

Module title		Abbreviation
<b>Mathematics 4 for Students of Physics and related Disciplines (Complex Analysis)</b>		11-M-F-152-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
<p>Basic knowledge of functional analysis that is required in the course Quantum Mechanics I. The definition of Hilbert space opens up understanding of quantum mechanical states as vectors. The representation-free form of quantum mechanics and the representation as a wave function generated by basic states form an important element of the formal framework of quantum mechanics with the so-called bracket formalism by Dirac.</p> <p>Fundamentals of partial differential equations in physics and systems of differential equations.</p> <p>Part I: functional analysis</p> <p>1.1 Linear vector spaces</p> <p>1.2 Metric, standardized spaces</p> <p>1.3 Linear operators</p> <p>1.4 Function space, completion, Lebesgue integral, Hilbert space</p> <p>1.5 Linear operators on the Hilbert space</p> <p>1.6 Matrix representation of operators</p> <p>1.8 The Dirac delta function and its different representations</p> <p>Part II: differential equations</p> <p>2. Partial differential equations</p> <p>2.1 Linear partial differential equations of 2nd order</p> <p>2.2 1D and 3D wave equation</p> <p>2.3 Helmholtz equation and potential theory</p> <p>2.4 Parabolic differential equations</p>		
Intended learning outcomes		
The student has basic knowledge of mathematics and basic knowledge of Hilbert space mathematics, as well as knowledge of solution methods for partial differential equations and is proficient in the necessary computing techniques.		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>V (4) + Ü (2)</p> <p>Module taught in: Ü: German or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)		
<p>written examination (approx. 120 minutes)</p> <p>Language of assessment: German and/or English</p>		
Allocation of places		
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Additional information		
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Workload		
240 h		

**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) Physics (2015)  
 Bachelor' degree (1 major) Nanostructure Technology (2015)  
 Bachelor' degree (1 major) Physics (2020)  
 Bachelor' degree (1 major) Nanostructure Technology (2020)  
 Bachelor' degree (1 major) Functional Materials (2021)  
 Bachelor' degree (1 major) Quantum Technology (2021)  
 exchange program Physics (2023)