HCMC UNIVERSITY OF TECHNOLOGY AND EDUCATION
Faculty of Electrical And Electronic Engineering
Department of Industrial Electronics

ELECTRONICS AND COMMUNICATION
ENGINEERING TECHNOLOGY
Level: Undergraduate

SYLLABUS

1. Course name: Radio Frequency Identification Technology

2. Course code: RFID321363

3. Credits: 3 (3/0/4)

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

4. Instructors:

> 1/ Nguyen Van Hiep, MEng
> 2/ Truong Ngoc Anh, MEng

5. Course conditions

> Prerequisites: Basic electronics
> Corequisites: Microprocessor, Digital Systems

6. Course Description

This course provides students the knowledge of the radio frequency identification technology. In addition, students will learn the structure, operation, proticol of the components of RFID systems: tag, reader, middleware, ... Introduce students to the advantages, limitations, development future, the standards of the RFID technology. This course discusses examples of both prevalent and emerging applications, to give students an idea of the application potential of the technology as item tracking and tracing, inventory monitoring and control, asset monitoring and management, anti-theft, electronic payment, access control, anti-counterfeit, smart tags. Instructions on how to plan, design and implement a solution using RFID technology.

7. Course Goals

Goals	Goal description (This course provides students:)	EPOs
G1	An ability to Basic knowledge of the radio frequency identification technology.	01 (H)
G2	An ability to analyze, explain and resolve technical problems related to RFID technology for skills.	02 (M) 03 (H)
G3	An ability to do teamwork, communication and presentation to the crowd, write reports and representation	07 (M)
G4	An ability to forming, planning, deployment, operation, and evaluation systems using RFID technology and complete real models realated to ECET	10 (L) 11 (H)

* 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 apply the operating principle of RFID systems, the operation of each component of the RFID system.	01 02
G2	G2.1	The ability to apply the two fundamentally different design approaches for delivering power from reader to tag: magnetic induction and electromagnetic wave capture.	01
	G2.2	The ability to present the operating principle of active tags, passive tags, semi-active tags, stationary readers, handheld readers.	01
	G2.3	The ability to search for documents, research the problems of RFID technology.	02
	G2.4	The ability to valuate strengths and weaknesses of RFID systems with existing technology when applied.	02
G3	G3.1	The ability to work in groups to discuss and resolve the problems related to the RFID technology. Capable of presenting a scientific matter with Powerpoint slides for skills.	03
G4	G4.2	The ability to plan, design and implement an RFID Solution with skills.	10, 03
	G4.3	The ability to choose suitable solutions for the enterprise to deploy based on RFID solutions is being offered in the market. The ability to operate, inspect and evaluate the system after deployment.	11

9. Study materials

- Textbooks:

[1] Nguyen Van Hiep, *Cong nghe nhan dang doi tuong bang song vo tuyen*, NXB Dai hoc quoc gia 2014.

- References:

[1] Sandip Lahiri, *RFID Sourcebook*, Prentice Hall PTR 2005.

[2] Himanshu Bhatt, Bill Glover, *RFID Essentials*, O'Reilly 2006.

[3] Klaus Finkenzeller, *RFID Handbook*, John Wiley & Sons 2003

10. Sudent Assessments

- Grading points: 10

- Planning for students assessment is followed:

Type	Contents	Linetime	Assessment techniques	CLOs	Rates (%)
Midterms					**50**
Exam01	Create a clip introduce to RFID technology.	Week 5	Individual clip via LMS	G1.1 G2.1	10
Exam02	The knowledge of RFID technology.	Week 7	Quizes	G1.1 G2.2 G2.3	20
Exam03	Designing and implementation RFID application circuits used MFRC522.	Weeks 7-10	Individual board assessment at home	G2.4 G4.2 G4.3	20

Final report					50
Final report	Students work topics related RFID Technology	Week 11-15	Reports, presentations to the class	G3.1, G1.1 G2.1, G2.2 G2.3, G2.4 G4.2	

11. Course details:

Weeks	Contents	CLOs
1	**Chapter 1: <OVERVIEW OF RFID TECHNOLOGY>** *(3/0/6)*	

	A/ **Contents and teaching methods:** *(3)*
	 Contents:
	      1.1 Fundamental Concepts
	      1.2 RFID System
	        - Tag
	        - Reader
	        - Reader antenna
	        - Controller
	        - Sensor, actuator, and annunciator…
	 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.
	 + Playback clips about RFID technology.
	 + Questions
		G1.1 G2.1

	B/ **Self-study contents**: *(6)* - Host and software system - Communication infrastructure.	G1.1 G2.2 G2.3
2	**Chapter 2: <PRINCIPLES OF RADIO FREQUENCY IDENTIFICATION>** *(3/0/6)*	

	A/ **Contents and teaching methods**: *(3)*
	 Contents:
	      2.1 Near-Field-Based RFID Design
	      2.2 Far-Field-based RFID Design
	      2.3 Properties of Backscatter RF System
	      2.4 Modulation Techniques Used with RFID
	 Teaching methods:
	 + Theoretical lectures
	 + Questions
	 + Discussion groups
		G2.3 G2.4

	B/ **Self-study contents**: *(6)*	G2.2

	2.5 Properties of Magnetic Fields 2.6 Comparison of the Properties of RFID Based on Frequency	
3	**Chapter 3: <RFID TAG>** *(3/0/6)*	

	A/ **Contents and teaching methods***:(3)*
	Contents:
	3.1 Tag Protocols
	- Protocol Terms and Concepts
	- How Tags Store Data
	- Singulation and Anti-Collision Procedures
	Teaching methods:
	  + Theoretical lectures
	  + Questions.
	  + Discussion groups
		G1.1
		G3.1

	B/ **Self-study contents:** *(6)*
	  - Tag Features for Security and Privacy
	  - Learn to Troubleshoot Tag Communications
		G2.2
		G3.1

4	**Chapter 3: <RFID TAG (cont.)>** *(3/0/6)*	

	A/ **Contents and teaching methods***:(3)*
	Contents:
	3.2 Mifare Tags
	  - Features
	  - Tag Memory
	  - How to read, write to tag data.
	  - Encode using Key A, KeyB
	Teaching methods:
	  - Theoretical lectures
	  - Questions.
	  - Discussion groups
		G2.1
		
		G2.2

	B/ **Self-study contents:** *(6)* - Research to read/write data of RFID tags using smartphone. - Research to read/write data of RFID tags using microcontroller.	G3.1 G2.3
5	**Chapter 4: <RFID READER>** *(3/0/6)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 4.1 Parts of a Reader Protocol 4.3 EPCglobal Protocol Overview **Teaching methods**: + Theoretical lectures + Questions. + Discussion groups	G1.1 G2.2

	***B/* Self-study contents**: *(6)* 4.2 Vendor Protocols 4.4 Future Protocols	G2.3
6	***Chapter 4: <RFID READER (cont.)>*** *(3/0/6)*	

	***A/* Contents and teaching methods**: *(3)*
	Contents:
	4.3 Introduction to the popular Reader on market
	    - Features
	    - Operation.
	    - Applications
	4.4 Introduction to MFRC522 module
	    - Features
	    - Operation
	    - Interface
	    - Using with CCS for Pic16F887, Ardunio UNO R3.
	Teaching methods:
	+ Theoretical lectures
	+ Questions.
	+ Discussion groups
		G1.1
		G2.2
		
		G2.3

	***B/* Self-study contents**: *(6)* Coding controls three leds using RC522 module.	G4.3
7	***Chapter 5: <NFC TECHNOLOGY>*** *(3/0/6)*	
	***A/* Contents and teaching methods**: *(3)* **Contents:** 5.1 Technology overview 5.2 Development History 5.3 Features of NFC technology 5.4 Applications **Teaching methods**: + Theoretical lectures + Questions. + Discussion groups	G1.1 G2.2
	***B/* Self-study contents** *(6)* - Compare RFID with NFC - Compare NFC with Bluetooth.	G2.3 G3.1
8	***Chapter 6: <ADVANTAGES AND LIMITATIONS OF THE RFID TECHNOLOGY>*** *(3/0/6)*	
	***A/* Contents and teaching methods**: *(3)* **Contents:** 6.1 Advantages of the RFID Technology	G2.2

	6.2 Limitations of the RFID Technology **Teaching methods**: + Theoretical lectures + Questions. + Discussion groups	G3.1
	B/ Self-study contents *(6)* - Corresponding each advantage of RFID technology, students find an application. - Students find out how fix the limitations of RFID technology when applied in practical cases.	G3.1
9	*Chapter 7: <APPLICATION AREAS> (3/0/6)*	
	A/ **Contents and teaching methods**: *(3)* **Contents:** 7.1 Prevalent Application Types - Item tracking and tracing - Inventory monitoring and control - Asset monitoring and management - Anti-theft - Electronic payment - Access control **Teaching methods**: + Theoretical lectures + Questions. + Discussion groups	G2.2
	B/ **Self-study contents** *(6)* Students find or record the videos about the popular applications of RFID technology.	G2.3
10	*Chapter 7: <APPLICATION AREAS (cont.)> (3/0/6)*	
	A/ **Contents and teaching methods**: *(3)* **Contents:** 7.2 Emerging Application Types - Anti-counterfeit - Smart tags **Teaching methods**: + Theoretical lectures + Questions. + Discussion groups	G1.1 G2.2
	B/ **Self-study contents** *(6)* Students research five systems that apply RFID technology in Vietnam.	G3.1
11	*Chapter 8: <RFID VERSUS BAR CODE> (3/0/6)*	

	A/ **Contents and teaching methods**: *(3)* **Contents:** 8.1 What is a bar code? 8.2 Advantages of bar codes over RFID 8.3 Advantages of RFID over bar codes **Teaching methods**: + Theoretical lectures + Questions. + Discussion groups	G2.2 G3.1
	B/ **Self-study contents** *(6)* 8.4 Disadvantages of RFID and Bar Codes 8.5 RFID will replace bar codes soon?	G2.1 G1.1
12	*Chapter 9:* **<DESIGNING AND IMPLEMENTING AN RFID SOLUTION>** *(3/0/6)*	
	A/ **Contents and teaching methods**: *(3)* **Contents:** 9.1 System Architecture 9.2 Technical Variables 9.3 Implementation Notes **Teaching methods**: + Theoretical lectures + Questions. + Discussion groups	G3.1 G4.2 G4.3
	B/ **Self-study contents** *(6)* Standards of RFID technology.	G1.1 G3.1
13 -15	**<ESSAY ACCEPTANCE REPORT OF THE GROUPS>**	G2.2 G4.2 G3.1

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