

Tsuyama College		Year	2021		Course Title	Computational Science	
Course Information							
Course Code	0051			Course Category	General / Compulsory		
Class Format	Lecture			Credits	School Credit: 2		
Department	Department of Integrated Science and Technology Advanced Science 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）						
Instructor	TAKETANI Hisashi,MATSUSHIMA Yukiko,HATA Yoshikazu,FANG Guanshen						
Course Objectives							
Learning purposes : To learn the computational methods, and conduct such methods and simulation of data to solve various actual problems by using computer.To learn computational methods, and use such methods and simulation of data to solve actual problem.							
Course Objectives : 1. To comprehend the basis of simulation of data. 2. To understand the basis of computational 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 computational methods.		The student fully comprehends the basis of computational methods.		The student roughly comprehends the basis of computational methods.		The student does not comprehend the basis of computational 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 current problems in massively parallel computing to others.		The student fully comprehends the current problems in massively parallel computing.		The student roughly comprehends the current problems in massively parallel computing.		The student does not understand the current problems in massively parallel computing.
Assigned Department Objectives							
Teaching Method							
Outline	General or Specialized : Specialized						
	Required, Elective, etc. : Required subjects						
	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".						
	Relationship with JABEE programs :The main goals of learning / education in this class are "(C)Acquirement of the information technology".						
Style	Course outline : In this lecture, students learn the basis of simulation and computational methods, and how to apply them on computer to sovlve actual problems. In detail, students learn and understand 1) the application of C programming language, 2) basic computational methods, and 3) solution of typical problems based on such methods. In additional, students also learn current situation of massively parallel computing, which is necessary in computer simulation. At last, the heat topic in recent years, Artificial Intelligence is also concerned in class.						
	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 : Ensure that every report is submitted.
	Foundational subjects : Foundation of Integrated science and engineering,Information literacy, electrical and electronic circuit, Introduction of CAD
	Subjects concerned: All specialized subjects since grade three.
	Attendance advice : Computer, network, and information techniques have miracle improvement during recent years. Reading of material that related with computer and network is recommended. 2 times of late for class will be counted as 1 absence.

### Characteristics of Class / Division in Learning

<input type="checkbox"/> Active Learning	<input type="checkbox"/> Aided by ICT	<input type="checkbox"/> Applicable to Remote Class	<input type="checkbox"/> Instructor Professionally Experienced
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### Course Plan

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1st Semester	1st Quarter	1st	Guidance.Introduction of content of this lecture, learning method, and usage of computers.	
		2nd	The concept of simulation by computer. Exercise: login, setting of password, the basis of C language programming.	Understand the basis of simulation, and make sure the computer is able to be used.
		3rd	Equation: Dichotomy and exercise.	Understand the principle of Dichotomy, make and run the program of Dichotomy.
		4th	Equation: Newton's method and exercise.	Understand the principle of Newton's method, make and run the program of Newton's method.
		5th	Simultaneous linear equations: matrix and Upper triangular simultaneous linear equations, exercise.	Understand the principle of Simultaneous linear equations.
		6th	Simultaneous linear equations:Gaussian elimination and exercise.	Understand the principle of Gaussian elimination, make and run the program of Gaussian elimination.
		7th	Simultaneous linear equations:Gauss-Jordan method and exercise.	Understand the principle of Gauss-Jordan method, make and run the program of Gauss-Jordan method.
		8th	Mid-term examination.	
	2nd Quarter	9th	Explanation of mid-term examination.	Understand the problems of mid-term examination.
		10th	Simultaneous linear equations: shape of solutions, Linear programming.	Understand the principle of shape of solutions, and Linear programming.
		11th	Simultaneous linear equations:LU decomposition and exercise(1).	Understand the basis of LU decomposition, make and run the program of LU decomposition.
		12th	Simultaneous linear equations:LU decomposition and exercise(2).	Understand the basis of LU decomposition, make and run the program of LU decomposition.
		13th	Polynomial method: Lagrange polynomial method and exercise.	Understand the basis of Lagrange polynomial method, make and run the program of Lagrange polynomial method.
		14th	Polynomial method: Newton polynomial formula and exercise.	Understand the basis of Newton polynomial formula, make and run the program of Newton polynomial formula.
		15th	1st semester final exam	
		16th	Return and commentary of exam answers	
2nd Semester	3rd Quarter	1st	Curve fitting: Spline function and exercise.	Understand the basis of Spline function, make and run the 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	Numerical integration: Trapezoidal rule and exercise.	Understand the basis of Trapezoidal rule, make and run the program of Trapezoidal rule.
		4th	Numerical integration: Simpson's rule and exercise.	Understand the basis of Simpson's rule, make and run the program of Simpson's rule.
		5th	Numerical integration: Gaussian integral formula and exercise.	Understand the basis of Gaussian integral formula, make and run the program of Gaussian integral formula.
		6th	Numerical integration: double integral and exercise.	Understand the basis of double integral, make and run the program of double integral.
		7th	Differential equation: Runge-Kutta method and exercise(1).	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	Differential equation: Runge-Kutta method and exercise(2).	Understand the basis of Runge-Kutta method, make and run the program of Runge-Kutta method.
		11th	Partial differential equation: Difference approximation and exercise(1).	Understand the basis of Difference approximation, make and run the program of Difference approximation.

		12th	Partial differential equation: Difference approximation and exercise(2).	Understand the basis of Difference approximation, make and run the program of Difference approximation.
		13th	Partial differential equation: Difference approximation and exercise(3).	Understand the basis of Difference approximation, make and run the program of Difference approximation.
		14th	Review of content, exercise.	
		15th	2nd semester final exam	
		16th	Return and commentary of exam answers	

Evaluation Method and Weight (%)
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	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	50	0	0	20	30	0	100
Basic Proficiency	50	0	0	20	30	0	100
Specialized Proficiency	0	0	0	0	0	0	0
Cross Area Proficiency	0	0	0	0	0	0	0