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 234	การออกแบบวงจรดิจิทัล
(English)	EGCI 234	Digital Circuit Design

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: Major Course (Required Major)

4. **Responsible faculty member**
   Dr. Mingmanas Sivaraksa

5. **Trimester / year of study**
   - 5.1 Trimester 1st / year of study 2nd year
   - 5.2 Number of students: 5-40 students

6. **Pre-requisite(s)** none

7. **Co-requisite(s)** none

8. **Venue of study** Mahidol University, Salaya campus

9. **Date of latest revision** October 2011

Section 2 Goals and Objectives

1. **Goal** At the end of the course, students should
   1. Know and understand the designing of digital circuits.
   2. Understand steps and procedure of circuit design.
   3. Capable of designing digital circuits to solve engineering problems.

2. Objective of development revision

To up-date the knowledge content of the course

Section 3 Course Management

1. Course Description

การออกแบบวงจรดิจิทัล ประตูสัญญาณพื้นฐาน พีชคณิตบูลีน การออกแบบวงจรตรรกะเชิงผสม (เช่น ตัวถอดรหัส ตัวเข้ารหัส อุปกรณ์รวมส่งสัญญาณ และวงจรเปรียบเทียบ) การลดทอนทางตรรกะ ระบบจำนวน รหัสฐานสอง ฟลิปฟล็อปและเรจิสเตอร์ วงจรนับ การออกแบบวงจรประสานเวลาและไม่ประสานเวลา ตัวแปลงแอนะล็อกเป็นดิจิทัล และตัวแปลงดิจิทัลเป็นแอนะล็อก การจัดระบบหน่วยความจำ

Digital Circuit Design, Basic Gates, Boolean Algebra, Combination Logic Circuit Design (e.g. Decoder, Encoder, Multiplexer, and Comparator circuits), Logic Minimization, Number Systems, Binary Codes, Flip-Flops and register, Counter Circuits, Synchronous and Asynchronous Circuit Design, A/D and D/A converters, Memory Organization.

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

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 good academic ethical behaviors.

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 Lecture

1.2.2 Emphasis on morality and ethics

1.2.3 Group assignments

1.2.4 Group discussion

1.3 ***Evaluation methods:***

1.3.1 Written examination

1.3.2 Presentation

1.3.3 Class attendance, class participation and behavior in class

1.3.4 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 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 Case studies with past experiences and current events

2.2.3 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 examples and case studies with past experiences and current events

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 discussion in case studies

4.2.2 Group discussion
4.2.3 Group assignment

4.3 ***Evaluation methods:***

4.3.1 Class attendance, class participation and behavior in class
4.3.2 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 Case studies with past experiences and current events
5.2.2 Group discussion
5.2.3 Group assignment
5.2.4 Self Study

5.3 ***Evaluation methods:***

5.3.1 Written examination
5.3.2 On-time submission of reports and assignments and their quality
5.3.3 Class attendance, class participation and behavior in class
5.3.4 Presentation with appropriate technology

Section 5 Teaching and Evaluation Plans

1. Teaching plan

week	Topics	Hours			Teaching methods/multi media	Instructor
		Lecture	Lab	Self-Study		
1	History and overview. Introduction to Switching Theory.	4	0	8	Lecture	Thanadol Pritranan
2	Digital Circuit Design. Basic Gates and Boolean Algebra.	4	0	8	Lecture, exercises and case studies	
3-4	Combination Logic Circuit	8	0	16	Lecture and	

week	Topics	Hours			Teaching methods/multi media	Instructor
		Lecture	Lab	Self-Study		
	Design. Logic Minimization Techniques.				exercises	
5	Number Systems. Binary Codes.	4	0	8	Lecture and exercises	
6	Flip-Flops and Registers.	4	0	8	Lecture, exercises and case studies	
	Midterm Examination					
7	Counter Circuits Design	4	0	8	Lecture and exercises	
8-9	Synchronous and Asynchronous Circuits Design and Examples of Applications	8	0	16	Lecture, exercises and case studies	
10	Analog to Digital and Digital to Analog Converters Design	4	0	8	Lecture and exercises	
11	Memory Organization	4	0	8	Lecture, exercises and case studies	
12	Final Examination					
	Total	44	0	88		

2. Evaluation Plan

Expected outcomes	Methods / activities	Week	Percentage
1.1.5, 4.1.1, 4.1.4	Attendance in class behavior and exercises	1-11	20%
2.1.1, 2.1./, 3.1.1, 3.1.4, 5.1.2	Midterm Examination Final examination	6 12	35% 35%
2.1.8, 3.1.2, 4.1.1, 4.1.4, 4.1.6, 5.1.3	Report and Discussion	1-11	10%

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Section 6 Teaching Materials and Resources

1. **Texts and main documents**

   Tocci, Ronald J. , Widmer Neal S., Moss. Gregory L.**,** Digital Systems**,** Principles and Applications 10th edition, Pearson Edition, 2007

2. **Documents and important information**

   None

3. **Documents and recommended information**

   Website: http://wps.prenhall.com/chet_tocci_electech_10/

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**

   Use evaluation from 1 and 2 for course improvement
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, before each teaching period and review course contents every 3 years.

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