

UNIVERSITY OF CRETE
DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS

2026-27 Seminar on Spin Geometry and Dirac operators

I. Spin Geometry

1. Abstract description of the exterior algebra of a vector space
2. Clifford algebras
3. The Clifford algebra of the euclidean n -space
4. The spin group
5. The spin representation
6. The spin^c group
7. Quaternionic structures on spinor spaces
8. Reduction of principal fiber bundles
9. Spin structures of principal $SO(n, \mathbb{R})$ -bundles, $n \geq 3$
10. Spin structures of associated principal bundles
11. Spin^c structures
12. Associated spinor bundles

II. Dirac operators

1. Connections on spinor bundles
2. Curvature formulas
3. Dirac operators in spinor bundles
4. Hermitian manifolds and spinors
5. The Dirac operator of a Riemannian symmetric space
6. Essential self-adjointness
7. Dirac operators and topology
8. Eigenvalue estimates
9. Killing spinors
10. The twistor equation in Riemannian manifolds
11. The Seiberg-Witten equation
12. The Seiberg-Witten invariants

Bibliography

1. T. Friedrich, Dirac-Operatoren in der Riemannschen Geometrie, Vieweg, 1997
2. M.J.D. Hamilton, Mathematical Gauge Theory with applications to the standard model of particle Physics, Springer, 2017
3. H.B. Lawson and M.-L. Michelsohn, Spin Geometry, Princeton University Press, 1989
4. S. Kobayashi and K. Nomizu, Foundations of Differential Geometry, Vol. I, Interscience Publishers, 1963

The seminar lectures will be held every Wednesday at 09:00 in room B 212.