

Mathematics 2: Multivariable Calculus and Geometry (O000083)

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 1)	English	lecture	30.0 h
		seminar: coached	30.0 h
		exercises	

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

Series expansions, vectors, 3D Coordinate geometry, functions of several variables

Position of the course

In this course, the students are taught university level calculus, vectors, 2-d and 3-d coordinate geometry. As higher-dimensional problems are of most interest for prospective graduates, most attention will be paid to the calculus of functions of several variables. Some related topics namely sequences and power series will also be covered as the knowledge of these is necessary for any engineer.

Contents

- 1 Vectors and coordinate geometry: Conics, linear transformations, parametric curves, polar curves, length of curves, vector products, planes, straight lines in 3D, quadric surfaces, cylindrical and polar coordinate systems.
- 2 Infinite sequences and series, tests for convergence, absolute and conditional convergence, power series, Taylor and binomial series.
- 3 Differential Calculus of functions of several variables: Functions of several variables, level curves and surfaces, limits and continuity, partial derivatives, tangent planes, normal lines, chain rule, applications of partial derivatives including gradients, directional derivatives, linear and quadratic approximations, differentials, optimization of functions of several variables, method of Lagrange multipliers.
- 4 Multiple integration: Double integrals, iteration, improper double integrals, change of variables for integration, triple integrals, use of cylindrical and spherical coordinates for multiple integration, applications of multiple integration in finding volumes, mass.

Initial competences

O000095 - Mathematics 1: Engineering Mathematics.

Final competences

- 1 Possess in-depth knowledge, insight and skills with regards to the foundation and applications of coordinate geometry and multivariable calculus.
- 2 Identify the right mathematical technique to solve problems in 3 dimensional geometry commonly encountered in engineering.
- 3 Analyse and solve real life problems in engineering wherein functions of several

- variables are involved.
- 4 Visualize problems in 2- and 3-dimensional geometry.
 - 5 Understand abstract concepts involving infinite series.

Conditions for credit contract

Access to this course unit via a credit contract is unrestricted: the student takes into consideration the conditions mentioned in 'Starting Competences'

Conditions for exam contract

Access to this course unit via an exam contract is unrestricted

Teaching methods

Lecture, seminar: coached exercises

Learning materials and price

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

References

R. A. Adams & C. Essex, *Calculus: a Complete Course*, Eighth Edition, Pearson.
James Stewart, *Calculus*, 7th Edition, International metric version, Brooks/Cole
Cengage Learning, 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

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

Written examination with open questions

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

Non-periodic evaluation: Mid-term exam

Calculation of the examination mark

Non-periodic evaluation - Mid-term exam: 20%

Periodic Evaluation - Final Exam: 80%

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