Tsuyama College	Year	2022	Course Title	Computational Science

Course Information

Course Code	0056	Course Category	General / Compulsory
Class Format	Lecture	Credits	School Credit: 2
Department	Department of Integrated Science and Technology Communication and Informations System Program	Student Grade	3rd
Term	Year-round	Classes per Week	2
Textbook and/or Teaching Materials	Textbook: Cによる数値計算法入門（森北出版）Reference book: "A book that understands the mechanism of probability and statistics" (Gijutsuhyoronsha) "Case Study of Statistical literacy" (Work academy)		
Instructor	MATSUSHIMA Yukiko,MURAKAMI Katsuhiro,FANG Guanshen		

Course Objectives

Learning purposes : To learn the computional methods, and conduct such methods and simulation of data to solve various actual problems by using computer. To learn computional methods, and use such methods and simulation of data to solve actual problem. To learn the cases of utility of data science, and the basis skills of statistics.

Course Objectives :
1. To comprehend the basis of simulation of data.
2. To understand the basis of computional methods.
3. To understand the basis of C programming language.
4. To know the problems in massively parallel computing.

Rubric

	Excellent	Good	Acceptable	Not acceptable
Achievement 1	The student can explain the basis of simulation, and propose methods of simulation to solve actual problems.	The student understands the basis of simulation, and can try to solve actual problems via simulation.	The student partly understands the basis of simulation, and know the reasons and some methods to solve problems.	The student does not understand the basis of simulation, and does not know the reasons and some methods to solve problems.
Achievement 2	The student deeply comprehends and can represent the basis of computional methods.	The student fully comprehends the basis of computional methods.	The student roughly comprehends the basis of computional methods.	The student does not comprehend the basis of computional methods.
Achievement 3	The student deeply comprehends and can represent the basis of C programming language.	The student fully comprehends the basis of C programming language.	The student roughly comprehends the basis of C programming language.	The student does not comprehend the basis of C programming language.
Achievement 4	The student deeply comprehends and can represent the basis of data science.	The student fully comprehends the basis of data science..	The student roughly comprehends the basis of data science..	The student does not understand the basis of data science..

Assigned Department Objectives

Teaching Method

Outline	General or Specialized : Specialized Field of learning : Information science, Information Engineering and conern subjects, computational science. Relationship with Educational Objectives :This class is equivalent to "(2) Acquire basic science and technical knowledge". Course outline : In this lecture, students learn the basis of simulation and computational methods, and how to apply them on computer to sovle actual problems. In detail, students learn and understand 1) the application of C programming language, 2) basic computitional methods, and 3) solution of typical problems based on such methods. In additional, students learn the manipulation of data, the basis of statistic through actual cases. Artificial Intelligence is also concerned in class.
Style	Course method : Classes are conducted in the way of representation and students' exercises. Class focus on giving the image of solution of problem using information devices. In every lesson, representation will be given by professor in the first half(45 minutes), and students will do exercises in the second half (45 minutes). Every time a report will be given as portfolio to students to confirm their understanding. Grade evaluation method : Exams (50%) + reports submission (30%) + effort in exercises(20%). Examinations will be conducted a total of 4 times, and the evaluation ratios will be the same. The students who cannot reach 60 points in every examination, can attend additional examination. If he/she passed, his/her evaluation may be changed not more than 60 points.

Notice	Precautions on the enrollment :Students must take this class (no more than one-third of the required number of class hours missed) and earn the credit in order to complete the 3rd year course. Course advice : 1: Prepare the content of next lecture. On the other hand, review the content after every lecture. 2: Ensure that every report is submitted. Foundational subjects : Foundation of Integrated science and engineering, Information literacy, Calculus I and II, Foundation of mathematic, Foundation of linear algebra Subjects concerned: All specialized subjects since grade three. Attendance advice : 1: Computer, network, and information techniques have miracle improvement during recent years. Reading of material that related with computer and network is recommended. 2: Preparation of the content of foundational subjects. 3: Prepare and review the content of every lecture, to improve comprehension. 4: 2 times of late for class will be counted as 1 absence.

Characteristics of Class / Division in Learning

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

Must complete subjects

Course Plan

			Theme	Goals
1st Semester	1st Quarter	1st	Guidance.Introduction of content of this lecture, learning method, and usage of computers.	
		2nd	Review: the basis of C language programming (part 1).	Understand and complete C programs that include variables, conditional expression.
		3rd	Review: the basis of C language programming (part 2).	Understand and complete C programs that include array, iteration.
		4th	Review: the basis of C language programming (part 3).	Understand and complete C programs that include micro, function.
		5th	Equation: Dichotomy and exercise.	Undertand the principle of Dichotomy, make and run the program of Dichotomy.
		6th	Equation: Newton's method and exercise.	Undertand the principle of Newton's method, make and run the program of Newton's method.
		7th	Simultaneous linear equations: matrix and Upper triangular simultaneous linear equations, exercise.	Undertand the principle of Simultaneous linear equations.
		8th	Mid-term examination.	
	2nd Quarter	9th	Explanation of mid-term examination.	Unerstand the problems of mid-term examination.
		10th	Simultaneous linear equations:Gaussian elimination and exercise.	Undertand the principle of Gaussian elimination, make and run the program of Gaussian elimination.
		11th	Simultaneous linear equations:Gauss-Jordan method and exercise.	Undertand the principle of Gauss-Jordan method, make and run the program of Gauss-Jordan method.
		12th	Polynomial method: Lagrange polynomial method and exercise.	Understand the basis of Lagrange polynomial method, make and run the program of Lagrange polynomial method.
		13th	Polynomial method: Newton polynomial formula and exercise.	Understand the basis of Newton polynomial formula, make and run the program of Newton polynomial formula.
		14th	Curve fitting: Spline function and exercise.	Understand the basis of Spline function, make and run the program of Spline function.
		15th	1st semester final exam	
		16th	Return and commentary of exam answers	
2nd Semester	3rd Quarter	1st	Exercise: C program of Spline function.	Review of the basis of Spline function, complete the C program of Spline function.
		2nd	Curve fitting: Minimization of squares and exercise.	Understand the basis of Minimization of squares, make and run the program of Minimization of squares.
		3rd	Exercise: C program of minimization of squares	Review of the basis of Spline function, complete the C program of minimization of squares.
		4th	Numerical integration: Trapezoidal rule and exercise.	Understand the basis of Trapezoidal rule, make and run the program of Trapezoidal rule.
		5th	Numerical integration: Simpson's rule and exercise.	Understand the basis of Simpson's rule, make and run the program of Simpson's rule.
		6th	Differential equation: Runge–Kutta method and exercise(1).	Understand the basis of Runge–Kutta method, make and run the program of Runge–Kutta method.
		7th	Differential equation: Runge–Kutta method and exercise(2).	Understand the basis of Runge–Kutta method, make and run the program of Runge–Kutta method.
		8th	2nd semester mid-term exam	
	4th Quarter	9th	Return and commentary of exam answers	
		10th	Basis of statistic (Manipulation of data with Excel), creation of graphs and tables with Excel.	Understand the basis of statistic, and can create graphs and tables with Excel.
		11th	Basis of statistic (average, variance, standard deviation)	Understand and calculate average, variance, standard deviation for given data in Excel.

		12th	Basis of statistic (correlation coefficients)	Understand and calculate correlation coefficients for given data in Excel.
		13th	Basis of statistic (matrix of correlation coefficients) and case study	Understand and calculate correlation coefficients for given data in Excel. Understand the case of utility of data science skills.
		14th	Review of content, exercise.	
		15th	2nd semester final exam	
		16th	Return and commentary of exam answers	

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Portfolio	Total
Subtotal	60	0	0	40	100
Basic Proficiency	0	0	0	0	0
Specialized Proficiency	60	0	0	40	100
Cross Area Proficiency	0	0	0	0	0