

## Mathematics 3: Differential Equations (0000088)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits 5.0** **Study time 150 h**

### Course offerings in academic year 2027-2028

A (semester 2) English Incheon

### Lecturers in academic year 2027-2028

|                |      |                    |
|----------------|------|--------------------|
| Rao, Shodhan   | KR01 | lecturer-in-charge |
| Somnic, Jacobs | KR01 | staff member       |

### Offered in the following programmes in 2027-2028

|                                                                                                                            | crdts | offering |
|----------------------------------------------------------------------------------------------------------------------------|-------|----------|
| <a href="#">Bachelor of Science in Environmental Technology</a>                                                            | 5     | A        |
| <a href="#">Bachelor of Science in Food Technology</a>                                                                     | 5     | A        |
| <a href="#">Bachelor of Science in Molecular Biotechnology</a>                                                             | 5     | A        |
| <a href="#">Joint Section Bachelor of Science in Environmental Technology, Food Technology and Molecular Biotechnology</a> | 5     | A        |

### Teaching languages

English

### Keywords

Ordinary and partial differential equations, Analytical methods, Numerical methods, stability, Python libraries

### Position of the course

This course will introduce students to basic and more advanced analytical and numerical methods for solving differential equations. They also learn to implement numerical computational methods using Python libraries.

### Contents

1. Analytical methods: Ordinary differential equations: First, second and higher order, methods of undetermined coefficients and variation of parameters, second-order spring-mass-damper systems, Series solutions, Euler equation, Laplace transforms, Fourier series, method of separation of variables for parabolic partial differential equations.
2. Numerical methods: Direction fields, equilibrium points, stability and bifurcation, Euler's method and Runge-Kutta methods for first order differential equations, numerical integration.

### Initial competences

0000095 - Mathematics 1: Engineering Mathematics;  
0000083 - Mathematics 2: Multivariable Calculus and Geometry  
0000096 - Informatics.

### Final competences

- 1 Possess in-depth knowledge, insight and skills with regards to the foundation and applications of differential equations in engineering.
- 2 Identify the right technique to analytically solve a given real life problem involving simple linear differential equation.
- 3 Solve problems involving linear differential equations in certain areas of physics including mechanics, vibration and thermodynamics.
- 4 Implement and apply numerical methods for ordinary differential equations using Python libraries.
- 5 Perform correct and critical interpretations of the Python-output generated while

solving a differential equation.

### **Conditions for credit contract**

Access to this course unit via a credit contract is determined after successful competences assessment

### **Conditions for exam contract**

This course unit cannot be taken via an exam contract

### **Teaching methods**

Seminar, Lecture

### **Study material**

Type: Slides

Name: Lecture slides

Indicative price: Free or paid by faculty

Optional: no

Language : English

Type: Other

Name: Lecture notes provided in the class

Indicative price: Free or paid by faculty

Optional: no

Language : English

### **References**

W.E. Kohler, L.W. Johnson, "Elementary Differential Equations with Boundary Value Problems", 2nd Edition, Pearson, 2005

E. Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley, 2011.

W.E. Boyce, R.C. Prima, "Elementary Differential Equations", 10th Edition, Wiley, 2012.

### **Course content-related study coaching**

#### **Assessment moments**

end-of-term and continuous assessment

#### **Examination methods in case of periodic assessment during the first examination period**

Written assessment with open-ended questions

#### **Examination methods in case of periodic assessment during the second examination period**

Written assessment with open-ended questions

#### **Examination methods in case of permanent assessment**

Written assessment with open-ended questions

#### **Possibilities of retake in case of permanent assessment**

examination during the second examination period is not possible

#### **Calculation of the examination mark**

Nonperiodic Evaluation - Written examination with open questions: 20%

Periodic Evaluation (Final Exam) - Written exam with open questions: 80%

Students need to attend and participate in the exercise sessions in order to pass the course.