| Course number | U-LAS10 10025 LE55 | | |
|---|---|---|---|
| Course title (and course title in English) | Mathematical Description of Natural Phenomena-E2<br>Mathematical Description of Natural Phenomena-E2 | Instructor's name, job title, and department of affiliation | Graduate School of Engineering<br>Senior Lecturer,ISLAM, A K M Mahfuzul |

| 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<br>(Face-to-face course) | Year/semesters | 2025・First semester |
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| Days and periods | Tue.2 | Target year | Mainly 1st year students | Eligible students | For science students |
|---|---|---|---|---|---|

## [Overview and purpose of the course]

Mathematics is a powerful tool to understand the nature. Generally, only problem-solving techniques are taught till high school. However, the beauty of mathematics lies in creating abstractions. Abstraction is creating new names for some values, processes or understandings. We understand a particular phenomenon first and then we name that phenomenon so that we can use that name in further calculation to help our understanding. For example, we have named PI as a particular value that requires some explanation. But, when we use PI in calculations we do not break down that concept every time. This course aims at developing a solid understanding of several mathematical concepts. Through this course, students will learn how various physical phenomena such as vibration of a structure, wave propagation, fluid dynamics and so on - can be described in differential equations. They will also learn how to solve those physical problems using different techniques.

## [Course objectives]

- To understand the relationship between scientific observation and mathematics
- To learn why and how most physical phenomena can be expressed using differential equations
- To learn how to formulate differential equations from physical problems
- To learn how to solve the differential equations

## [Course schedule and contents)]

1. Introduction [2 weeks]
  a) Types of natural phenomena
  b) Different types of problems and relationship with differential equations
2. Basics of Calculus [6 weeks]
  a) Review of calculus: derivatives, basic rules, chain rule, implicit differentiation, inverse functions, and their derivatives, etc.
  b) Exponential and logarithmic functions, their derivatives, characterizations of exponential functions, etc.
3. Complex number [2 weeks]
4. Differential equations and partial differential equations [2 weeks]
5. Modeling of natural phenomena using differential equations [2 weeks]
6. Examinations [1 week]
7. Feedback [1 week]

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Mathematical Description of Natural Phenomena-E2(2)

**[Course requirements]**

None

**[Evaluation methods and policy]**

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

**[Textbooks]**

Instructed during class

**[References, etc.]**

**（References, etc.）**

Introduced during class

**[Study outside of class (preparation and review)]**

Preparation and review are required. Handouts will be provided beforehand. Sample programs ( Matlab or Python) will also be provided to deepen the understanding and grow a feeling of several mathematical concepts. Students are encouraged to run the programs, visualize how differential equations evolve.

**[Other information (office hours, etc.)]**

Office hour after class.

**[Essential courses]**