Course Specification

Name of Institution	Mahidol University
Campus/faculty/department	Salaya campus Mahidol University International College Science Division

Section 1 General Information

1. Course Code and course title

(Thai)	EGCI 332	ระบบฝังตัว
(English)	EGCI 332	Embedded Systems

2. Number of Credits 4(4-0-8) (Lecture/Lab/Self-study)

3. Curriculum and type of subject

3.1 Curriculum Bachelor of Engineering (Computer Engineering)

3.2 Type of subject Required course

4. Responsible faculty member

Assoc. Prof. Dr. Chatchai Neatpisarnvanit

5. Trimester / year of study

5.1 Trimester 3rd / year of study 2nd year

5.2 Number of students 5-30 students

6. **Pre-requisite(s)** EGCI 202

7. Co-requisite(s) none

8. Venue of study Mahidol University, Salaya campus

9. Date of latest revision December 2011

Section 2 Goals and Objectives

1. Goal

1. Students can explain the principles of embedded systems
2. Students can design embedded systems suitable for industrial applications
3. Students can design and write programs using high-level languages

2. Objective of development revision

To up-date the knowledge content of the course

Section 3 Course Management

1. Course Description

(Thai) กระบวนการออกแบบและพัฒนาระบบฝังตัว ระบบฝังตัวแบบพกพาได้และทำงานด้วยแบตเตอรี่ การโปรแกรมภาษาระดับสูงสำหรับระบบฝังตัว ระบบปฏิบัติการเวลาจริง การต่อประสานกับอุปกรณ์ต่อพ่วงขั้นสูง ตัวแปลงดีเอซีและเอดีซี เซ็นเซอร์และตัวปรับสภาพสัญญาณ

(English) Embedded system design and development process; portable battery operated embedded systems; high-level language programming for embedded system applications; real-time operating system; advanced peripheral interfacing; DAC and ADC converters; Sensors and signal conditioners.

2. Credit hours / trimester

Lecture (hours)	Additional Class (hours)	Laboratory/field trip/internship (hours)	Self-study (hours)
44 hours (4 hours x 11 weeks)	-	-	88 hours (8 hours x 11 weeks)

3. Numbers of hours that the lecturer provides individual counseling and guidance

1 hour/week

Section 4 Development of Students' Learning Outcome

1. Expected outcome on students' skill and knowledge

Student will be able to apply the knowledge from lecturer and additional research with the ideas received from analysis and synthesis to set up solutions / precautions to benefit individuals and their community.

2. Teaching Methods

- Lecture
- Self-study
- Programming exercises.

3. Evaluation methods

1. Morality and Ethics

1.1 ***Expected outcome on morality and ethics:***

1.1.1 To be aware of values and morality, ethics, scarification and honesty.

● 1.1.2 To process self-discipline, punctuality, self-responsibility, and social responsibility.

1.1.3 To process leadership and supporter skills and be able to work in a team with integrity and cooperation.

1.1.4 To demonstrate good listening behavior and have respect for the rights and value of others.

○ 1.1.5 To pay respect to the rule of organization and social.

1.1.6 To demonstrate the ability to analyze ethical impacts of computer usage to personals, organizations and social.

● 1.1.7 To demonstrate the ability to analyze ethical impacts of computer usage to personals, organizations and social.

1.2 ***Teaching methods:***

Learning Centered Education: Emphasis on knowledge development, important skills in career development and living, encourage students to use their full potentials

1.2.1 Case studies, emphasizing on morality and ethics

1.2.2 Self-study

1.3 ***Evaluation methods:***

1.3.1 Class attendance, class participation, and behavior in class

1.3.2 On-time submission of reports and assignments, and their quality

2. Knowledge development

2.1 *Expected outcome on knowledge development:*

- 2.1.1 To process the knowledge related to principles, theories, and practice in the course.
- 2.1.2 To be able to analyze, understand, and explain the computer requirements and be able to apply knowledge and skills using the appropriate tools to solve a problem.
- 2.1.3 To be able to analyze, design and install, and/or evaluate computer components to meet the requirements of the users
- 2.1.4 To have the ability to remain current in research, and pursue new knowledge and perform ability to apply the knowledge.
- 2.1.5 To know, understand and perform eagerness to develop computer knowledge and skills continuously.
- 2.1.6 To have a breadth knowledge in order to oversee the changes and understand the impact of new technology.
- 2.1.7 To have a hand-on experience in software development and/or software applications.
- 2.1.8 To demonstrate knowledge integration with other related sciences.

2.2 *Teaching methods:*

Learning Centered Education: Emphasis on knowledge development, important skills in career development and living, encourage students to use their full potentials

2.2.1 Lecture and in-class participation
2.2.2 Demonstration of example programs
2.2.3 Case studies with past experiences and current events
2.2.4 Self study

2.3 *Evaluation methods:*

2.3.1 Written examination
2.3.2 Quality of reports and assignments

3. Intellectual development

3.1 *Expected outcome on intellectual development:*

- 3.1.1 To have discretionary and systematic thinking skill.
- 3.1.2 To have the ability to search, consolidate and evaluate ideas and evidence for problem solving.

- ○ 3.1.3 To be able to apply knowledge and experience to analyze and creatively solve problems both in general and in academic contexts.
- ● 3.1.4 To be able to apply knowledge and experience to synthesize solution and precautions.

3.2 ***Teaching method:***

3.2.1 Systematic problem solving through case studies
3.2.2 Self study

3.3 ***Evaluation methods:***

3.3.1 Written examination
3.3.2 Quality of reports and assignments

4. Interpersonal relationship and responsibility

4.1 ***Expected outcome on interpersonal relationship and responsibility:***

- ○ 4.1.1 To perform good communication skills with various groups of people.
- 4.1.2 To be a constructive team member (in various roles).
- 4.1.3 To process the knowledge of the course to identify social problems.
- ● 4.1.4 To demonstrate self and team responsibility.
- 4.1.5 To have initiative in problem solving.
- 4.1.6 To take responsibility in a life-long learning.

4.2 ***Teaching methods:***

4.2.1 Group assignments and group discussion
4.2.2 Self study

4.3 ***Evaluation methods:***

4.3.1 Presentation
4.3.2 Class attendance, class participation, and behavior in class
4.3.3 On-time submission of reports and assignments, and their quality

5. Mathematical analytical thinking, communication skills and information technology skills

5.1 ***Expected outcome on mathematical analytical thinking, communication skills and information technology skills:***

- ● 5.1.1 To be able to select and apply existing tools for computer related work.

5.1.2 To possess the ability to apply information technology for data gathering, processing, interpreting and presenting information/results.

5.1.3 To have the ability to communicate effectively and select appropriate methods for presentation.

5.1.4 To use information technology appropriately.

5.2 ***Teaching methods:***

5.2.1 Demonstration of program development tools

5.2.2 Case studies with past experiences and current events

5.3 ***Evaluation methods:***

5.3.1 Quality of reports and assignments

Section 5 Teaching and Evaluation Plans

1. Teaching plan

Week	Topics	Hours			Teaching methods/ multimedia	Instructor
		Lecture	Lab	Self-Study		
1	Introduction to embedded systems	4	0	8	Lecture, case studies, discussion, self study	Assoc. Prof. Dr. Chatchai Neatpisarnvanit
2	Embedded system design and development process	4	0	8	Lecture, case studies, homework assignment, self study	
3	Printed circuit board	4	0	8	Lecture, case studies, homework assignment, self study	
4	C language programming for embedded systems	4	0	8	Lecture, case studies, homework assignment, self study	
5-6	Real-time operating system (RTX-51)	8	0	16	Lecture, case studies, homework assignment, self study	

Week	Topics	Hours			Teaching methods/ multimedia	Instructor
		Lecture	Lab	Self-Study		
	Midterm Examination					
7	DAC and ADC converters	8	0	16	Lecture, case studies, homework assignment, self study	
8	Sensors and signal conditioners	8	0	16	Lecture, case studies, homework assignment, self study	
9	Portable battery operated embedded systems	8	0	16	Lecture, case studies, homework assignment, self study	
10	Advanced peripheral interfacing (graphical liquid crystal display)	8	0	16	Lecture, case studies, homework assignment, self study	
11	Review and conclusion	8	0	16	Lecture, case studies, student presentation, self study	
12	**Final Examination**					
	Total	**44**	**0**	**88**		

2. Evaluation Plan

Expected outcomes	Methods / activities	Week	Percentage
1.1.2, 1.1.5, 4.1.1, 4.1.4	Attendance and in class behavior	1-11	5%
2.1.1, 2.1.2, 2.1.3, 3.1.1, 3.1.4	Midterm Examination Final examination	6 12	35% 35%
1.1.7, 2.1.2, 2.1.7, 3.1.4, 5.1.1	Homework assignment	2-10	15%
1.1.7, 2.1.2, 2.1.3, 2.1.5, 2.1.6, 2.1.7, 3.1.3, 3.1.4, 4.1.4, 5.1.1	Project	11	10%

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Section 6 Teaching Materials and Resources

1. Texts and main documents

Kai Qian, David den Haring, and Li Cao, Embedded Software Development with C, Springer, 2009.

Michael J. Pont, Patterns for Time-triggered Embedded Systems, Pearson, 2008.

John Catsoulis, Designing Embedded Hardware, O'Rielly, May 2005.

2. Documents and important information

None

3. Documents and recommended information

None

Section 7 Evaluation and Improvement of Course Management

1. Strategies for effective course evaluation by students

1.1 Evaluation of peers by students
1.2 Student evaluation
  1.2.1 Course content
  1.2.2 Course management
  1.2.3 Suggestions
  1.2.4 Overall opinion

2. Evaluation strategies in teaching methods

2.1 Student evaluation
2.2 Presentation

3. Improvement of teaching methods

Workshop on course improvement with the participation of all instructors in the course

4. Evaluation of students' learning outcome

Analysis of students' learning outcomes using scores from class attendance, group activity and presentation of project and poster presentation

5. Review and improvement for better outcome

Review the course before trimester starts and before each teaching period

Symbol ● represents main responsibility / Symbol ○ represents minor responsibility / Space represents no responsibility
These symbols will appear in Curriculum Mapping