## Module description: Linear Algebra 2

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| **Module Code** | t.BA.XXM3.LA2.19HS |
| **ECTS Credits** | 4 |
| **Language of Instruction/Examination** | German |
| **Organizational Unit** | IAMP |
| **Module Coordinator** | Chantal Landry |
| **Legal Framework** | The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail. |
| **Module Characteristic** | Type 2b

2 times 2 lecture lessons (not necessarily consecutive) per semester week and class |
| **Module Description** | Students are familiarised with and master the basic concepts and propositions of linear algebra and complex numbers. They can formulate simple concrete questions in the mathematical language and are able to solve these independently and present their solutions. |
| **Module Content** | **Vector spaces:**<br><br>• The n-dimensional vector space Rn and introduction to general vector spaces<br>• Vector subspaces and subspace criterion<br>• Linear independence of vectors<br>• The linear span of a set of vectors, basis und dimension of a vector space<br><br>**Linear transformations:**<br><br>• Linear transformations and matrices<br>• Kernel, image and the rank-nullity theorem<br>• Applications: geometric transformations and change of basis<br><br>**Complex numbers:**<br><br>• The Cartesian complex plane<br>• The different complex number forms<br>• Operations with complex numbers<br>• The fundamental theorem of algebra<br><br>**Eigenvalues and eigenvectors**<br><br>• Finding eigenvalues and eigenvectors<br>• Multiplicity of eigenvalues<br>• Applications: matrix diagonalization, constant-coefficient linear differential equations |
| **Prerequisite Knowledge** | Knowledge of mathematics of the technical Berufsmatura |

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| **Learning Objectives (Competences)** | Students... | Competencies | Taxonomies |
|---|---|---|---|
| | You understand vectors as elements of a vector space. | F, M | K2 |
| | You are familiar with the linear independence of vectors and can assess this using mathematical argumentation. | M, F | K2, K3 |
| | You understand the concepts of linear span of a set of vectors and basis of a vector space. | F, M | K2 |
| | You are able to determine a basis and the dimension of a vector space. | F, M | K3 |
| | You understand the connection between linear mappings and the matrix calculus and know the representation matrices of some geometric transformations. | F, M | K2, K3 |
| | You understand the concepts of the kernel and image of a linear mapping and can determine these. | M, F | K2, K3 |
| | You can describe the base change between two bases of a vector space using a transformation matrix. | M, F | K2, K3 |
| | You know complex numbers in their different forms and can visualize them. | F, M | K2 |
| | You can perform calculations with complex numbers. | M, F | K3 |
| | You can calculate eigenvalues, eigenvectors and eigenspaces of a linear mapping. | M, F | K2, K3 |

| **Performance Assessment** | **End-of-module exam** | **Assessment** | **Length (min.)** | **Weighting** | **Form** |
|---|---|---|---|---|---|
| | written exam | Grade | 90 | 80 | acc. to module agreement |

| | **Performance assessment during the semester** | **Assessment** | **Length (min.)** | **Weighting** | **Form** |
|---|---|---|---|---|---|
| | Intermediate test<br>*An intermediate written test, the mark for which, only in the event of a positive contribution, counts for 20% of the total mark.* | Grade | 45 | 20 | acc. to module agreement |

| **Classroom Attendance Requirement** | None |
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| **Learning material** | • Gramlich, G. Lineare Algebra Eine Einführung. Carl Hanser. ISBN 978-3-446-44103-3.<br>• Papula, L. Mathematik für Ingenieure und Naturwissenschaftler (Bände I und II). Springer Vieweg Wiesbaden. ISBN 978-3-658-05620-9.<br>• Ruhrländer, M. (2017). Lineare Algebra für Naturwissenschaftler und Ingenieure. Pearson Studium. ISBN 978-3-86326-767-4. |
| **Comments** | |