School of Mathematics

Course 447 — Differential Geometry and Topology 2005-06
(JS & SS Mathematics, SS Theoretical Physics)

Lecturer: Dr. C. Lazaroiu

Requirements/prerequisites: A good understanding of certain results in multivariate analysis. (211, 221)

Duration: 21 weeks

Number of lectures per week: 3 including tutorials

Assessment:

End-of-year Examination: One 3-hour exam in May/June.

Description:

The course is an introduction to differential geometry and topology at the advanced undergraduate/begging graduate level.

The course is recommended to mathematicians and to those theoretical physicists interested in gravitational physics and gauge theories.

The course is concerned with mathematical results, and not with physical applications.

The following topics will be covered:

• Basic differential geometry (manifolds, differential structures, differentiable maps, vector and tensor fields, differential forms, Cartan calculus, Lie group actions, orientability, integration on manifolds, de Rham cohomology)

• Basic Riemannian geometry (metrics, Levi-Civita connection, curvature tensor, basic Hodge theory)

• Fiber bundles (principal and vector bundles, connections, characteristic classes, Chern-Weyl theory)

• Elements of algebraic topology (homology and cohomology theories, applications to singular, Chech and de Rham theories). Warning: The course assumes a certain amount of mathematical maturity, in particular a thorough understanding of analysis, multilinear algebra, group theory, general topology and basic category theory.


Textbooks:


Recommended: The treatment of some topics is inspired by the following books:


• Michael Spivak, A comprehensive introduction to differential geometry vols 1-5, Publish or Perish, Inc; 3rd edition (1999) ISBN 0914098705


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