Geometry & Physics

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The course is designed to provide a self-contained introduction to the methods of coordinate-free differential geometry and describe some important applications of these concepts to mathematical physics.

The below are taken from the lecture notes, which may be downloaded from my webpage `www-thphys.physics.ox.ac.uk/users/JamesBinney/`

1 Basic equipment

1.1 Tangent vectors and Lie derivatives

1.2 Vector fields and Lie derivatives

1.3 Mapping manifolds

1.4 Tensors and forms

1.5 Exterior derivatives

1.6 Integration of forms

2 Hamiltonian mechanics

2.1 Canonical coordinates

2.2 Canonical transformations

3 Fibre bundles

3.1 Connections

3.2 Electromagnetism as a gauge field

3.3 Torsion and curvature

3.4 Cartan structural equations

3.5 General gauge fields and Lie groups

3.6 Yang–Mills theory

4 Riemannian spaces

4.1 The Hodge $*$ operator

4.2 Riemannian connection