DIFFERENTIABLE MANIFOLDS

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SS 2022

PROGRAM

(1) Basic concepts. Charts, atlases, manifolds. Coordinates. Dimension. The implicit function theorem. Maps. Submanifolds. Topological manifolds. Bump functions and partitions of unity.
(2) The tangent space and the tangent bundle. Vector fields as derivations. The Lie bracket. The pushforward. The Lie derivative. Frobenius theorem.
(3) Vector bundles. Densities and integration. The divergence of vector fields. The cotangent bundle. The tensor bundle. Riemannian metrics.
(4) Differential forms. The de Rham differential. Cohomology and the Poincaré lemma. Graded linear algebra and the Cartan calculus. Orientation and the integration of differential forms. Manifolds with boundary and Stokes theorem.

REFERENCES

[1] A. S. Cattaneo, *Notes on Manifolds*, 2018.

See also:

[2] R. Bott and L. W. Tu, *Differential Forms in Algebraic Topology,* Springer 1982.
[3] N. Hitchin, *Differentiable Manifolds,*
   https://people.maths.ox.ac.uk/hitchin/hitchinnotes/manifolds2012.pdf
[4] J. M. Lee, *Introduction to Smooth Manifolds,* Springer 2002.
[5] F. W. Warner, *Foundations of Differentiable Manifolds and Lie Groups,* Springer 1983.