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	ICCS 220	การออกแบบตรรกะดิจิตัล
English	ICCS 220	Digital Logic Design

2. Number of credit 4 (4-0-8)
(lecture 4 hours – self study 8 hours/ week)

3. Curriculum and type of subject

3.1 Curriculum	offered in international curriculum
3.2 Type of subject	Major Required course, Computer Science

4. Responsible faculty member Full-time faculty members, Mahidol University International College, Mahidol University

5. Trimester / year of study

5.1 Trimester	1 and 2 / Second year
5.2 Number of students	_____ students

6. Pre-requisites ICCS 100 Computer Fundamentals and Concepts

7. Co-requisites -

8. Venue of study Mahidol University, Salaya campus

Section 2 Goals and Objectives

1. Goals

To let the students having knowledge in relation to Digital arithmetic, number systems, binary and hexadecimal base codes and logic; Boolean algebra; the Karnaugh's map simplification; digital electronic circuits: logic gates, flip-flops, combinational circuits, gate minimization; arithmetic logic circuit, adder and subtractor circuits; counters and registers, MOD count up and count down, asynchronous and synchronous counters design.

2. Objectives of development/revision

The objective for this course is to provide the basic concepts of computer hardware. It is a prerequisite course for computer logics, computer systems, microprocessors etc. Even advanced technology such as Pentium microprocessor is still based on digital electronics concepts.

Section 3 Course Management

1. Course descriptions

คณิตเชิงดิจิตอล ระบบตัวเลข รหัสและตรรกเลขฐานสอง ฐานสิบหก พีชคณิตบูลีน ผังคาร์โนห์อย่างง่าย ความรู้พื้นฐานและการทำงานของวงจรอิเล็กทรอนิกส์ระบบเกทฟลิปฟลอป วงจรรวมการลดรูปเกท วงจรเลขตรรกวงจรเพิ่มและลดการนับค่าขึ้นและลง การออกแบบวงจรนับและวงจรบันทึก

Digital arithmetic, number systems, binary and hexadecimal base codes and logic; Boolean algebra; the Karnaugh map simplification; digital electronic circuits: logic gate, flip flop, combinational circuits, gate minimization; arithmetic logic circuit, adder and subtractor circuits; counters and registers, MOD count up and count down, asynchronous and synchronous counters design.

2. Credit hours / trimester

Lecture	Additional class	Laboratory / field trip/ internship	Self study

44 hours (4 hour x 11 weeks)	-	-	88 hours (8 hours x 11 weeks)

3. Number of hours that the lecture provides individual counseling and guidance

1 hour / week

Section 4 Development of Students' Learning Outcome

1. Expected outcome on students' skill and knowledge

Students will be able to apply the knowledge from lectures and additional laboratories with the ideas received from analysis and synthesis to set up solutions/ precautions to benefit individuals;

2. Teaching methods

Course organized using Lectures, in-class case studies, discussion, self-study and student presentations.

3. Evaluation methods

1. Morality and Ethics

1.1 Expected outcome on morality and ethics

- ●)1(To posses morality and ethics
- ●)2(To have self-discipline, honesty, kindness, self- responsible and social responsibility
- ●)3(To demonstrate academic ethical behavior
- ●)4(To respect others' rights and be a good listener
- ●)5(To respect rules and regulations
- ○)6(To have good attitude toward professors/career
-)7(To demonstrate Leadership, team player

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) Lecture
(2) In-class case studies
(3) Discussion
(4) Self-study
(5) Student presentations

1.3 Evaluation methods

(1) Written examination
(2) Homework
(3) On-time submission of EWB Simulation project and its quality

2. Knowledge development

2.1 Expected outcome on knowledge development

-)1(To posses basic knowledge, theories and concepts towards the understanding of self, society, surrounding in order to be well-rounded person
-)2(To process the knowledge related to principles, theories and practice in the course
-)3(To integrate the knowledge to other related subjects
-)4(To remain current in research and new knowledge

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

(1) Lecture
(2) In-class case studies
(3) Discussion
(4) Self-study

(5) Student presentations

2.3 Evaluation methods

(1) Written examination

(2) Homework

(3) On-time submission of EWB Simulation project and its quality

3. Intellectual development

3.1 Expected outcome on intellectual development

-)1(To have systematic and analytical thinking
-)2(To be able to search, consolidate and evaluate ideas and evidence for problem solving
-)3(To be able to apply knowledge and experience to analyze and creatively solve problems both in general and academic

3.2 Teaching methods

(1) Real experience teaching and encourage on skill development besides the professional skill

(2) In-class case studies

(3) Discussion

(4) Self-study

(5) Student presentations

3.3 Evaluation methods

(1) Written examination

(2) Homework

(3) On-time submission of Simulation project and its quality

4. Interpersonal relationship and responsibility

4.1 Expected outcome on Interpersonal relationship and responsibility

-)1(To posses good interpersonal relationship skills (self esteem and dignity) and have respect for the rights and value of others

)2(To possess leadership and initiative in problem solving

)3(To be constructive team member (in various roles) and be responsible for assignment tasks, professional and society

4.2 Teaching methods

(1) Extensible assignments Lecture

(2) In-class case studies

(3) Discussion

(4) Self-study

(5) Student presentations

4.3 Evaluation methods

(1) Written examination

(2) Homework

(3) On-time submission of EWB Simulation project and its 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

)1(To be able to select and apply appropriate statistical and mathematical methods to research problems

)2(To be able to apply information technology for data gathering, processing, interpreting and presenting information/results

)3(To have the ability to communicate effectively and select appropriate methods of presentation

5.2 Teaching methods

(1) Extensible assignments Lecture

(2) In-class case studies

(3) Discussion

(4) Self-study

(5) Student presentations

5.3 Evaluation methods

(1) Written examination

(2) Homework

(3) On-time submission of EWB Simulation project and its quality

Section 5 Teaching and Evaluation Plans

1. Teaching plan

Week	Topic	Hours	Teaching methods/ multimedia	Instructor
1	Digital systems, Digital circuits, Digital v.s. Analog Digital computer. Number systems, Binary, Octal Decimal and Hexadecimal number systems.	**5**	Interactive lecture, Laboratory	
2	BCD, Digital codes : Binary to Decimal conversions, Parity method, ASCII code. Introduction to Boolean algebra. 2's Compliment, Addition and subtraction.	**5**	Interactive lecture, Laboratory	
3	Basic logic gates : AND, OR, NOR, NAND, INVERTER and	**5**	Interactive lecture,	

	EX-OR, EX-NOR gate. Boolean theorems, DeMorgan's Theorem.		Laboratory	
4	Combination logic circuits, Sum-of-Product	**5**	Interactive lecture, Laboratory	
5	Product-of Sum form, Karnaugh map and logic circuit design methods, Parity checker .	**5**	Interactive lecture, Laboratory	
6	Midterm Exam			
7	Latch logic circuits, Clock signals, Introduction to Flip-Flop : SC, JK, D and Enable Flip-Flop, Flip-Flop timing operations.	**5**	Interactive lecture, Laboratory	
8	Master / Slave Flip-Flop, Synchronous and Asynchronous systems. Detecting an input sequence, Parallel / Series data transfer , Data bus operation.	**5**	Interactive lecture, Laboratory	
9	Basic adder circuit, Full adder, BCD adder, Carry propagation, Computer multiplication / division, ALU unit. Counters and registers, Asynchronous (ripple) counter.	**5**	Interactive lecture, Laboratory	
10	Synchronous (parallel) counter , MOD number . MOD-X counter. UP/DOWN counters, BCD counter. Shift-register counters ,	**5**	Interactive lecture, Laboratory	

	decade counters. Presettable counter , 74LS193/74HC193 and some commercial ICs counter. IEEE/ANSI notation , Decoding a counter.			
11	Synchronous counter design, irregular counter design. Counter application circuits, parallel (serial) data in / serial (parallel) data out.	**5**	Interactive lecture, Laboratory	
12	**Final Exam**			

2. Evaluation plan

Expected outcomes	Methods / activities	Week	Percentage

Section 6 Teaching Materials and Resources

1. Texts and main documents

1.1 Horstmann, Cornell G. Core Java, C.S.: Prentice-Hall. vol. I & II

1.2 Deitel PJ, Deitel HM. Java How to Program: Prentice-Hall

2. Documents and important information

3. Documents and recommended information

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 lecturers in this 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**

    Meeting of lecturers to review the course before semester starts and before each period of teaching