Tsuyama College	Year	2024	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	First Semester	Classes per Week	2
Textbook and/or Teaching Materials	Textbooks : MITSUIDA Yoshiro et al.,"Numerical Calculation Method 3rd Ed. (Japanese)"(Morikita Pub.)		
Instructor	ONISHI Atsushi		

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 can raise all names and characteristics of errors which occur in the calculation process and which are caused by the expression method of numbers in this class.	The students can raise names and characteristics of 80% of errors which occur in the calculation process and which are caused by the expression method of numbers in this class.	The students can raise names and characteristics of 60% of errors which occur in the calculation process and which are caused by the expression method of numbers in this class.	The students can raise only names and characteristics of less 60% of errors which occur in the calculation process and which are caused by the expression method of numbers in this class.
Achievement 2	The students can explain all principles and characteristics of the numerical calculation methods in this class.	The students can explain principles and characteristics of 80% of the numerical calculation methods in this class.	The students can explain principles and characteristics of 60% of the numerical calculation methods in this class.	The students can explain only principles and characteristics of less 60% of the numerical calculation methods in this class.

Assigned Department Objectives

Teaching Method

Outline	General or Specialized : Specialized Field of learning : Information System･Programming･Network Foundational academic disciplines : Information Science, Computer Engineering and related fields / 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 is "(B)". 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. 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 (70%) + Reports(30%, including the evaluation of homework 20%). Examinations will be conducted a total of 2 times, and the evaluation ratios will be even. The teacher does not carry out the reexamination without defects in the regular examination. If the teacher carry out a makeup exam, the teacher will show persons concerned requirements for retesting. 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.As a preparatory study, the students are required to review mathematics previously. Course advice : This class 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. The computer solves many mathematical problems by the computer's own way. And the students learned these own ways in the progrraming cource. The students should learn about errors which are produced by those own ways and other characteristics in this class. 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 the student is late for the role call, he will be treated as a latecomer. The teacher considers that ths student was absent once when late twice. 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 appropriate. 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
1st Semester	1st Quarter	1st	Guidance	
		2nd	Errors	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	Equation1(Bisection method, Newton's method) (Activity out of the school hour : Preparations for lessons of contents learning in next week and homework)	The students can explain bisection method. The students can explain some major numerical algorithms for computers.
		4th	Equation2(Bare Stow method) (Activity out of the school hour : Preparations for lessons of contents learning in next week and homework)	The students can explain bare stow method. The students can explain some major numerical algorithms for computers.
		5th	Equation system1(Gauss-Jordan Iteration method) (Activity out of the school hour : Preparations for lessons of contents learning in next week and homework)	The students can explain Gauss-Jordan iteration method. The students can explain some major numerical algorithms for computers.
		6th	Equation system2(Gauss-Seidel method) (Activity out of the school hour : Preparations for lessons of contents learning in next week and homework)	The students can explain Gauss-Seidel method. The students can explain some major numerical algorithms for computers.
		7th	Interpolation1(Lagrange's Interpolation) (Activity out of the school hour : Preparations for lessons of contents learning in next week and homework)	The students can explain Lagrange's interpolation. The students can explain some major numerical algorithms for computers.
		8th	Mid-term exam	
	2nd Quarter	9th	Return and commentary of exam answers,Interpolation2(Least Square method) (Activity out of the school hour : Preparations for lessons of contents learning in next week and homework)	The students can explain least square method. The students can explain some major numerical algorithms for computers.
		10th	Numerical integration(Trapezoidal rule, Simpson's rule) (Activity out of the school hour : Preparations for lessons of contents learning in next week and homework)	The students can explain Trapezoidal rule. The students can explain Simpson's rule. The students can explain some major numerical algorithms for computers.
		11th	Ordinary differential equation(Euler’s formula, Runge-Kutta method) (Activity out of the school hour : Preparations for lessons of contents learning in next week and homework)	The students can explain Euler’s formula. The students can explain Runge-Kutta method. The students can explain some major numerical algorithms for computers.
		12th	Partial differential equation1(Parabolic type) (Activity out of the school hour : Preparations for lessons of contents learning in next week and homework)	The students can explain the elucidation of parabolic type partial differential equation. The students can explain some major numerical algorithms for computers.
		13th	Partial differential equation2(Hyperbolic type, Elliptic type) (Activity out of the school hour : Preparations for lessons of contents learning in next week and homework)	The students can explain the elucidation of hyperbolic type partial differential equation. The students can explain the elucidation of elliptic type partial differential equation. The students can explain some major numerical algorithms for computers.
		14th	Inverse matrix	The students can explain how to find inverse matrix. The students can explain some major 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	Report	Other	Total
Subtotal	70	0	0	0	30	0	100
Basic Proficiency	0	0	0	0	0	0	0
Specialized Proficiency	70	0	0	0	30	0	100
Cross Area Proficiency	0	0	0	0	0	0	0