

课程大纲
COURSE SYLLABUS
2025

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| 1. | 课程代码/名称 Course Code/Title | Differentiable Manifolds |
| 2. | 课程性质 Compulsory/Elective | Compulsory |
| 3. | 课程学分/学时 Course Credit/Hours | 48 |
| 4. | 授课语言 Teaching Language | English |
| 5. | 授课教师 Instructor(s) | Ingrid Irmer |
| 6. | 是否面向本科生开放 Open to undergraduates or not | Yes |
| 7. | 先修要求 Pre-requisites | <p>(如面向本科生开放，请注明区分内容。)</p> <p>Linear Algebra, Calculus, Abstract algebra 1, Real Analysis, Vector Calculus and Topology 1. Helpful : Differential Geometry, Algebraic Topology and Dynamical Systems</p> |
| 8. | 教学目标 Course Objectives | <p>(如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.)</p> <p>This is a first graduate course on smooth manifolds, introducing various aspects of their topology, geometry, and analysis. We will start at the beginning with the definition of a smooth manifold, look at some examples, and then explore the basic associated objects, including submanifolds, tangent vectors, bundles, and derivatives. We will apply the inverse function theorem to geometric issues like transversality, and then look at vector fields, associated flows, and the Lie derivative. Differential forms on manifolds will also be a focus, including how to differentiate and integrate them over smooth manifolds. This will require a very brief introduction to Riemannian geometry. In addition to treating the foundations of the subject carefully, this course aims to emphasize examples and geometric intuition throughout. Time permitting, there will be some special topics treated at the end of the course. These will be decided based on student preferences.</p> |
| 9. | 教学方法 Teaching Methods | <p>(如面向本科生开放，请注明区分内容。 The lectures will focus on important definitions, worked examples and intuition. Students are required to read the more detailed treatment in the textbook. References for background reading on related topics will be provided, and interested students are encouraged to use these to deepen their knowledge in areas of particular interest to them, or of relevance to their research projects.</p> |
| 10. | 教学内容 Course Contents | <p>(如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.)</p> |

Section 1

Smooth Manifolds

Section 2

Smooth Maps

Section 3

Vector Fields

Section 4

Submersions, Immersions and Embeddings

Section 5

Submanifolds

Section 6

Sard's Theorem

Section 7

Lie Groups

Section 8

Vector Fields

Section 9

Integral Curves and Flows

Section 10

Vector Bundles

Section 11

Cotangent bundles

Section 12

Multilinear Algebra

Section 13

Riemannian Metrics

Section 14

Differential Forms

Sections 15 and 16

Integration on Manifolds

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11.**课程考核****Course Assessment**

(☐ 1 考核形式 Form of examination; ☐ 2 . 分数构成 grading policy; ☐ 3 如面向本科生开放, 请注明区分内容。

If the course is open to undergraduates, please indicate the difference.)

Monthly homework assignments: (35%)

Midterm Exam: (30%)

Final Exam: (35%)

12.**教材及其它参考资料****Textbook**

Lee, John M. Introduction to smooth manifolds. Second edition.

Graduate Texts in Mathematics, 218. Springer, New York, 2013. xvi+708 pp.