Differential Geometry & Mathematical Physics: Syllabus (2019)

- Manifolds and vector bundles; sections of vector bundles
- Jet-bundles (of functions, maps, sections of bundles)
- Tangent and cotangent bundles; modules of vector fields and 1-forms
- Pullback, pushforward and Lie derivative along vector field
- Tensor products, tensors and tensor bundles
- Symmetric and alternating (skew) tensors
- Exterior forms, de Rham differential, inner product (contraction)
- Cartan and Weyl (infinitesimal Stokes) formulas
- Commutator of vector fields, commutator of super-derivations i_X, d, L_X
- Abstract Lie algebras (including infinite-dimensional) and algebras of vector fields
- Abstract Lie groups (finite-dimensional) and their actions on manifold
- Particular geometric strucures: Riemannian, (almost) complex, symplectic, Hermitian
- Linear connections on abstract budles and on a manifold (on its tangent)
- Torsion and curvature of a connection
- Vector distributions, their curvatures and (Frobenius) integrability
- Lie equation as PDE system for symmetries of geometric structures
- Cartan distribution on jet-spaces
- Contact vector fields, prolongations and Lie fields
- Geometric theory of differential equations
- Classical symmetries of differential equations
- Differential invariants and invariant derivations