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 221 โครงสร้างข้อมูลและขั้นตอนวิธี
   (English) EGCI 221 Data Structure and Algorithms

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. Rangsipan Marukatat

5. **Trimester / year of study**
   5.1 Trimester 2nd / year of study 2nd
   5.2 Number of students 20

6. **Pre-requisite(s)** EGCI 111 Computer Programming

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

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

Section 2 Goals and Objectives

1. **Goal**
   Students can
   1. Explain properties and algorithm of various data structures.
   2. Analyze and compare efficiency of algorithms.
   3. Select suitable data structures and algorithms to solve problems.

2. **Objective of development revision**
   To update the knowledge content of the course

Section 3 Course Management

1. Course Description

การวิเคราะห์ขั้นตอนวิธี ชนิดข้อมูลนามธรรม โครงสร้างข้อมูลแบบเชิงเส้น: รายการโยง กองซ้อน คิว โครงสร้างข้อมูลแบบไม่เชิงเส้น: ต้นไม้ ตารางแฮช กราฟ ขั้นตอนวิธีการเรียงลำดับและการค้น การเรียกซ้ำ การแบ่งแยกและเอาชนะ กำหนดการพลวัต ขั้นตอนวิธีเชิงละโมบ แนะนำเอ็นพีคอมพลีต

Analysis of algorithms; abstract data type; linear data structures: linked lists, stacks, queues; non-linear data structures: trees, hash tables, graphs; sorting and searching algorithms; recursion, divide and conquer, dynamic programming, greedy algorithms; introduction to NP-completeness

2. Credit hours / trimester

Lecture (hours)	**Additional Class (hours)**	**Laboratory/field trip/internship (hours)**	**Self-study (hours)**
48 hours (4 hours x 12 weeks)	-	0 hours (0 hours x 11 weeks)	96 hours (8 hours x 12 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
- Practical laboratory exercises
- Group projects

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 Respect and follow rules and regulations of institution and society

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
- 3.2.2 Case studies with past experiences and current events
- 3.2.3 Self-Study

3.3 ***Evaluation methods:***

- 3.3.1 Written examination
- 3.3.2 Presentation
- 3.3.3 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 be initiative in problem solving.
- 4.1.6 To demonstrate leadership qualities in uncertain situations.
- 4.1.7 To take responsibility in a life-long learning.

4.2 ***Teaching methods:***

- 4.2.1 Group discussion
- 4.2.2 Group assignment

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 Computer programming with exercises

5.2.2 Case studies with past experiences and current events
5.2.3 Group discussion
5.2.4 Group assignment
5.2.5 Self-Study

5.3 ***Evaluation methods:***

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

Section 5 Teaching and Evaluation Plans

1. Teaching plan

week	Topics	Hours			Teaching methods/ multimedia	Instructor
		Lecture	Lab	Self-Study		
1	Review of fundamental mathematics, algorithm analysis, asymptotic runtime	4	0	8	lecture, case studies, exercise	Assoc. Prof. Dr. Rangsipan Marukatat
2	Linear data structures: linked list, stacks, queues	4	0	8	lecture, case studies, exercises	
3-4	Trees: binary tree, binary search tree, AVL trees, heaps	6	0	12	lecture, case studies, exercises	
4-5	Review of OOP, programming with linear data structures	6	0	12	programming exercises	
6-8	Midterm exam Searching, hash tables, graphs and graph algorithms	10	0	20	lecture, case studies, exercises	
8-9	Programming with non-linear data structures and graphs	6	0	12	programming exercises	
10	Sorting, divide and conquer	4	0	8	lecture, case studies, exercises	
11	Optimization problems, dynamic programming, greedy algorithms	4	0	8	lecture, case studies, exercises	
12	Introduction to NP-complete, review of data structures and algorithms	4	0	8	lecture, case studies	
13	Final Examination					
	Total	**48**	**0**	**96**		

2. Evaluation Plan

Expected outcomes	Methods / activities	Week	Percentage
1.1.2, 1.1.5, 4.1.1, 4.1.4, 5.1.3	Attendance and in-class behavior	1-11	10%
2.1.1, 2.1.2, 3.1.1, 3.1.4, 5.1.2	Midterm Examination Final examination	6 13	35% 35%
1.1.7, 2.1.1, 2.1.2, 3.1.4, 5.1.2	Exercises and group projects	1-11	20%

Section 6 Teaching Materials and Resources

1. Texts and main documents

- Corman TH, Leiserson CE, Rivest RL, Stein S. Introduction to algorithms (2nd edition). MIT Press, 2002.
- Weiss MA. Data structures and algorithm analysis in Java (3rd edition). Pearson, 2011.

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 major responsibility
Symbol ○ represents minor responsibility/Space represent no responsibility
These symbols appear in Curriculum Mapping