

Table of Contents

Chapter 1: Foundations

1.0	Review of Differential Calculus and Topology	1
1.1	Differentiable Manifolds	8
1.2	Tensor Bundles	13
1.3	Immersions and Submersions	23
1.4	Vector Fields and Tensor Fields	31
1.5	Covariant Derivation	39
1.6	The Exponential Mapping	53
1.7	Lie Groups	59
1.8	Riemannian Manifolds	67
1.9	Geodesics and Convex Neighborhoods	78
1.10	Isometric Immersions	86
1.11	Riemannian Curvature	97
1.12	Jacobi Fields	109

Chapter 2: Curvature and Topology

2.1	Completeness and Cut Locus	124
2.1	Appendix – Orientation	136
2.2	Symmetric Spaces	141
2.3	The Hilbert Manifold of H^1 -curves	158
2.4	The Loop Space and the Space of Closed Curves	170
2.5	The Second Order Neighborhood of a Critical Point	181
2.5	Appendix – The S^1 - and the \mathbb{Z}_2 -action on AM	196
2.6	Index and Curvature	203
2.6	Appendix – The Injectivity Radius for 1/4-pinched Manifolds	212
2.7	Comparison Theorems for Triangles	215
2.8	The Sphere Theorem	229
2.9	Non-compact Manifolds of Positive Curvature	240

Chapter 3: Structure of the Geodesic Flow

3.1	Hamiltonian Systems	256
3.2	Properties of the Geodesic Flow	265

3.3	Stable and Unstable Motions	279
3.4	Geodesics on Surfaces	288
3.5	Geodesics on the Ellipsoid	303
3.6	Closed Geodesics on Spheres	324
3.7	The Theorem of the Three Closed Geodesics	337
3.8	Manifolds of Non-Positive Curvature	350
3.9	The Geodesic Flow on Manifolds of Negative Curvature	363
3.10	The Main Theorem for Surfaces of Genus 0.	380
	References	393
	Index	403