Tsuyama College	Year	2021	Course Title	Numerical Analysis

Course Information

Course Code	0034	Course Category	Specialized / Elective
Class Format	Lecture	Credits	Academic Credit: 2
Department	Advanced Electronics and Information System Engineering Course	Student Grade	Adv. 2nd
Term	Second Semester	Classes per Week	2
Textbook and/or Teaching Materials	Textbooks : HORINOUCHI Soichi et al.,"Introduction to Numerical Calculation in C 2nd Ed.(Japanese)"(Morikita Pub.), Reference books : YAMAMOTO Tetsuro, "Introduction to Numerical Analysis" (Science Pub.)		
Instructor	KIKUCHI Yosuke		

Course Objectives

Learning purposes :
It is necessary to understand the computer-specific errors, in order to execute calculations for a large scale engineering phenomena by a computer. it is also necessary to understand calculation that is suitable for computers and methods to obatin approximate solutions for problems for which there is no general solution method.
The purpose of this lecture is to understand these points.

Course Objectives :
1. To understand the various errors that occur on a computer.
2. To be able to explain the principles and characteristics of well-known numerical methods.

Rubric

	Excellent	Good	Acceptable	Not acceptable
Achievement 1	The students list and explain at least four numerical error.	The students list at least four numerical error. The students can also connect error to their explanations , for given errors and their explanations.	The students list at least four numerical error. The students can not connect error to their explanations , for given errors and their explanations.	The students can not list more than four numerical errors.
Achievement 2	The students can make programs using the ideas of bisection method and Newton's method with referring to the textbook.	The students can make a calculation using the ideas of bisection method and Newton's method with referring to the textbook in Excel.	The students can calculate the examples in the textbook using the ideas of bisection method and Newton's method in Excel.	The students can not calculate the examples in the textbook in Excel.
Achievement 3	The students can make programs using the ideas of LU decomposition, Gauss-Seidel method, trapezoidal rule and Euler method with referring to the textbook.	The students can make programs using the ideas of LU decomposition, Gauss-Seidel method, trapezoidal rule and Euler method with referring to the textbook for examples of the textbook.	The students can make more than 2 programs using the ideas of LU decomposition, Gauss-Seidel method, trapezoidal rule or Euler method with referring to the textbook for examples of the textbook.	The students can not make more than 2 programs using the ideas of LU decomposition, Gauss-Seidel method, trapezoidal rule or Euler method with referring to the textbook for examples of the textbook.

Assigned Department Objectives

Teaching Method

Outline	※Relationship with practice: This course is provided by a teacher who worked at another institute (IMAI Quantum Computation and Information Project and Quantum Computation and Information Project Solution Oriented Research for Science and Technology. The purpose of this course is to use teacher's experience in understanding the basic idea of information theory as the basis of information engineering. This course is given in lecture format. General or Specialized : Specialized Foundational academic disciplines : Informatics/Computing Technologies/High performance computing Relationship with Educational Objectives :This class is equivalent to "(2) Specialized technical fields pertaining to electrical/electronic engineering, and information/control systems". Relationship with JABEE programs : The main goal of learning / education in this class are "A A-2" also "A-1" is involved. Course outline : Simulation is one of the essential part of technology development in any engineering field. In simulation, computer solve a mathematical model that describes an enginnering phenomena. This course provides understanding the calculations and their important points in computing on a computer.
Style	Course method : The class explanes the topics of numerical analysis using materials. Depending on the number of students, the class may be seminar format. Exercises will be given as much as possible. Some explanations that are not in textbook will based on handouts. In principle, preparation or review will be presented for each topics. Grade evaluation method : Exams (100%). Examinations will be conducted a total of 2 times, and the evaluation ratios will be weighted. As a general, retaking exams can not performed. Bringing textbook and notebook at examination is not permitted but depending on the situation. Examinations are based on the rubric but there is no guarantee that the examinations cover achievements in rubric.

Notice	Precautions on the enrollment : This is a class that requires study outside of class hours. A total of 45 hours of study is required per credit, including both class time and study outside class time. Follow the instructions of the instructor regarding study outside of class hours. Course advice : This clas is suitable for students who would like to know development of computer simulation systems and to acquire the basic knowledge of the development. The students are expected to have knowledge of mathematics they have learned. Information concerned with classes will appear on Blackboard(LMS). The students need to consult Blackboard in advance. Foundational subjects : Foundamental Mathematics I(1), Differential and Integral I(2), Fundamental Linear Algebra(2), Differential and Integral II(3), Applied Mathematics II(4), Programming I(1), Programming II(2), Programming Language(3), Experiments of Electronic and Computer Systems(EC1) Attendance advice : If you are late for the roll call, you will be treated as absent 1 period. This class is based on knowledge of mathematics the studets have learned, like Differential and Integral, Linear Algebra and so on. Students should be able to refer to their texts and notes as approptiate. The preparatory work is the main part of the study outside of lecture. Then the students should be done. This work help the students' understanding of lecture.

Characteristics of Class / Division in Learning

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

Elective subjects

Course Plan

			Theme	Goals
2nd Semester	3rd Quarter	1st	Guidance	
		2nd	Errors	The student can name at least two types of error. The students understand the relation between numerical representation and errors on a computer. The students understand the effects of errors of numerical calculations on a computer.
		3rd	Equation(Bisection method, Newton's method)	The students can explain bisection method. The students can explain some numerical algorithms for computers.
		4th	Equation(Principle of contraction mapping)	The students can explain contraction mapping.
		5th	Equation system(Sweeping-out method)	The students can make a program of sweeping-out method referring textbook.The students can explain some numerical algorithms for computers.
		6th	Equation system(LU decomposition, Gauss-Seidel method)	The students can make a program of LU decomposition referring textbook.The students can explain some numerical algorithms for computers.
		7th	Interpolation	The students can make a program of interpolation referring textbook.The students can explain some numerical algorithms for computers.
		8th	Mid-term exam	
	4th Quarter	9th	Return and commentary of exam answers	
		10th	Numerical integration 1(Trapezoidal rule)	The students can make a program of trapezoidal rule referring textbook.The students can explain some numerical algorithms for computers.
		11th	Numerical integration 2(Simpson's rule)	The students can make a program of Simpson's rule referring textbook.The students can explain some numerical algorithms for computers.
		12th	Numerical integration 3(Newton-Cotes rules, Composite numerical integration)	The students can explain Newton-Cotes rules and Composite numerical integration. The students can also explain some numerical algorithms for computers.
		13th	Ordinary differential equation(Euler method, Heun's method)	The students can explain initial value problem. The students can also explain some numerical algorithms for computers.
		14th	Ordinary differential equation(Runge-Kutta method)	The students can make a program of Runge-Kutta method referring textbook.The students can explain some numerical algorithms for computers.
		15th	(Final exam)	
		16th	Return and commentary of exam answers	

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	100	0	0	0	0	0	100
Basic Proficiency	0	0	0	0	0	0	0
Specialized Proficiency	100	0	0	0	0	0	100
Cross Area Proficiency	0	0	0	0	0	0	0