Subject: The classical differential geometry of curves and surfaces. The lectures will be self-contained. The course will conclude with proofs of the theorems of Gauss & Bonnet and of Poincaré & Hopf connecting total curvature (from the geometry of surfaces), genus (from topology) and total index of vector fields (from analysis and differential equations).

Prerequisites: Linear algebra (Eq., Math 20F or equivalent), vector calculus (Eq., Math 20E of equivalent), and course on "mathematical reasoning" (Eq. Math 109 or equivalent).

Grades will be based on: participation in class and discussion section, a notebook of problems due at the end of the quarter, and the final exam. In solving the problems, you may collaborate, and you may consult the instructor or assistant -- just be sure to credit the ideas and work of others. Cite all sources appropriately - books, research papers, and websites.

Instructor J. Fillmore APF 6250 858 534 2651 jfillmore@ucsd.edu

Books on reserve in Science and Engineering Library - at the circulation desk. Books may be checked out for 48 hours - with the exception of the five Spivak volumes which may be checked out for three hours. Do browse in the stacks.

do Carmo, Manfredo Perdigao
  Differential geometry of curves and surfaces
  QA641 .C33

Global differential geometry,
  S.S. Chern, editor; contributors, Lamberto Cesari et al.
  MAA Studies in mathematics; vol. 27.
  QA1 M426 v.27

Klingenberg, Wilhelm
  A course in differential geometry
  Springer-Verlag, New York, c1978.
  QA641 .K5813

Millman, Richard S. and Parker, George D.
  Elements of differential geometry
  QA641 .M52

O'Neill, Barrett
  Elementary differential geometry
  QA641 .O58

Spivak, Michael
  A comprehensive introduction to differential geometry, 2d ed.
  QA641 .S59 1979 1-5 (5 volumes)

Struik, Dirk Jan
  Lectures on classical differential geometry, 2d ed.
  QA641 .S72 1961

Willmore, Thomas
  An introduction to differential geometry
  QA641 .W738
Outline [tentative]

Lecture 0. Introduction
Lecture 1. Curves in space. Local theory.
Lecture 2. Curves in space. Some global theorems.
Lecture 3. Surfaces in space. First fundamental form.
Lecture 5. Surfaces in space. Fundamental equations.

Historical - important contributors to differential geometry:

R. Descartes 1596-1650 Analytic geometry
C. Huygens 1629-1695 Curvature & evolutes
G.W. Leibniz 1646-1716 Calculus
I. Newton 1647-1727 Calculus
L. Euler 1707-1783 Curves and surfaces
G. Monge 1746-1818 Curves and surfaces
C. Dupin 1784-1873 Curves and surfaces
A.L. Cauchy 1789-1857 Curvature and contact
J.C.F. Gauss 1777-1855 Intrinsic geometry of surfaces
- "Disquisitiones"
B. Riemann 1828-1866 Higher dimensional spaces
G. Darboux 1842-1917 Leçons ...
G. Ricci 1853-19?? Tensor calculus
T. Levi-Civita 1873-19?? Tensor calculus
A. Einstein 1879-1955 General Relativity
F. Klein 1849-1925 Erlanger programme
S. Lie 1847-1899 Continuous groups
E. Cartan 1869-1949 Moving frames, exterior calculus
W. Blaschke 1885-1962 Miscellaneous theorems
C. Chevalley ????- Lie groups
G. de Rham ????- Harmonic forms and topology
S.S. Chern ????- Geometry and topology.

--- and many others