Course Specifications

Valid as from the academic year 2016-2017

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 2016-2017

A (semester 1)	seminar: practical PC room classes	15.0 h
	lecture	25.0 h
	seminar: coached exercises	20.0 h

Lecturers in academic year 2016-2017

Rao, Shodhan	LA10	lecturer-in-charge

Offered in the following programmes in 2016-2017	crdts	offering
Bachelor of Science in Food Technology	5	A
Joint Section Bachelor of Science in Environmental Technology, Food Technology and Molecular Biotechnology	5	A
Bachelor of Science in Environmental Technology	5	A
Bachelor of Science in 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, partial differential equations, series solutions, Fourier series, Laplace transforms
2. Numerical methods: Direction fields, equilibrium points, bifurcation, Euler's method, Runge-Kutta methods, numerical integration, finite difference methods, stability of numerical methods

Week 1: Direction fields, first order linear differential equations
Week 2: First order nonlinear, second order linear homogeneous differential equations
Week 3: Second order linear nonhomogeneous, higher order differential equations
Week 4: Method of variation of parameters, series solutions
Week 5: Euler equation, Frobenius methods, solution to heat equations
Week 6: Fourier series, Laplace transforms
Week 7: Convolution theorem, direction fields using Matlab
Week 8: Euler's method, Runge-Kutta methods
Week 9: Numerical Integration, stability of Euler's and Midpoint method
Week 10: Finite difference method, FTCS scheme and its stability
Week 11: Equilibrium points, stability and bifurcation
Week 12: Revision and tips for exams

Initial competences

In order to take this course, the student needs to have passed Mathematics I and Mathematics II.

Final competences

The student is able to recognize various types of differential equations. The student is able to apply elementary analytical solution techniques. The student can implement and apply numerical solution methods for (partial) differential equations. The student is able to perform correct and critical interpretations of the generated MATLAB-output. The student can write and interpret MATLAB-functions and scripts.

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

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

Examination methods in case of permanent evaluation

Assignment

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible in modified form

Calculation of the examination mark

Assignment 20%
Mid-term Exam: Written exam with open questions 20%
Final Exam: Written exam with open questions, skills test 60%