Module Description 24-B-GT Geometry and Topology

Faculty of Mathematics

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This module guide reflects the current state and is subject to change. Up-to-date information and the latest version of this document can be found online via the page

https://ekvv.uni-bielefeld.de/sinfo/publ/modul/525585868

The current and valid provisions in the module guide are binding and further specify the subject-related regulations (German "FsB") published in the Official Announcements of Bielefeld University.

Non-official translation of the module descriptions. Only the German version is legally binding.

24-B-GT Geometry and Topology

Faculty

Faculty of Mathematics

Person responsible for module

Prof. Dr. Stefan Bauer

Regular cycle (beginning)

Every summer semester

Credit points

10 Credit points

Competencies

Students familiarise themselves with the basic concepts of set-theoretical topology. They develop an understanding of how these concepts provide a connection to spatial visualisation for many initially abstract and vague problems. Students will be able to use spatial visualisation to conduct independent mathematical proofs. They learn how to deal with various geometric objects of central importance and acquire basic knowledge and skills that are required in in-depth courses on algebraic geometry, algebraic topology, differential geometry, global analysis, functional analysis, algebra, number theory and mathematical physics. They are confident in applying the methods of geometry and topology and can successfully transfer them to new problems in geometry and topology.

In the tutorials, students demonstrate the acquisition of competences in the technologies of geometry and topology, the ability to apply the associated concepts, presentation and communication skills as well as perseverance as a basic mathematical competence. An understanding of the concepts and their interrelationships as well as confidence in applying the methods to new problems is demonstrated in the final exam.

Content of teaching

- Topological spaces, continuous mappings and associated constructions
- Coherence, separation and compactness properties
- Fundamental group, theorem of Seifert and van Kampen
- Superposition theory, lifting theorem and topological Galois theory
- Manifolds, vector and fibre bundles, vector fields and differential forms

Optionally, the teaching staff can cover further topics:

- Introduction of categories, functors and sheaves
- Gaussian curvature, Gauss-Bonnet theorem, Euler characteristic
- Fibres

Recommended previous knowledge

Knowledge of analysis and linear algebra

Necessary requirements

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Explanation regarding the elements of the module

The module cannot be studied together with module 24-B-GT-5.

Module structure: 1 SL, 1 bPr [1]

Courses

Title	Type	Regular cycle	Workload [5]	LP[2]
Geometry and Topology	lecture	SoSe	60 h (60 + 0)	2 [Pr]
Tutorial on Geometry and Topology	exercise	SoSe	90 h (30 + 60)	3 [SL]

Study requirements

Allocated examiner	Workload	LP[2]
Teaching staff of the course **Tutorial on Geometry and Topology (exercise)** *Regular completion of the exercises on geometry and topology, each with a recognisable solution approach, as well as participation in the exercise groups on geometry and topology (The students regularly contribute to the scientific discussions in the exercise group. In particular, comments and questions on the proposed solutions presented as well as twice-calculating exercises when requested). The organiser may replace some of the exercises with face-to-face exercises.*	see above	see above

Examinations

Allocated examiner	Type	Weighting	Workload	LP[2]

Teaching staff of the course **Geometry and Topology (lecture)** *Proof of a sufficient number of correctly solved exercises, which are worked on as part of the study requirements of the module (usually 50% of the points achievable in the semester for solving the exercises) and passing a final exam in the form of a written exam (usually 90 min) or anl oral exam (usually 30 min). The final exam relates to the content of the lecture and the tutorial and is used for assessment.* *A remote electronic written examination is not permitted as a final exam.*	e-Portfolio mit mündlicher Abschlussprüfung o. e-Portfolio mit schriftlicher Abschlussprüfung o. Portfolio mit mündlicher Abschlussprüfung o. Portfolio mit schriftlicher Abschlussprüfung	1	150h	5

Legend

1 The module structure displays the required number of study requirements and examinations.

2 LP is the short form for credit points.

3 The figures in this column are the specialist semesters in which it is recommended to start the module. Depending on the individual study schedule, entirely different courses of study are possible and advisable.

4 Explanations on mandatory option: "Obligation" means: This module is mandatory for the course of the studies; "Optional obligation" means: This module belongs to a number of modules available for selection under certain circumstances. This is more precisely regulated by the "Subject-related regulations" (see navigation).

5 Workload (contact time + self-study)

SoSe Summer semester

WiSe Winter semester

SL study requirement

Pr Examination

bPr Number of examinations with grades

uPr Number of examinations without grades