

**Module: Elective Advanced Lectures:
BCGS Courses**

Module No.: physics70d

Course:



Topology for Physicists (T)

Course No.:

Category	Type	Language	Teaching hours	CP	Semester
Elective	Lecture with exercises	English	3+1	6	ST

Requirements for Participation:

Preparation:

Bachelor of physics or mathematics; the basics of exterior calculus are assumed

Form of Testing and Examination:

Written or oral examination

Length of Course:

1 semester

Aims of the Course:

This course gives an introduction to various topological concepts and results that play an important role in modern theoretical physics.

Contents of the Course:

Elements of homotopy theory: homeomorphic spaces, homotopic maps, fundamental group, covering spaces, homotopy groups, long exact homotopy sequence of a fibration
 Homology and cohomology: Poincare lemma, Mayer-Vietoris sequence, Cech-deRham complex, Hurewicz isomorphism theorem, spectral sequences
 Vector bundles and characteristic classes: Euler form, Thom isomorphism, Chern classes
 Applications: Berry phase; Dirac monopole problem; visualization of closed differential forms by Poincare duality; cohomology of electrical conductance; supersymmetry and Morse theory; index theorems; homotopy classification of topological insulators

Recommended Literature:

R. Bott and L.W. Tu: Differential forms in algebraic topology (Springer, 1982)
 A.S. Schwarz, Topology for physicists (Springer, 1994)