SYLLABUS

1. **Course name:** Microprocessor
2. **Course code:** MICR330363
3. **Credits:** 3 (3/0/6)
   Duration: 15 weeks (45h main course and 90h self-study)
4. **Instructors:**
   1- M.Eng. Nguyen Dinh Phu
   2- M.Eng. Nguyen Thanh Binh
   3- M.Eng. Truong Ngoc Thanh
   4- M.Eng. Nguyen Van Hiep
   5- M.Eng. Phan Van Hoan
5. **Course conditions**
   Prerequisites: Basic electronics, Digital Systems
   Corequisites: N/A
6. **Course description**

This course provides students the knowledge of the functional role of the processor, the processor system, the history of the microcontroller. The structure inside the 8-bit microcontroller, the principle of operation of 8-bit microcontrollers; the structure and operation principles of the peripherals of microcontroller like timers / counters, analog to digital conversion, interrupts, pulse width modulation, data transfer UART, SPI, I2C. In addition, students will learn basic knowledge of assembly language programming and in-depth knowledge about the programming languages C to control applications of microcontrollers, application circuits using microcontrollers.

7. **Course Goals**

Goals	***Goal description*** *(This course provides students:)*	ELOs
G1	Basic knowledge of microprocessor/ microcontroller systems and C language for microcontroller.	1.1, 1.2
G2	An ability to use textbooks, books, powerpoint slides and to do homework and exams in English.	2.1, 3.3
G3	An ability to analyze, explain and solve basic problems on systems using microprocessor / microcontroller.	3.2
G4	An ability to design circuits using microcontroller hardware and software used for system programming microcontrollers and to use simulation software for microcontrollers.	2.2

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

8. Course Learning Outcomes (CLOs)

CLOs		*Description* *(After completing this course, students can have:)*	Outcome
G1	G1.1	basic knowledge about microcontroller architecture, the principle of operation of the integrated peripherals of the microcontroller.	1.1, 1.2,
	G1.2	the ability to explain the principle of using the microcontroller circuit, reading flowcharts and program applications using microcontrollers.	1.1, 1.2
G2	G2.1	the ability to read and understand the datasheet of microcontroller, lectures in English.	2.1, 3.3
G3	G3.1	the ability to understand the principles, functions and parameters calculation for peripheral ports, ADC, Interrupt, Timer / Counter, data transmission, pulse width modulation; objects such as LED control unit, 7-segment LED, LCD, buttons, keyboard matrix, temperature sensors, power communication IC to control stepper motors and DC motors.	3.2
	G3.2	the ability to analyze, write flowcharts, writing programs in the C programming language used to control each component independently.	3.2
G4	G4.1	the ability to analyze, design hardware for systems using microcontrollers and peripherals.	2.2
	G4.2	the ability to design software for systems using microcontrollers and peripherals.	2.2
	G4.3	the ability to using simulation software to perform simulations for the user to control the system.	2.2

9. Study materials

- Textbooks:

[1] Nguyen Dinh Phu, *Giao trinh Vi xu ly*, NXB Dai hoc Quoc gia, 2012.

- References:

[1] Richard H. Barnett, Sarah Cox, Larry O'Cull, *Embedded C Programming and the Microchip PIC*, Delmar Publishers Inc, 1 edition November 3, 2003.

[2] Martin P. Bates, *Programming 8-bit PIC Microcontrollers in C: With Interactive Hardware Simulation*, Newnes, 1 edition July 29, 2008.

10. Student Assessments

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

Type	Contents	Linetime	Assessment techniques	CLOs	Rates (%)
Midterms					**50**
Exam	Circuit design and write programs that use microcontrollers with	Week 10	Individual paper	G1.1, G1.2 G3.1, G3.2	20%

	peripherals such as single LED, 7-segment LED, button, counter, timer.		assessment in class		
Project					
Report	Circuit design, writing programs, simulations using microcontrollers with peripherals such as LCD, keyboard matrix, interrupts, ADC, sensor LM35.	Week 11	Online	G3.1, G3.2 G4.1, G4.2 G4.3	15%
Quiz Online					
Quiz01	The general knowledge about the structure of microcontroller hardware, memory, assembly instructions, commands C.	Week 4	Online	G1.1, G1.2 G2.1, G3.1 G3.2	5%
Quiz02	The overview knowledge peripherals, single LED, 7-segment LED, LCD, buttons, English terminology.	Week 8	Online	G1.1, G1.2 G2.1, G3.1 G3.2	5%
Quiz03	The overview ADC knowledge, interrupt, timer / counter, the English term.	Week 12	Online	G1.1, G1.2 G2.1, G3.1 G3.2	5%
Final exam					**50**
Final Exam	- The exam covers all contents related to the expected learning outcomes of the course.		Individual paper assessment in class	G3.1, G3.2 G4.1, G4.2	

11. Course details:

Weeks	Contents	CLOs
1	***Chapter 1:*** **<PIC16F887 MICROCONTROLLER: DEVICE OVERVIEW>** *(3/0/6)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 1.1. Introduction. 1.2. An overview of microcontrollers of Microchip. 1.3. Exercise examples. **Teaching methods**: + Theoretical lectures; Questions.	G1.1 G2.1
	B/ **Self-study contents**: *(6)* + Quiz. + Reading IC's datasheet.	

2	***Chapter 2:*** **<PIC16F887 MICROCONTROLLER: MEMORY ORGANIZATION>** *(3/0/6)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 2.1. Introduction. 2.2. Memory architecture. 2.3. Organization of memory of PIC microcontroller 16F887. 2.4. Exercise examples. **Teaching methods**: + Theoretical lectures; Question.	G1.1
	B/ **Self-study contents**: *(6)* + Answer quiz. + Reading IC's datasheet.	
3	***Chapter 3:*** **<PIC16F887 MICROCONTROLLER: ASSEMBLY INSTRUCTIONS>***(3/0/6)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 3.1. Introduction. 3.2. Assembly language. 3.3. Assembly instructions of PIC16F887 microcontroller. 3.4. Exercise examples. **Teaching methods**: + Theoretical lectures; Question.	G1.2
	B/ **Self-study contents**: *(6)* + Answer quiz.	
4	***Chapter 4:*** **< PIC16F887 MICROCONTROLLER: THE BASICS OF C PROGRAMMING LANGUAGE>** *(3/0/6)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 4.1 Introduction. 4.2 The basic elements of the programming language C. 4.3 C compiler, libraries. 4.4 Exercise examples. **Teaching methods**: + Theoretical lectures; Question.	G1.2
	B/ **Self-study contents**: *(6)* + Answer quiz. + Exercises.	
	Chapter 5: **< PIC16F887 MICROCONTROLLER: PERIPHERAL CONNECTIONS>** *(9/0/18)*	

5, 6, 7	***A/* Contents and teaching methods***: (9)* **Contents:** 5.1 Introduction. 5.2 Functions of the microcontroller ports. 5.3 The 16F887 PIC microcontroller port. 5.4 Input/output port command of CCS-C language. 5.5 The special configuration of the PIC16F887. 5.6 LED applications. 5.7 7-segment LED applications. 5.8 Multiplexer 7-segment LED applications. 5.9 Push button, key matrix applications. 5.10 LCD applications. 5.11 Exercise examples. **Teaching methods**: + Theoretical lectures; Question.	G1.1 G1.2 G3.1 G3.2 G4.1 G4.2 G4.3
	***B/* Self-study contents**: *(18)* + Quiz, homework. + Exercises.	
8, 9	***Chapter 6:* <PIC16F887 MICROCONTROLLER: TIMER/COUNTER>** *(6/0/12)*	
	A/* Contents and teaching methods: (6)* **Contents:** 6.1 Introduction. 6.2 Timer TMR0. 6.3 Timer TMR1. 6.4 Timer TMR2. 6.5 Instructions of Timer/Counter in CCS-C language. 6.6 Timer applications. 6.7 Counter applications. 6.8 Exercise examples. **Teaching methods**: + Theoretical lectures; Question.	G1.1 G1.2 G3.1 G3.2 G4.1 G4.2 G4.3
	***B/* Self-study contents**: *(12)* + Quiz, homework. + Exercises.	
10	***Chapter 7:* <PIC16F887 MICROCONTROLLER: ANALOG TO DIGITAL CONVERTER – ADC>** *(3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** 7.1 Introduction. 7.2 Overview ADC of PIC16F887 microcontroller.	G1.1 G1.2 G3.1 G3.2

	7.3 Instructions of ADC in CCS-C language. 7.4 ADC applications. 7.5 Exercise examples. **Teaching methods**: + Theoretical lectures; Question.	G4.1 G4.2 G4.3
	B/* Self-study contents**: *(6)* + Quiz, homework. + Exercises**.** + ***Exam midterm.	
11, 12	***Chapter 8:* <PIC16F887 MICROCONTROLLER: INTERRUPT>** *(6/0/12)*	
	A/* Contents and teaching methods: (6)* **Contents:** 8.1 Introduction. 8.2 Overview interrupt of PIC16F887 microcontroller. 8.3 Interrupts of PIC16F887 microcontroller. 8.4 Instructions of interrupts in CCS-C language. 8.5 Interrupt applications. 8.6 Exercise examples. **Teaching methods**: + Theoretical lectures; Question	G1.1 G1.2 G3.1 G3.2 G4.1 G4.2 G4.3
	***B/* Self-study contents**: *(12)* + Quiz, homework. + Exercises.	
13	***Chapter 9:* <PIC16F887 MICROCONTROLLER: PULSE WIDTH MODULATION – PWM>** *(3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** 9.1 Introduction. 9.2 Overview PWM. 9.3 Overview Enhanced PWM. 9.4 Instructions of PWM in CCS-C language. 9.5 PWM applications. 9.6 Exercise examples. **Teaching methods**: + Theoretical lectures; Question.	G1.1 G1.2 G3.1 G3.2 G3.3 G4.1 G4.2 G4.3
	***B/* Self-study contents**: *(6)* + Quiz, homework. + Exercises.	
	***Chapter 10:* <PIC16F887 MICROCONTROLLER: SERIAL COMMUNICATION – UART>** *(3/0/6)*	

14, 15	***A/* Contents and teaching methods***: (3)* **Contents:** 10.1 Introduction. 10.2 An overview of the types of data transmission. 10.3 Communications synchronous serial data and asynchronous. 10.4 Serial communication EUART of PIC16F887. 10.5 Instructions of EUART in CCS-C language. 10.6 EUART applications. 10.7 Serial communication I2C, SPI of PIC16F887. 10.8 I2C, SPI applications. 10.9 Exercise examples. **Teaching methods**: + Theoretical lectures; Question.	G1.1 G1.2 G3.1 G3.2 G3.3 G4.1 G4.2 G4.3
	***B/* Self-study contents**: *(6)* + Quiz, homework. + Exercises.	

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: August 01 2012

14. Approval level:

Dean	Department	Instructor
Assoc. Prof. PhD. **Nguyen Minh Tam**	**Assoc. Prof. PhD.** **Nguyen Thanh Hai**	**M.Eng. Nguyen Dinh Phu**

15. Syllabus updated process

1st time: Updated content dated: **August 01 2012**	Instructors
2st time: Updated content dated	Head of department