Toyama College		Year	2022		Course Title	Seminar on Mathematics and Physics Application

Course Information

Course Code	0020		Course Category	Specialized / Elective
Class Format	Lecture		Credits	Academic Credit: 2
Department	Control Information Systems Engineering Course		Student Grade	Adv. 1st
Term	Second Semester		Classes per Week	2
Textbook and/or Teaching Materials				
Instructor	Ito Nao			

Course Objectives

(1) To understand Fourier transform, Laplace transform and special functions that are rerated to Fourier transform and Laplace transform.
(2) To understand how to solve physical problems using Fourier transform, Laplace transform and special functions.

Rubric

	Ideal Level of Achievement (Very Good)	Standard Level of Achievement (Good)	Unacceptable Level of Achievement (Fail)
Evaluation 1	Can properly understand the definition and the nature of Fourier transform, Laplace transform and special functions, and can solve problems for application.	Can understand the definition and the nature of Fourier transform, Laplace transform and special functions, and can solve fundamental problems.	Cannot understand the definition and the nature of Fourier transform, Laplace transform and special functions, and cannot solve fundamental problems.
Evaluation 2	Can properly use mathematical techniques for physical problems in engineering field, can solve problems for application.	Can use mathematical techniques for physical problems in engineering field, can solve fundamental problem	Cannot use mathematical techniques for physical problems in engineering field, cannot solve fundamental problems.

Assigned Department Objectives

ディプロマポリシー B-1
JABEE B1

Teaching Method

Outline	Mathematics and physics are important for acquiring technical knowledge of engineering. This course will focus on exercise for calculating equations of mathematics and physics.
Style	In the mathematics part, students will learn about the definition and the nature of Fourier transform, Laplace transform and special functions through exercises. In the physics part, students will learn about classical mechanics, introduction to quantum mechanics and how to apply the mathematical knowledge to them.
Notice	Instead of memorizing the mathematics and the physics knowledge, students are encouraged to study with focus on understanding the basic ways of thinking. Instead of being passive, students are expected to ask questions whenever they do not understand something. Because this course focuses on exercise, students should work on exercise each class in the way of self-learning. The recognition of credit requires 60 points or more rating.

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	Guidance and review for mathematics The lecture makes guidance about this course to students. Students review knowledge of mathematics that is needed for solving differential equations treated in this course.	Can solve differential equations treated in this course.
		2nd	Fourier transform (1) Students learn the definition of Fourier series expansion and how to calculate them.	Can explain Fourier series expansion and calculate its fundamental problems.
		3rd	Fourier transform (2) Students learn to solve partial differential equations using Fourier series.	Can solve partial differential equations using Fourier series.
		4th	Fourier transform (3) Students learn the expansion from Fourier series to Fourier transform.	Can explain the expansion from Fourier series to Fourier transform.
		5th	Fourier series and Riemann zeta function Students learn the definition of Riemann zeta function and how to calculate particular values of Riemann zeta function using Parseval's equation that is from Fourier series.	Can explain the definition of Riemann zeta function, and can calculate particular values of Riemann zeta function using Parseval's equation that is from Fourier series.
		6th	Exercise Students work on exercises related to problems from contents so far.	
		7th	Laplace transform (1) Students learn the definition of Laplace transform as expansion from Fourier transform.	Can explain the definition of Laplace transform as expansion from Fourier transform.
		8th	Laplace transform (2) Students learn how to calculate Laplace transform.	Can calculate Laplace transform for fundamental functions.

		9th	Laplace transform (3) Students learn Laplace inverse transform.	Can calculate Laplace inverse transform for fundamental functions.
		10th	Laplace transform (4) Students learn how to solve differential equations using Laplace transform.	Can solve differential equations using Laplace transform
		11th	Laplace transform (5) Students learn how to solve differential equations from problems of engineering field using Laplace transform.	Can solve differential equations from problems of engineering field using Laplace transform.
	4th Quarter	12th	Laplace transform and Gamma function Students learn a formula of Gamma function described from Laplace transform, and how to calculate particular values of Gamma function.	Can explain the definition of Gamma function, and can calculate particular values of Gamma function.
		13th	Application of special functions to problems of physics Students learn to solve problems of physics using Riemann zeta function and Gamma function.	Can solve physics problems using Riemann zeta function and Gamma function.
		14th	Exercise Students work on exercises related to problems from Week 7 to Week 13.	
		15th	Exercise Students work on exercises related to problems from Week 7 to Week 13.	
		16th	Final Exam	

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	70	0	0	0	30	0	100
Basic Ability	35	0	0	0	15	0	50
Technical Ability	35	0	0	0	15	0	50