1. Course Code

2207

2. Course Title

Fundamentals of Software Engineering

3. Teacher

ITO, Mamoru

4. Term

Fall 2

5. Course Overview and Objectives

Software is playing an increasingly important role in the evolution of ICT systems. However, developing software on time, on budget, and on target is very difficult. Many software projects fail or end with challenges. This class provides a comprehensive and interdisciplinary learning opportunity for software practitioners to solve various problems in software projects and ensure their success.

6. Course Goals (Attainment Targets)

(1) Have a basic understanding of software development life cycle and process models
(2) Utilize basic techniques in software analysis and design
(3) Acquire practical decision-making skills required for software project management
(4) Deepen an understanding of social environments surrounding software development
(5) Analyze the ethical issues in software development
(6)

7. Correspondence relationship between Educational goals and Course goals

Educational goals of the school			Course Goals
High level ICT skills	Basic academic skills		(1), (2)
	Specialized knowledge and literacy		(1), (2)
Human skill (Tankyu skill)	Ability to continually improve own strengths		(2)
	Ability to discover and resolve the problem in society	Problem setting	(3), (4)
		Hypothesis planning	(3), (4)
		Hypothesis testing	
		Practice	
	Fundamental Competencies for Working Persons	Ability to step forward	(3)
		Ability to think through	(3), (4)
		Ability to work in a team	(1), (2)
Professional ethics			(3), (4), (5)

8. Course Requirements (Courses / Knowledge prerequisite for this course)

None

9. Textbooks (Required Books for this course)

None

10. Reference Books (optional books for further study)

R. S. Pressman, B. R. Maxim. Software Engineering: A Practitioner's Approach. McGraw Hill Higher Education.
IEEE Computer Society. Guide to the Software Engineering Body of Knowledge. IEEE Computer Society Press.

11. Evaluation

Goals	Evaluation method & point allocation					
	examination	Quiz	Reports	Presentation	Deliverables	Other
(1)	○	○		○		
(2)	○	○		○		
(3)	○	○	○	○		
(4)	○	○	○			
(5)	○	○	○			
(6)						
Allocation	30	30	30	10		

12. Notes

This course provides the course materials on Moodle.

13. Course plan

(Notice) This plan is tentative and might be changed at the time of delivery

Lesson 1: Basic principles — Lecture/Discussion 90 min

The Software runs on a computer. The basic knowledge on computers expands an understanding of software development. We will learn how a computer works in this lesson.

- Introduction
- Computer organization (CPU, memory, I / O, clock)
- Von Neumann architecture
- Memory hierarchy
- Program performance

Lesson 2: Data structures and algorithms — Lecture/Discussion 90 min

The data structures and algorithms should be considered for us to design a computer program. This lesson will provide students with the introduction of data structures and algorithms.

- Address space and virtual memory
- Major data structures – array, list, stack, queue, and tree
- Major algorithms - sorting algorithms and search algorithms
- Computational complexity

Lesson 3:Software engineering and ethics	Lecture/Discussion 90 min

The software grows increasingly important along with the popularization of computers. We will discuss the reality surrounding software development after understanding of the features of the software and learn the necessity of software engineering.

- Features of software
- Importance of software
- Environment surrounding software development
- Role of software engineering

Lesson 4: Software development processes	Lecture/Discussion 90 min

A “Process” can be defined as a “set of interrelated or interacting activities, which transforms inputs into outputs”. Good process is required to produce good outputs. We will learn the overview of software life cycle process models and the meaning of process improvement.

- Definition of software process
- Life cycle models
- Present situation and issues on software process
- Meaning of software improvement

Lesson 5: Project management processes	Lecture/Discussion 90 min

Generally, software is developed by a project team. The project team should be managed adequately. This lesson will clarify a project, project management, project lifecycle, and project organizations.

- Definition of project and project management
- Project life cycle
- Relationship with organizations and stakeholders
- Trend in project management standards

Lesson 6: Requirements analysis	Lecture/Discussion 90 min

The role of software engineer is to realize the requirements of customers and users by use of software. But their requirements are sometimes ambiguous and lack consistency. We should acquire their requirements exhaustively and analyze them systematically. We will marshal the concepts of requirements and flow of requirement analysis.

- Difference between needs wants and demands
- Functional requirements and non-functional requirements
- Requirements analysis techniques
- Requirements modeling

Lesson 7: Software design	Lecture/Discussion 90 min

The optimum design technique should be selected based on the target and objectives of software development. This lesson introduces major software design techniques such as structured design and object-oriented design.

- Architectural design
- Structured design
- Object-oriented design

Lesson 8: Software testing	Lecture/Discussion 90 min

Software testing is becoming important because defects in software have the significant impact on the society. We will learn the positioning of software testing, kinds of software testing, and testing techniques in this lesson.

- Necessity and limitation of software testing
- Flow of software development and testing phases
- White box test and black box test
- The major testing techniques

Lesson 9: Software quality	Lecture/Discussion 90 min

One of the objectives of software engineering is to develop high-quality software. Management on software quality is more important than that of hardware quality because software is invisible. We will understand the whole picture of software quality and necessary activities to achieve the required quality in this lesson.

- Difference between quality and grade
- Software quality model
- Quantitative quality management
- Software design review

Lesson 10: Object-oriented methodology	Lecture/Discussion 90 min

Object-oriented methodology is becoming popular in association with increasing in size and complication of software. This methodology is used not only for programming but also for requirements analysis and software design. This lesson will focus on object-oriented analysis and design by the use of UML modeling.

- A brief history of object-oriented methodology
- Object-oriented analysis
- Modeling and UML diagrams
- Object-oriented design

Lesson 11-12: Unified modeling language (UML)	Lecture/Exercise 180 min

UML is becoming commonly-used with object-oriented technology. UML stands for Unified Modeling Language, which is a useful tool for analysis and design of complex software systems. We will learn how to describe major diagrams.

- Overview
- Use Case Diagram
- Activity Diagram
- Class Diagram, Object Diagram
- Sequence Diagram

Lesson 13-14: Exercises in UML modeling	Exercise: 180 min

Software analysis and design includes various activities from requirements analysis to implementation, which holds extremely important position in software developments. In the following three lessons, exercises in the analysis and design of software systems are conducted through group work. After the exercises, each group of the students makes a presentation on the results of group work.

- Exercises in structural and behavioral modeling
- Exercises in analysis and design of software
- Exercises in drawing UML diagrams
- Presentations

Lesson 15: Presentation	Presentation 90 min

Each group conducts a presentation of the results of UML modeling.

- Presentation

Term-end Examination	Examination: 90 min

A multiple-choice exam is conducted to evaluate the level of understanding of each student. Your answers to these questions will all be processed by computer.

- Multiple-choice exam