	Teaching methods:	
0	+ Lecture	G1
	+ Discussion	
	+ Presentation	
	Self- study contents: (6)	
	+ Homework	
7	MIDTERM EXAM	
7	MIDTERM EXAM Chapter 6. Embedded software (cont') (3/0/6)	
7	MIDTERM EXAM Chapter 6. Embedded software (cont') (3/0/6) Contents: (3)	
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7 8 9	MIDTERM EXAMChapter 6. Embedded software (cont') (3/0/6)Contents: (3)6.3 Real-time operating system6.4 Driver6.5 MiddlewareTeaching methods:+ Lecture+ Discussion+ PresentationSelf- study contents: (6)+ RTOSsChapter 7. Communications (3/0/6)Contents: (3)7.1 UART, SPI, I2C7.2 Wireless	G1.2 G2.1
7 8 9	MIDTERM EXAMChapter 6. Embedded software (cont') (3/0/6)Contents: (3)6.3 Real-time operating system6.4 Driver6.5 MiddlewareTeaching methods:+ Lecture+ Discussion+ PresentationSelf- study contents: (6)+ RTOSsChapter 7. Communications (3/0/6)Contents: (3)7.1 UART, SPI, I2C7.2 WirelessTeaching methods:	G1.2 G2.1 G1
7 8 9	MIDTERM EXAMChapter 6. Embedded software (cont') (3/0/6)Contents: (3)6.3 Real-time operating system6.4 Driver6.5 MiddlewareTeaching methods:+ Lecture+ Discussion+ PresentationSelf- study contents: (6)+ RTOSsChapter 7. Communications (3/0/6)Contents: (3)7.1 UART, SPI, I2C7.2 WirelessTeaching methods:+ Lecture	G1.2 G2.1 G1

	+ Presentation		
	Self- study contents: (6)		
	+ Wifi, Zigbee, Lora		
	Chapter 8. Algorithms and feedback control (3/0/6)		
10	A/ Contents and teaching methods: (3) Contents: 8.1 Algorithms 8.2 Feedback control Teaching methods: + Lecture + Discussion + Presentation	G1	
	<i>B</i> / Self- study contents: (6) + PID control		
11	EXERCISE AND EXAM		
	Chapter 9. EMBEDDED SYSTEM DEVELOPMENT > (3/0/6)		
12	 A/ Contents and teaching methods: (3) Contents: 9.1 Embedded system development with IDE 9.2 Embedded system development with development kit Teaching methods: + Lecture + Discussion + Presentation 	G2,3	
	<i>B</i> /Self-study contents: (6) + Arduino kit		
	Chapter 10. Embedded system design (3/0/6)		
13	 A/ Contents and teaching methods: (3) Contents: 10.1 Embedded system design Teaching methods: + Lecture + Discussion + Presentation B/ Self- study contents: (6) Simulate the design of an excluded system 	G2,3	
	+ Simulate the design of an embedded system		
1 4	Chapter 10. EMBEDDED SYSTEM DESIGN> (3/0/6)		
14	Contents: (3) 10.2 Desing an embedded system based on microcontroller	G2,3	

	Teaching methods:	
	+ Lecture	
	+ Discussion	
	+ Presentation	
	Self- study contents: (6)	
	+ Simulate the design of an embedded system	
15	REVIEW	

12. Learning ethics:

Home assignments and projects must be done by the students themselves. Plagiarism found in the assessments will get zero point

13. First approved date: January 15, 2012

14. Approval level:

Dean	Department	Instructor
Assoc. Prof. PhD. Nguyen Minh Tam	Assoc. Prof. PhD. Phan Van Ca	PhD. Truong Ngoc Son
15. Syllabus updated process		
1 st time: Updated content dated: 15/01/	2014	Instructors
2nd time: Updated content dated: 15/01	/2016	Head of department