SYLLABUS

1. **Course name: Advanced Microprocessor**
2. **Course code: ADMI 320763**
3. **Credits:** 3 (3/0/6)

   Duration: 15 weeks (45h main course and 90h self-study)
4. **Instructors:**

   1- Nguyen Dinh Phu, MEng
   2- Nguyen Thanh Bình, MEng
   3- Truong Ngoc Anh, MEng
   4- Phan Van Hoan, PhD
5. **Course conditions**

   Prerequisites: Microprocessor.
   Corequisites: Microprocessor, Digital Systems.
6. **Course description**

This course provides students the knowledge of the 32 bit ARM Cortex. Students will learn the structure and operation of ARN Cortex's peripherals from basic to advanced, so they can design the hardware and program the software the systems using ARM Cortex.

7. **Course Goals**

Goals	***Goal description*** *(This course provides students:)*	**ELOs**
G1	Basic knowledge of 32 bit ARM Cortex. 1237,10,11	01 (H)
G2	An ability to calculate, design and control the systems using ARM Cortex.	02 (M) 10 (L)
G3	An ability to apply written, oral, graphical communication for skills.	03 (M)
G4	An ability to use textbooks, books, powerpoint slides and to do homeworks and design systems with hardwares and codes using materials in English.	11 (H)
G5	An ability to use tools and methods for solving problems related to ARM Cortex systems.	07 (M)

** 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**	The ability to analyze the 32 bit ARM Cortex structure.	01

	G 1.2	The ability to control the intergated peripherals in 32 bit ARM Cortex.	01
G2	**G2.1**	The ability to calculate and design the systems using ARM Cortex.	02, 10 07
	G2.2	The ability to control the ARM Cortex systems.	02 07
	G2.3	The ability to analyze and solve the problems in ARM Cortex systems.	02 07
G3	**G3.1**	The ability to apply written for skills.	03, 07
	G3.2	The ability to apply oral, graphical communication for skills.	03
G4	**G4.1**	The ability to use textbooks, books, powerpoint slides and to do homeworks and design design systems with hardware and codes using English.	11
G5	**G5.1**	An ability to use tools and methods for solving problems related to ARM Cortex systems.	07

9. Study materials

- Textbooks:

[1] Phan Van Hoan, *Bai giang vi xu ly nang cao*, Dai hoc Su pham Ky thuat TP.HCM, 2014.

- References:

[1] Solomon Systech, Datasheet SSD1298, 2008.

[2] ST Microcontroler, Datasheet STM32F10xx, 2009.

[3] VLSI Solution, Datasheet VS1003, 2012.

10. Sudent Assessments

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

Type	Contents	Linetime	Assessment techniques	CLOs	Rates (%)
Midterms					**50**
Exam01	Design applications base on some peripherals learned.	Weeks 10	Individual paper assessment in class	G1.1, G1.2, G4.1	10
Project01	Research and control some of following peripherals: TFT LCD, Touch Panel, SD Card…	week 5	Presentation, Q&A	G1.1, G1.2, G2.1, G2.2, G2.3, G3.1, G3.2, G4.1, G5.1	20
Homework01	Watch video clip on digital learning website then record a similar one and send it back to the lecturer every	Week 3 to 14	Record video clip at home	G1.1, G1.2, G2.1, G2.2, G2.3, G3.2	20

	week.				
Final Project					**50**
Final Project	Design a real system using ARM Cortex including some of following peripherals: USB, UART, SPI, I2C, TFT, SD card, CAN, LAN, Flash,VS1003…	week 6 to 15	Presentation, Q&A	G1.1, G1.2, G2.1, G2.2, G2.3, G3.1, G3.2, G4.1, G5.1	

11. Course details:

Weeks	Contents	CLOs
1	***Chapter 1:*** **<ARM OVERVIEW>** *(3/0/6)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 1.1 ARM overview. 1.2 History of ARM. 1.3 ARM's architecture. 1.4 ARM Cortex overview. 1.5 ARM Cortex M3 overview. 1.6 Unaligned data accesses. 1.7 Thumb-2 intructions. 1.8 3-stage pipeline. **Teaching methods**: + Traditional lectures using powerpoint to review basic knowledges of steel structures course, to demonstrate large applications of these structures in different buidings. A series of diagnostic questions will be also used to estimate students knowledges. + Questions.	G1.1
	B/ **Self-study contents**: *(6)* + Review the lesson on class. + Find out some different microcontroler's architectures. + Compare architectures found. + Prepare the lesson "**ARM STM32F1x Family**".	G1.1, G4.1
2	***Chapter 2:*** **<ARM STM32F1x FAMILY>** *(3/0/6)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 2.1 ST Microcontroler's ARM. 2.2 ARM STM32F1x overview. 2.3 STM32F1x's architecture.	G1.1

	2.4 Memory organization. 2.5 Bit Band. 2.6 Boot configuration. 2.7 Power supplies. 2.8 Low-power modes. **Teaching methods**: + Theoretical lectures. + Questions.	
	***B/* Self-study contents**: *(6)* + Review the lesson on class. + Compare all Low-power modes. + Prepare the lesson "**Reset, Clock Control**".	G1.1, G4.1
3	***Chapter 3:* <RESET, CLOCK CONTROL>** *(3/0/6)*	
	A/* Contents and teaching methods:(3)* **Contents:** 3.1 STM32F1x's reset. 3.2 STM32F1x's clock. 3.3 Program on the real board to check the theory. **Teaching methods**: + Theoretical lectures. + Practice on real board. + Questions.	G1.1, G1.2 G2.1, G2.2, G2.3, G4.1 G5.1
	***B/* Self- study contents**: *(6)* + Review the lesson on class. + Watch video clip on digital learning website then record a similar one. + Take note problems while recording to ask the lecturer. + Prepare the lesson "**GPIO and AFIO**".	G1.1, G1.2 G2.1, G2.2, G2.3, G4.1 G5.1
4	***Chapter 4:* < GPIO AND AFIO >** *(3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** 4.1 GPIO overivew. 4.2 Basic structrure of a standard I/O port. 4.3 GPIO registers and intructions. 4.4 AFIO. 4.5 GPIO and AFIO examples. 4.6 Program on the real board to check the theory. **Teaching methods**: + Theoretical lectures; Practice on real board. + Questions.	G1.1, G1.2 G2.1, G2.2, G2.3, G4.1 G5.1
	***B/* Self- study contents**: *(6)*	G1.1, G1.2,

	+ Review the lesson on class. + Record a video clip about GPIO and AFIO. + Take note problems while recording to ask the lecturer. + Prepare for the project 1.	G2.1, G2.2, G2.3, G4.1, G5.1
5	**<PROJECT 1>** ***(3/0/6)***	
	A/* Contents and teaching methods: (3)* **Contents:** **Student present:** + System performance. + All research results by powerpoint slide. **Lecturer:** + Give the questions. + Finger out the wrong results.	G1.1, G1.2, G2.1, G2.2, G2.3, G3.1, G3.2, G4.1, G5.1
	***B/* Self- study contents**: *(6)* + Repair all wrong results. + Prepare the lesson "**Interrupt and event**".	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1
6	***Chapter 5:* <Interrupt and Event>** *(3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** 5.1 NVIC's overview. 5.2 Interrupt priority. 5.3 Steps to use interrupt. 5.4 NVIC's instructions. 5.5 NVIC examples. 5.6 External interrupt. 5.7 Program on the real board to check the theory. **Teaching methods**: + Theoretical lectures; Practice on real board. + Questions.	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1
	***B/* Self- study contents**: *(6)* + Review the lesson on class. + Record interrupt and event video clip. + Take note problems while recording to ask the lecturer. + Prepare the lesson "**Direct Memory Access**".	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1
7	***Chapter 6:* < Direct Memory Access -*DMA*>** *(3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** 6.1 DMA Introduction. 6.2 DMA's main functions. 6.3 DMA and some related peripherals.	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1

	6.4 DMA's instructions. 6.5 DMA examples. 6.6 Program on the real board to check the theory. **Teaching methods**: + Theoretical lectures. + Practice on real board. + Questions.	
	***B/* Self- study contents**: *(6)* + Review the lesson on class. + Record DMA video clip. + Take note problems while recording to ask the lecturer. + Prepare the lesson "**ADC**".	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1
8	***Chapter 7:* < ADC >** *(6/0/12)*	
	A/* Contents and teaching methods: (3)* **Contents:** 7.1 ADC introduction. 7.2 ADC's main features. 7.3 ADC block diagram. 7.4 ADC's calibration. 7.5 Data alignment. 7.6 Single conversion mode. 7.7 Continuous conversion mode. 7.8 ADC's instructions. 7.9 ADC examples. 7.10 Program on the real board to check the theory. **Teaching methods**: + Theoretical lectures; Practice on real board. + Questions.	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1
	***B/* Self- study contents**: *(6)* + Review the lesson on class. + Record ADC video clip. + Take note problems while recording to ask the lecturer. + Prepare the lesson "**ADC cont**".	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1
9	***Chapter 7:* < ADC (cont.)>** *(6/0/12)*	
	A/* Contents and teaching methods: (3)* **Contents:** 7.11 Analog watchdog. 7.12 Scan conversion mode. 7.13 Trigger injected mode. 7.14 Auto injected mode. 7.15 Discontinuous mode.	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1

	7.16 Dual ADC mode. 7.17 Internal temperature sensor. 7.18 Program on the real board to check the theory. **Teaching methods**: + Theoretical lectures; Practice on real board. + Questions.	
	***B/* Self- study contents**: *(6)* + Review the lesson on class. + Record ADC video clip. + Take note problems while recording to ask the lecturer. + Prepare for the test.	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1
10	**< TEST 1>** *(3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** + Student design applications base on some peripherals learned. + Lecturer repair the test. **Teaching methods**: + Questions and answers. + Discuss to solve problems.	G1.1, G1.2, G2.1, G2.2
	***B/* Self- study contents**: *(6)* + Record video clip solving the requirements on the test. + Prepare the lesson "**TIMER**".	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1
11	***Chapter 8:* < Timer >** *(6/0/12)*	
	A/* Contents and teaching methods: (3)* **Contents:** 8.1 Timer introduction. 8.2 Timer's main features. 8.3 Timer1 and timer8 block diagram. 8.4 Timer's prescaler. 8.5 Upcounting, downcounting and center aligned mode. 8.6 Program on the real board to check the theory. **Teaching methods**: + Theoretical lectures; Practice on real board. + Questions.	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1
	***B/* Self- study contents**: *(6)* + Review the lesson on class. + Record Timer video clip. + Take note problems while recording to ask the lecturer. + Prepare the lesson "**Timer (cont)**".	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1

12	***Chapter 8:*** **< Timer (cont)>** *(6/0/12)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 8.7 Input capture mode. 8.8 PWM input mode. 8.9 Output compare mode. 8.10 PWM mode. 8.11 Complementary outputs and dead-time insertion. 8.12 One pulse mode. 8.13 Encoder interface mode. 8.14 Slave mode. 8.15 Slave mode's instructions. 8.16 Program on the real board to check the theory. **Teaching methods**: + Theoretical lectures; Practice on real board. + Questions.	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1
	B/ **Self- study contents**: *(6)* + Review the lesson on class. + Record Timer video clip. + Take note problems while recording to ask the lecturer. + Prepare the lesson "**FSMC**".	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1
13	***Chapter 9:*** **< FSMC >** *(3/0/6)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 9.1 FSMC's main features. 9.2 FSMC block diagram. 9.3 Memory organization. 9.4 Interfacing with NOR Flash. 9.5 Interfacing with SRAM. 9.6 Interfacing with NAND Flash. **Teaching methods**: + Theoretical lectures. + Questions.	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1
	B/ **Self- study contents**: *(6)* + Review all learned lessons.	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1
14	**< Review >** *(3/0/6)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** + Review contents.	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1,

	+ Exercises. **Teaching methods**: + Questions and answers. + Instructing to do exercises.	G5.1
	***B/* Self- study contents**: *(6)* + Record video clip correcting the exercises on class. + Prepare for the final project.	G1.1, G1.2, G2.1, G2.2, G2.3, G4.1, G5.1
15	**< Final Project>** *(3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** **Student present:** + System performance. + All research results by powerpoint slide. **Lecturer:** + Give the questions. + Finger out the wrong results.	G1.1, G1.2, G2.1, G2.2, G2.3, G3.1, G3.2, G4.1, G5.1
	***B/* Self- study contents**: *(6)* + Repair all wrong results.	G1.1, G1.2, G2.1, G2.2, G2.3, G3.1, G3.2, G4.1, G5.1

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**

15. Syllabus updated process

1st time: Updated content dated	Instructors
2st time: Updated content dated	Head of department
