# GE430 Differential Geometry 2
## A.A. 2014/2015

**Prof. Massimiliano Pontecorvo**

**Topics in Riemannian Geometry**

Prerequisite: Geometry of surfaces, Gaussian curvature.

**1. Introduction.** We will treat some aspects of the relation between Riemannian geometry and topology of manifolds. In particular, the aim is to prove Gauss-Bonnet theorem for surfaces and Hopf-Rinow theorem which holds in any dimension. Both results will be proved using the study of geodesics; namely the curves which, at least locally, minimize the distance on a Riemannian manifold.

**2. Integration on surfaces.** Area of a surface and total Gaussian curvature.

**3. Covariant derivative.** Covariant derivative of a tangent vector field. Parallel transport and geodesics. Geodesic curvature.

**4. Gauss-Bonnet theorem.** Proof of Gauss-Bonnet theorem, local and global version. Relations between topology and geometry of surfaces.

**5. Hopf-Rinow theorem.** Riemnnian manifolds of arbitrary dimension. The exponential map in Riemannian geometry. Convex neighborhoods. Complete manifolds: proof of Hopf-Rinow theorem. Applications: rigidity of the sphere.

**6. Exercises.** Written exercises at home and in class.

## Testi consigliati


[1] M. Do Carmo , *Differential Geometry of Curves and Surfaces*. Prentice Hall, (1976).
[2] M. Do Carmo , *Riemannian Geometry*. Birkäuser, (1992).
[3] M.Abate, F.Tovena, *Curve e Superfici*. Springer, (2006).
[4] Marco Abate, Francesca Tovena, *Geometria Differenziale*. Springer, (2011).


## Modalità d'esame

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|---|---|---|---|
| - valutazione in itinere ("esoneri") | | ■ SI | □ NO |
| - esame finale | scritto | ■ SI | □ NO |
| | orale | ■ SI | □ NO |
| - altre prove di valutazione del profitto | | □ SI | ■ NO |