A smooth \( n \)-dimensional manifold is a space obtained by gluing together copies of \( \mathbb{R}^n \) by using smooth maps. Standard examples of smooth \( n \)-manifolds are \( \mathbb{R}^n \) itself, \( n \)-spheres, or \( n \)-dimensional real projective spaces.

Differential topology is the study of smooth manifolds which merges tools from calculus with ideas from topology. The key point in the definition of a smooth manifold is the description of the space (and interesting equations on them) in a coordinate independent manner. This is a very powerful idea which has many applications to many other areas of mathematics. Differential topology also has many applications to modern theoretical physics particularly in relativity and quantum field theory since the fundamental equations of nature are coordinate invariant.

In this course, we will introduce smooth manifolds, smooth maps, tangent bundles and vector fields, immersions and submersions, distributions and foliations, tensors, differential forms, and integration, fiber bundles and connections and curvature. Other topics will be covered if there is time.