

Mathematics 3: Differential Equations (O000088)

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

Credits 5.0 Study time 150 h Contact hrs 60.0 h

Course offerings and teaching methods in academic year 2019-2020

A (semester 2)	English	lecture	27.5 h
		seminar: coached	20.0 h
		exercises	
		seminar: practical PC	12.5 h
		room classes	

Lecturers in academic year 2019-2020

Rao, Shodhan	KR01	lecturer-in-charge
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Offered in the following programmes in 2019-2020

	crdts	offering
Bachelor of Science in Environmental Technology	5	A
Bachelor of Science in Food Technology	5	A
Bachelor of Science in Molecular Biotechnology	5	A
Joint Section Bachelor of Science in Environmental Technology, Food Technology and Molecular Biotechnology	5	A

Teaching languages

English

Keywords

Ordinary and partial differential equations, Analytical methods, Numerical methods, MATLAB, stability

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 Matlab.

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

O000095 - Mathematics 1: Engineering Mathematics;
O000083 - Mathematics 2: Multivariable Calculus and Geometry
O000096 - 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

MATLAB software.

- 5 Perform correct and critical interpretations of the MATLAB-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

Lecture, seminar: coached exercises, seminar: practical PC room classes

Learning materials and price

A combination of written notes provided in the class and power point slides.

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

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions, skills test

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions, skills test

Examination methods in case of permanent evaluation

Written examination with open questions

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

Nonperiodic evaluation: Mid-term exam

Calculation of the examination mark

Written examination with open questions - Mid-term Exam: 20%

Final Exam: 80%

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