| Module title | | | Abbreviation |
|---|---|---|---|
| **Further Topics from Mathematics for Mathematical Physics** | | | 10-M-EWP-122-m01 |

| Module coordinator | Module offered by |
|---|---|
| Dean of Studies Mathematik (Mathematics) | Institute of Mathematics |

| ECTS | Method of grading | Only after succ. compl. of module(s) |
|---|---|---|
| 20 | numerical grade | -- |

| Duration | Module level | Other prerequisites |
|---|---|---|
| 2 semester | undergraduate | By way of exception, additional prerequisites are listed in the section on assessments. |

**Contents**

Two of the following topics in pure or applied mathematics:
**Numerical Mathematics 1** (Solution of systems of linear equations and curve fitting problems, nonlinear equations and systems of equations, interpolation with polynomials, splines and trigonometric functions, numerical integration)
**Stochastics 1** (Combinatorics, Laplace models, selected discrete distributions, elementary measure and integration theory, continuous distributions: normal distribution, random variable, distribution function, product measures and stochastic independence, elementary conditional probability, characteristics of distributions: expected value and variance, limit theorems: law of large numbers, central limit theorem)
**Introduction to Algebra** (Fundamental algebraic structures: groups, rings, fields; Galois theory)
**Introduction to Differential Geometry** (Curves in Euclidean spaces, curvature, Frenet equations, local classification, submanifolds in Euclidean spaces, hypersurfaces in particular, curvature of hypersurfaces, geodesics, isometries, main theorem on local surface theory, special classes of surfaces)
**Geometric Analysis** (Fundamentals in analysis on manifolds, submanifolds, calculus of differential forms, Stoke's theorem and applications in vector analysis and topology)
**Introduction to Discrete Mathematics** (Techniques from combinatorics, introduction to graph theory including applications, cryptographic methods, error-correcting codes)
**Introduction to Functional Analysis** (Banach spaces and Hilbert spaces, bounded operators, principles of functional analysis).

**Intended learning outcomes**

The student is acquainted with advanced concepts and methods of pure and/or applied mathematics. Based on these fundamental mathematical concepts and methods he/she is able to persue further studies and interrelate these concepts, and realises the advantages of thinking across the borders of different branches in mathematics.

**Courses** (type, number of weekly contact hours, language — if other than German)

This module has 8 components; information on courses listed separately for each component.

- 10-M-NUM-1-122, 10-M-STO-1-122, 10-M-ALG-1-122, 10-M-DGE-1-122, 10-M-GAN-1-122, 10-M-DIM-1-122, and 10-M-FAN-1-122: V + Ü (no information on language and number of weekly contact hours available)
- 10-M-ERP-P-122: M (no information on language and number of weekly contact hours available)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

This module has the following 8 assessment components. To pass this module, students must select tow out of the 7 assessment components that are first in the list below and pass one of them, furthermore they must pass the assessment component that is last in the list below.

**Assessment in module component 10-M-NUM-1-122:** Numerische Mathematik 1 (Numerical Mathematics 1), **in module component 10-M-STO-1-122:** Stochastik 1 (Stochastics 1), **in module component 10-M-ALG-1-122:** Einführung in die Algebra (Introduction to Algebra), **in module component 10-M-DGE-1-122:** Einführung in die Differentialgeometrie (Introduction to Differential Geometry), **in module component 10-M-GAN-1-122:** Geometrische Analysis (Geometric Analysis), **in module component 10-M-DIM-1-122:** Einführung in die Diskrete Mathematik (Introduction to Discrete Mathematics), and **in module component 10-M-FAN-1-122:** Einführung in die Funktionalanalysis (Introduction to Functional Analysis) **:**

- 8 ECTS credits, pass / fail
- written examination (approx. 90 to 180 minutes). If announced by the lecturer, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 30 minutes). The module component will also be considered successfully completed if it is selected as subject of the oral examination covering several modules (separate module component for assessment purposes (Prüfungsteilmodul)) and this examination is passed.
- Language of assessment: German; English if agreed upon with examiner(s)
- Additional prerequisites: To qualify for admission to assessment, students must meet certain prerequisites. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

**Assessment in module component 10-M-EWP-P-122:** Prüfung in Erweiterung Mathematik für Mathematische Physik (Assessment in Further Topics from Mathematics for Mathematical Physics)

- 4 ECTS credits, numerical grading
- oral examination of one candidate each (approx. 30 minutes). Assessment will have reference to the topics covered in the two module components selected by students.
- Language of assessment: German; English if agreed upon with examiner(s)
- Only after successful completion of module components: Module component 10-M-EWP-P can only be taken by students who passed the written examination in one of the other seven module components.

**Allocation of places**

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**Additional information**

Additional information on module duration: 1 to 2 semesters.

**Workload**

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**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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**Module appears in**

Bachelor' degree (1 major) Mathematical Physics (2012)