

# List of Topics

## Basic Differential Geometry Course

### I. Differential Geometry of Varieties, differentiability and tensors

1. Differential Geometry of Varieties on  $\mathbb{R}^n$  as level sets (locally)
2. Concept of topological space and abstract differential varieties
3. Tangent vectors and tangent face. Tensors
4. Differentiability. Theorem of inverse function and applications to immersion and submersion. Unit Partitioning. Whitney Theorem.

### II. Elementary Properties of Lie groups

1. Matrix Lie Groups
2. Subgroups and homomorphism
3. Uniparametric subgroups and exponential mapping

### III. Transversality and intersection number

1. Transversality and Sard's theorem
2. Intersection number and mapping degree
3. Jordan's Separation Theorems and Borsuk-Ulam theorem. Fundamental theorem of algebra.

### IV. Integration and elements of Rham cohomology

1. Differential forms and integration
2. Outer Derived and Rham cohomology
3. Stokes' theorem
4. Singular cohomology and Rham theorem

### V. Elementary Properties of Riemann metrics

1. Riemann metrics and examples
2. Covariant Derivative and Geodesic for fit varieties on  $\mathbb{R}^n$
3. Curvature and topology and geometry applications

### VI. Elementary Properties of Curvature

1. Variation formulas
2. Jacobi Fields
3. Elementary Properties of constant curvature varieties

## REFERENCE

- Boothby, W.M. An introduction to differentiable manifolds and Riemannian geometry
- do Carmo, M. Differential geometry of curves and surfaces
- Guillemin, V., Pollack, A. Differential Topology
- Hirsch, V. Topology
- Milnor, J. Topology from a Differential Viewpoint
- Spivak, M. Calculus on Manifolds
- Warner, F. Foundations of Differentiable Manifolds and Lie Groups