DIFFERENTIAL GEOMETRY, D COURSE, 24 LECTURES

- Smooth manifolds in $\mathbb{R}^n$, tangent spaces, smooth maps and the inverse function theorem. Examples, regular values, Sard's theorem (statement). [4]

- Notions of transversality and intersection numbers mod2, degree mod 2. [3]

- Curves in 2-space and 3-space, arc-length, curvature, torsion. The isoperimetric inequality. [2]

- Smooth surfaces in 3-space, First fundamental form, Area. [2]

- The Gauss map, second fundamental form, principal curvatures and Gaussian curvature. Theorema Egregium. [3]

- Minimal surfaces. Normal variations and characterization of minimal surfaces as critical points of the area functional. Isothermal coordinates and relation with harmonic functions. The Weierstrass representation. Examples. [3]

- Parallel transport and geodesics for surfaces in 3-space. Geodesic curvature.[2]

- The exponential map and geodesic polar coordinates. The Gauss-Bonnet theorem (including the statement about classification of compact surfaces). [3]

- Global theorems on curves: Fenchel's theorem: the total curvature of a simple closed curve is greater than or equal to 2π. The Fary-Milnor theorem: the total curvature of a simple knotted closed curve is greater than 4π. [2]

Bibliography.

(1) M. Do Carmo, *Differential Geometry of Curves and Surfaces,* Prentice-Hall, Inc., Englewood Cliffs, N.J., 1976
(2) V. Guillemin, A. Pollack , *Differential Topology,* Prentice-Hall, Inc., Englewood Cliffs, N.J., 1974.
(3) J. Milnor, *Topology from the differentiable viewpoint,* Revised reprint of the 1965 original. Princeton Landmarks in Mathematics. Princeton University Press, Princeton, NJ, 1997.
(4) B. O'Neill, *Elementary Differential Geometry,* Harcourt 2nd ed 1997.

(5) A. Pressley, *Elementary Differential Geometry,* Springer Undergraduate Mathematics Series, Springer-Verlag London Ltd. 2001.
(6) I.M. Singer, J.A. Thorpe, *Lecture notes on elementary topology and geometry,* Undergraduate Texts in Mathematics. Springer-Verlag, New York-Heidelberg, 1976.
(7) M. Spivak, *A Comprehensive Introduction to Differential Geometry,* Vols. I-V, Publish or Perish, Inc. 1999.
(8) J.A. Thorpe, *Elementary Topics in Differential Geometry,* Springer-Verlag 1995.