Course number	U-LAS10 10014 LE55		
Course title (and course title in English)	Mathematical Description of Natural Phenomena Mathematical Description of Natural Phenomena	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,Chang, Kai-Chun
Group	Natural Sciences	Field(Classification)	Mathematics(Foundations)
Language of instruction	English	Old group	Group B
Number of credits	2		
Number of weekly time blocks	1	Class style	Lecture (Face-to-face course)
Year/semesters	2025・First semester		
Days and periods	Tue.3	Target year	Mainly 1st year students
Eligible students	For science students		

[Overview and purpose of the course]

This course aims at bridging the gap between high school mathematics and college mathematics and enhancing students’ understanding of the mathematical concepts essential for advanced courses in the Undergraduate School of Engineering. The course explores how physical phenomena in engineering - such as radioactive decay, the motion of a sprung mass, and the vibrations of a structure - are described mathematically, primarily through differential equations. Also, it covers methods for solving and interpreting these differential equations, while revisiting fundamental topics from Calculus and Linear Algebra that support these tasks.

[Course objectives]

・To understand the relationship between scientific observation and mathematics.
・To understand how physical phenomena in engineering disciplines are described using differential equations, and how to solve and interpret these equations.

[Course schedule and contents)]

* The lecture is designed to cover the following topics.

1. Introduction
- Describing phenomena, input-output system model, etc. [2 weeks]

2. Basics of Calculus
- Picture of Calculus, derivatives, basic rules, chain rule, implicit differentiation, inverse functions and their derivatives, etc. [4 weeks]
- Exponential and logarithmic functions, their derivatives, characterizations of exponential functions, etc. [2 weeks]

3. Differential equations and phenomenon descriptions
- Radioactive decay, population growth/decay, mixed growth/decay [3 weeks]
- Spring problems, equations of motion, simple harmonic motions, damped vibrations, etc. [3 weeks]

4. Feedback [1 week]

Continue to Mathematical Description of Natural Phenomena(2)↓↓↓

Mathematical Description of Natural Phenomena(2)

[Course requirements]

None

[Evaluation methods and policy]

Quizzes and exercises (50%) and final examination (50%)

[Textbooks]

Handwriting and handouts distributed in class or uploaded to the PandA course site

[References, etc.]

（References, etc.）

G. Strang 『Calculus, 2nd ed.』 （Wellesley-Cambridge Press）
W.F. Trench 『Elementary Differential Equations』 （Brooks/Cole）

[Study outside of class (preparation and review)]

Students are expected to dedicate at least 2 hours to preview and review. More than half of this time is spent preparing for class and completing assignments.

[Other information (office hours, etc.)]

Any inquiry to the instructor: chang.kaichun.4z{at}kyoto-u.ac.jp. (replace {at} with @)