TQF 3 Course Specifications

Section 1 General Information

1. Course code and course title

Thai	ICCS 323	ไอโอที อิเล็กทรอนิกส์
English	ICCS 323	IoT Electronics

2. Number of credits 4 (4-0-8)
3. Program and type of subject
   - 3.1 Program: Undergraduate Degree (International Program)
   - 3.2 Type of Subject: Elective Major Course
4. Course Coordinator and Course Lecturer
   - 4.1 Course Coordinator: Piti Ongmongkolkul
   - 4.2 Course Lecturer: Piti Ongmongkolkul
5. Trimester/ Year of Study
   - 5.1 Trimester: All trimesters (including summer session) / for all students in all International College Undergraduate Programs
   - 5.2 Course Capacity: Approximately 30 students
6. Pre-requisites: ICPY 102 Physics II; ICCS 121 System Skills and Low-level Programming
7. Co-requisites: N/A
8. Venue of Study: Mahidol University, Salaya campus

Section 2 Goals and Objectives

1. Course Goals

Students should be able to design, build and implement electronics circuits to serve their need.

2. Objectives of Course Development/Revision

2.1 Course Objectives

1. To revise course contents
2. To include a well-defined course-level learning Outcomes.

2.2 Course-level Learning Outcomes: CLOs

By the end of the course, students will be able to (CLOs)

1. CLO1: Program microcontroller.
2. CLO2: Design and build electronics devices.
3. CLO3: Explain how common electronics devices works.
4. CLO4: Connect electronic devices to stream data to computer and perform communication over wireless network.
5. CLO5: Understand basic analog circuit.

Section 3 Course Management

1. Course Description

ไมโครคอนโทรลเลอร์ และ การเขียนโปรแกรม, การออกแบบวงจร, ชิ้นส่วนอิเล็กทรอนิกส์ต่าง ๆ, การเชื่อมต่อเครือข่าย, วงจรอนาล็อค

Microcontroller and Programming, Circuit Design and Analysis, Electrical Components, Networking, and Analog Circuit.

2. Credit hours per trimester

Lecture (Hour(s))	Laboratory/field trip/internship (Hour(s))	Self-study (Hour(s))
48	0	96

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

2 hour/week

Section 4 Development of Students' Learning Outcome

1. Short summary on the knowledge or skills that the course intends to develop in students (CLOs)

By the end of the course, students will be able to

1. CLO1: Program microcontroller.
2. CLO2: Design and build electronics devices.
3. CLO3: Explain how common electronics devices works.
4. CLO4: Connect electronic devices to stream data to computer and perform communication over wireless network.
5. CLO5: Understand basic analog circuit.

2. Teaching methods for developing the knowledge or skills specified in item 1 and evaluation methods of the course learning outcomes

Course CLO	Teaching methods	Evaluation Methods
CLO 1	Lecture, class discussion	Assignments, written examination
CLO 2	Lecture, class discussion	Assignments, written examination
CLO 3	Lecture, class discussion	Assignments, written examination
CLO 4	Lecture, class discussion	Assignments, written examination
CLO 5	Lecture, class discussion	Assignments, written examination

Section 5 Teaching and Evaluation Plans

1. Teaching plan

Week	Topic	Number of Hours		Teaching Activities/ Media	Lecturer
		Lecture Hours	Lab/ Field Trip/ Internship Hours		
1	Microcontroller Programming	4	0	Lecture, hands on exercise.	Piti O.
2	Switches and Pulse Width Modulation	4	0		
3	Reading Schematics and Soldering	4	0		
4	Integrated Circuit and Datasheet	4	0		
5	Motors	4	0		
6	Real-time System	4	0		
7	Wireless Communication	4	0		
8	Analog Circuits	4	0		
9	Individual Project	4	0		
10	Individual Project	4	0		
11	Individual Project	4	0		
12	Presentation	4	0		
	Total	48	0		

2. Plan for Assessing Course Learning Outcomes
   2.1 Assessing and Evaluating Learning Achievement
      a. Formative Assessment
         1. Class discussion

2. Reflective question

3. In-class examples

b. Summative Assessment

(1) Tools and Percentage Weight in Assessment and Evaluation

Learning Outcomes	Assessment Methods	Assessment Ratio (percentage)	
CLO1: Program microcontroller.	Exam	4	20
	Assignment/Project	16	
CLO2: Design and build electronics devices.	Exam	4	20
	Assignment/Project	16	
CLO3: Explain how common electronics devices works.	Exam	4	20
	Assignment/Project	16	
CLO4: Connect electronic devices to stream data to computer and perform communication over wireless network.	Exam	4	20
	Assignment/Project	16	
CLO5: Understand basic analog circuit.	Exam	4	20
	Assignment/Project	16	
Total			100

(2) Grading System

Grade	Achievement	Final Score (% range)	GPA
A	Excellent	90-100	4.0
B+	Very good	85-89	3.5
B	Good	80-84	3.0
C+	Fairly good	75-79	2.5

C	Fair	70-74	2.0
D+	Poor	65-69	1.5
D	Very poor	60-64	1.0
F	Fail	Less than 60	0.0

(3) Re-examination (If course lecturer allows to have re-examination)
N/A - (Not applicable with MUIC)

3. Student Appeals
N/A

Section 6 Teaching Materials and Resources

1. Textbooks and/or other documents/materials
    1. Brian W. Evans, Arduino Programming Notebook.
    2. Horowitz and Hill, Arts of Electronics.
2. Recommended textbooks and/or other documents/materials
   As posted on the course's e-learning site
3. Other Resources (If any)
   As posted on the course's e-learning site

Section 7 Evaluation and Improvement of Course Management

1. Strategies for effective course evaluation by students
    1.1. Discussion between course instructor and students
    1.2. Questionnaire from students.
2. Evaluation strategies in teaching methods
    2.1. Evaluation of effectiveness based on student evaluation scores and comments
    2.2. Evaluation through peer observations by co-instructor or other Division faculty
3. Improvement of teaching methods
    3.1. Adjustments based on student feedback, personal observations, comments from peer observations and discussions with supervisor and/or other Division faculty in one-on-one and/or group meetings as specified by MUIC guidelines.
4. Verification of students' learning outcomes.
    4.1. Verification through student performance on assessments based on MUIC/Division standards

5. Review and improvement for better outcome

5.1. Course instructors (and coordinator/supervisor) will meet to discuss results of student evaluations and student performance based on learning outcomes in order to identify point for improvement

5.2 Strategy for improvement set according to MUIC/Division guidelines

Appendix
Alignment between Course learning outcomes and Program learning outcome

Table 1 The relationship between course and Program Learning Outcomes (PLOs)

	Program Learning Outcomes (PLOs)					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
(ICCS323)					R	R

Table 2 The relationship between CLOs and Program LOs (Number in table = sub-LOs)

ICCS323	Learning Outcomes in the Computer Science Program					
	1	2	3	4	5	6
CLO1: Program microcontroller.					5.1	
CLO2: Design and build electronics devices.					5.4	6.1
CLO3: Explain how common electronics devices works.					5.3	
CLO4: Connect electronic devices to stream data to computer and perform communication over wireless network.					5.1 5.4	6.1
CLO5: Understand basic analog circuit.					5.3	

Table 3. Description of Program LOs and Sub-LOs of the program

CS LOs	Sub LOs
PLO1 Demonstrate proficiency in scientific communication.	1.1 Understand the format of communication in computer science.
	1.2 Communicate inchoate ideas to others for further development and refinement.
	1.3 Describe computing concepts to members of the community with accuracy and clarity.
PLO2 Carry out work with scientific integrity and professionalism.	2.1 Recognize the concepts of intellectual property, copyright licenses, and law pertaining to information technology.

CS LOs	Sub LOs
	2.2 Provide ethical reasoning and awareness of issues surrounding bias, fabrication, falsification, plagiarism, outside interference, censorship, and information privacy.
	2.3 Demonstrate good time management, self-regulation, autonomy, and professional code of conduct of the discipline.
PLO3 Appraise scientific information critically.	3.1 Apply quantitative reasoning using mathematical methods and scientific facts, taking into consideration multiple perspectives.
	3.2 Provide a succinct description of the issue (i.e., a problem, a question, or a hypothesis), separating facts and assumptions.
	3.3 Differentiate source, validity, objectives, key arguments, and consequences of a piece information.
	3.4 Create a response to the issue by synthesizing collected information critical to the assessment.
PLO4 Use a teamwork mindset in the context of computing.	
PLO5 Execute common computing methodologies appropriate for a problem scenario.	5.1 Carry out the process of converting a process/algorithm to a machine-executable program.
	5.2 Use suitable techniques for correctness and cost analysis of computer programs.
	5.3 Deconstruct a computer system to reveal its structure, components, and process of construction.
	5.4 Select common computing techniques (e.g., standard algorithms, data structures, design patterns, programing style, and computing paradigms) appropriate for a given problem scenario.
PLO6 Formulate computational solutions to novel situations grounded on the foundation of computer science.	6.1 Model a given problem using suitable abstractions, including problem decomposition, in the context of computing.
	6.2 Compare the relative strengths and weaknesses among multiple designs or implementations.
	6.3 Assess the feasibility and efficacy of a computational solution based on its design and implementation.
	6.4 Devise computational solutions to novel situations using knowledge and experience in computer science.