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	2026・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 is designed to bridge the gap between high school mathematics and college mathematics and to strengthen the foundational understanding necessary for advanced courses in the Undergraduate School of Engineering. The course explores how physical engineering phenomena - 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 required for these tasks.

[Course objectives]

・To understand the fundamental relationship between scientific observation, physical phenomena, and their mathematical description
・To model physical phenomena in engineering disciplines using differential equations, and master the methods required to both 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. [3 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 [4 weeks]
- Spring problems, equations of motion, simple harmonic motions, damped vibrations, etc. [3 weeks]

4. Feedback [1 week]

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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 LMS 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 two hours or more per week to course material, primarily for previewing content and reviewing lectures. More than half of this time should be focused on 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 @)

[Essential courses]