

GEOMETRY AND TOPOLOGY

PROF. DR. A. S. CATTANEO

HS 2017

PROGRAM

- (1) Basic concepts in point set topology. Connected and compact spaces. Continuous functions and their properties. Product topology. The Tychonoff theorem (no proof required).
- (2) Separation axioms; in particular, Hausdorff spaces.
- (3) Homotopy. The fundamental group and its properties. Covering spaces and their relation to the fundamental group.
- (4) Parametrized curves. Arc length. Frénet formula. Plane curves.
- (5) Regular surfaces: definition, properties, and examples. Surfaces of revolution. The tangent plane and the differential of a map. The first fundamental form. Area of a surface. Orientation.
- (6) The Gauss map and its properties. The second fundamental form. Curves on surfaces: normal curvature. The principal curvatures. The Gaussian curvature. Area and curvature. Vector fields.
- (7) Local isometries. Theorema egregium. Parallel transport and geodesics. The theorem of turning tangents. The Gauss–Bonnet theorem (without proof).

REFERENCES

- [1] I. M. SINGER and J. A. THORPE, *Lecture Notes on Elementary Topology and Geometry*, Chapters 1, 2, 3. Springer, 1976.
- [2] M. DO CARMO, *Differential Geometry of Curves and Surfaces*, Chapters 1, 2, 3, 4 (without 4.6 and 4.7). Dover, 2016.