



Course Title Theory of Computation

Undergraduate Program

Mahidol University International College

Course Code EGCI 404

Division Science

### TQF 3 Course Specifications

#### Section 1 General Information

1. Course code and course title

Thai	EGCI 404	ทฤษฎีการคำนวณ
English	EGCI 404	Theory of Computation

2. Number of credits 4 Credits

3. Program and type of subject

3.1 Program	Bachelor of Engineering ( <u>Computer Engineering</u> )
3.2 Type of Subject	Computer Engineering Elective Courses

4. Course Coordinator and Course Lecturer

4.1 Course Coordinator	Dr. Mingmanas Sivaraksa
4.2 Course Lecturer	Asst. Prof. Thanadol Pritranan

5. Trimester/ Year of Study

5.1 Trimester	from 3 <sup>rd</sup> trimester of 3 <sup>rd</sup> year Computer Engineering
5.2 Course Capacity	Approximately 25 students

6. Pre-requisite EGCI 201 Discrete Mathematics

7. Co-requisites None

8. Venue of Study Mahidol University, Salaya campus

9. Date of Latest Revision

Date ..... Month ..... Year .....



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## Section 2 Goals and Objectives

### 1. Course Goals

To develop student knowledge about theory of computation. The predefined systematic working machine, i.e. computer, will be studied from arithmetic/mechanic point of view to allow students to understand set of theories that support (the feasibility of) computer programming languages and computer machines. Structure and characteristic of languages are discussed.

Deterministic/nondeterministic finite state machines and other type of machines are described step-by-step. More advanced theories and machine's limitations are also covered.

### 2. Objectives of Course Development/Revision

#### 2.1 Course Objectives

1. Explain theories of computing machine.
2. Explain different type of machines relating to computer.
3. Apply theory of computation to solve engineering problems.

#### 2.2 Course-level Learning Outcomes: CLOs

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

1. CLO1 Describe theories that support computer programming languages and computer machines.
2. CLO2 Understand different type of machines relating to computer.
3. CLO3 Apply theory of computation to solve engineering problems.



### Section 3 Course Management

#### 1. Course Description

(Thai) แนะนำโครงสร้างของภาษาและลักษณะเฉพาะของภาษา: ภาษารูปนัย ภาษาปรกติและภาษาไม่ปรกติ ไวยากรณ์ไม่พึ่งบริบทและภาษาไม่พึ่งบริบท อธิบายลักษณะเฉพาะของเครื่องสถานะที่ใช้ในการตรวจสอบความเป็นสมาชิกในภาษา: เครื่องสถานะจำกัด ตัวแปรสัญญาณ เครื่องแปลงสถานะ เครื่องสถานะจำกัดเชิงไม่กำหนด เครื่องสถานะแบบกดลง เครื่องทัวริง ทฤษฎีการคำนวณขั้นสูง ทฤษฎีบทของคลีน ภาษานับได้เรียกซ้ำ ปัญหาการตัดสินใจ

(English) An introduction to the structure of languages and the characteristic of languages: formal languages, regular languages and non-regular languages, the context-free grammar and context-free languages; describing the characteristic of state machines used to check the membership of languages: finite state machines, transducers, state transition machines, non-deterministic finite state machines, push-down state machines, Turing machines; the advanced theory of computation: Kleene's Theorem, recursively enumerable languages, decision problems.

#### 2. Credit hours per trimester

Lecture (Hour(s))	Laboratory/ fieldtrip/ Internship (Hour(s))	Self-study (Hour(s))
48 hours (4 hours x 12 weeks)	-	96 hours (8 hours x 12 weeks)

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

1 hours/week



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#### 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 Describe theories that support computer programming languages and computer machines.
2. CLO2 Understand different type of machines relating to computer.
3. CLO3 Apply theory of computation to solve engineering problems.

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

Course Code	Teaching methods	Evaluation Methods
CLO1	Interactive Lecture, Individual Assignment	Homework, Quiz, Written Examination, Individual Evaluation
CLO2	Interactive Lecture, Individual Assignment	Homework, Quiz, Written Examination, Individual Evaluation
CLO3	Interactive Lecture, Discussion	Written Examination, Individual Evaluation



**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	Introduction, languages and recursive definitions.	4	0	Interactive Lecture, Individual Assignment	Interactive Lecture, Individual Evaluation, Quiz 1
2	Regular expressions, finite automata and transition graphs.	4	0		
3	Kleene's theorem, nondeterminism, finite automata with output.	4	0		
4-5	Regular languages and nonregular languages.	6	0		
5-6	Decidability, Context-free grammar (CFG) and Trees.	4	0		
6	Midterm Examination	2	0	Midterm Assessment	
7	Regular grammars and Chomsky normal form (CNF)	4	0	Interactive Lecture, Individual Assignment	Quiz 2-3, Individual Evaluation
8	Pushdown automata (PDA), CFG = PDA.	4	0		
9-10	Context-free languages and non-context-free languages.	6	0		
10	Intersection and complement, parsing and decidability.	2	0		
11	Turing machines	4	0		
12	Post machines, Minsky's theorem.	4	0		
13	Final Examination			Final Assessment	
	Total	48	0		



## 2. Plan for Assessing Course Learning Outcomes

### 2.1 Assessing and Evaluating Learning Achievement

#### a. Formative Assessment

The assessment tools such as homework, quizzes and exam are used to evaluate student's understanding by their ability to describe and prove theories that support computer programming languages and computer machines. Students should be able to explain different types of machines relating to computer. Also students should be able to analyze computer's limitations and its ability to solve the problems. The assessments are made through their homework, discussions, quizzes and exams.

#### b. Summative Assessment

##### (1) Tools and Percentage Weight in Assessment and Evaluation

Learning Outcomes	Assessment Methods	Assessment Ratio (Percentage)	
CLO1 Describe theories that support computer programming languages and computer machines.	Homework	5	25
	Quiz	5	
	Midterm Exam	15	
CLO2 Understand different type of machines relating to computer.	Homework	10	60
	Quiz	10	
	Midterm Exam	15	
	Final Exam	25	
CLO3 Apply theory of computation to solve engineering problems.	Final Exam	15	15
Total			100



(2) Grading System

Grade	Achievement	Final Score (% range)	GPA
A	Excellent	100-90	4.0
+B	Very Good	89-85	3.5
B	Good	84-80	3.0
+C	Fairly Good	79-75	2.5
C	Fair	74-70	2.0
+D	Poor	69-65	1.5
D	Very Poor	64-60	1.0
F	Fail	Less than 60	0.0

(3) Re-examination

N/A - (Not applicable with MUIC)

3. Student Appeals

The student wishing to appeal according to grading result must submit a written and signed appeal form personally to the academic affair unit. It is prohibited to assign another person to appeal on one's behalf. The written appeal form is then sent to the program director and chair of department. The final decision is transferred for approval by the faculty committee. The result of appeal then is informed to the student.

**Section 6 Teaching Materials and Resources**

1. Textbooks and/or other documents/materials

- 1) Daniel I.A. Cohen, Introduction to Computer Theory, second edition, John Wiley and Sons, 1997. ISBN 0-471-13772-3.

2. Recommended textbooks and/or other documents/materials

None

3. Other Resources (If any)

None



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## 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 opinions

### 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 each CLOs for evaluation.

### 5. Review and improvement for better outcome

Review the course before trimester starts, before each teaching period and review course contents every 3 years.



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**Appendix**

**Alignment between Courses and General Education courses**

**Relations between the course and the program**

**Table 1** Relations between the course and the PLOs

Theory of Computation	PLOs					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
EGCI 404				R		

**Table 2** Relations between CLOs and PLOs

EGCI 404	PLOs					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1 Describe theories that support computer programming languages and computer machines.				x		
CLO2 Understand different type of machines relating to computer.				x		
CLO3 Apply theory of computation to solve engineering problems.				x		

**Table 3** PLOs that the course is responsible for

PLOs	SubPLOs
PLO4: Generate potential solutions for problem solving with computer engineering knowledge and skills.	4.3 Conclude the problems and requirements in computer related problems 4.6 Construct engineering system using computer engineering knowledge for problem solving