Akashi College	Year	2022	Course Title	Computer Simulation

Course Information

Course Code	4514	Course Category	Specialized / Compulsory
Class Format	Lecture	Credits	School Credit: 1
Department	Electrical and Computer Engineering Electrical Engineering Course	Student Grade	5th
Term	Second Semester	Classes per Week	2
Textbook and/or Teaching Materials			
Instructor	KAMI Yasushi		

Course Objectives

1. Can explain the reason why numerical calculations yield errors.
2. Can describe a solution method (algorithm) on basic math problems.
3. Can explain how to simulate different phenomena on a computer, starting from how to create a model.

Rubric

	Ideal Level	Standard Level	Unacceptable Level
Achievement 1	Can explain the method so as to avoid major errors on numerical calculations	Can explain causes why major errors on numerical calculations occur.	Cannot explain the reasons why major errors on numerical calculations occur.
Achievement 2	Can accurately explain a solution method (algorithm) for all specified problems.	Can explain an overview of the methods (algorithms) for finding solutions to some problems.	Cannot explain the method (algorithm) of finding solutions to problems.
Achievement 3	Can program a method to find a solution (near real-time solution) for all specified problems	Can program a method to find solutions (near real-time solutions) for some problems.	Cannot program a method to find a solution to problems.

Assigned Department Objectives

Teaching Method

Outline	A simulation is the imitation of a phenomenon by reducing it into a model. The aim of this course is to conduct computer-based experiments on simple models of natural and social phenomena that are difficult to reproduce and observe, to identify the characteristics of the phenomenon and to deepen the understanding of the contents. In classes, we will introduce the basic concepts and the latest examples of modeling and simulation in the first half, and practice the methods to solve their own challenges by programming and explaining a simulator in the second half.
Style	Classes are conducted through lectures and exercises. Lectures will be conducted through handouts. In addition to what students learned in classes, they will perform individual activities on assignments of their choosing. Exercises are supposed to build a system to help students in their own graduation research. Students will be evaluated on assignment progress and the work produced during the exercises, and presentations.
Notice	This course's content will amount to 90 hours of study in total. These hours include the learning time guaranteed in classes and the standard self-study time required for pre-study / review, and completing assignment reports. As this course is built on the content of Data Structures and Algorithms, Computer Programming, and Probability and Statistics, it's recommended that students review these textbooks, materials, etc. as references during the classes. Students who miss 1/3 or more of classes will not be eligible for a passing grade.

Characteristics of Class / Division in Learning

☐ Active Learning	☑ Aided by ICT	☑ Applicable to Remote Class	☐ Instructor Professionally Experienced

Course Plan

			Theme	Goals
2nd Semester	3rd Quarter	1st	Introduction	Understand the objectives and the grading method, etc. of the course.
		2nd	Algorithms, calculations and recurrence relations	Understand time and space complexity of algorithms. Can derive (time) complexity of some algorithms. Can derive recurrence relations which give solutions of problems.
		3rd	Repetitive methods	Can derive repetitive methods which give solutions of problems.
		4th	Errors, loss of significance, data loss	Can explain the cause of phenomena that occurs in numerical calculations, such as truncation errors, loss of significance, data loss
		5th	Nonlinear equations	Can explain the Newton method, the bisection method ,and false position method .
		6th	Simultaneous equations 1	Can explain algorithms of Gaussian elimination and sweep out methods.
		7th	Simultaneous equations 2	Can explain algorithms of Jacobi, Gauss-Seidel and SOR method.
		8th	Exercise	Exercise on the contents of classes in the first half of the semester.

	4th Quarter	9th	Eigenvalue	Can explain algorithms of Jacobi and the power methods for obtaining eigenvalues of matrices.
		10th	Interpolation of functions	Can explain linear interpolation, Newton forward linear interpolation and lagrange linear interpolation.
		11th	Method of least squares	Can explain the method of least squares.
		12th	Numerical differentials	Can calculate first and second order numerical differentials with forward, central and backward formulas. Can calculate first order numerical differential with laglange interpolation.
		13th	Numerical integrals	Can calculate numerical integrals with rectangle, trapezoidal and Simpson's rule.
		14th	Initial value problem and Boundary value problem of ordinary differential equations	Can explain algorithms of Euler, Heun's and Runge–Kutta method for the Initial value problem. Can explain an algorithm of finite-dfference method for the boundary value problem.
		15th	Review	Review the content of classes in the second half of the semester.
		16th	Final exam	

Evaluation Method and Weight (%)

	Examination	Exercise	Total
Subtotal	80	20	100
Basic Proficiency	0	0	0
Specialized Proficiency	80	20	100
Cross Area Proficiency	0	0	0