

---

# Contents

Preface	ix
CHAPTER I. Manifolds and Vector Fields	1
1. Differentiable Manifolds	1
2. Submersions and Immersions	16
3. Vector Fields and Flows	21
CHAPTER II. Lie Groups and Group Actions	41
4. Lie Groups I	41
5. Lie Groups II. Lie Subgroups and Homogeneous Spaces	60
6. Transformation Groups and $G$ -Manifolds	66
7. Polynomial and Smooth Invariant Theory	85
CHAPTER III. Differential Forms and de Rham Cohomology	99
8. Vector Bundles	99
9. Differential Forms	113
10. Integration on Manifolds	122
11. De Rham Cohomology	129
12. Cohomology with Compact Supports and Poincaré Duality	139
13. De Rham Cohomology of Compact Manifolds	151
14. Lie Groups III. Analysis on Lie Groups	158
15. Extensions of Lie Algebras and Lie Groups	169

---

CHAPTER IV. Bundles and Connections	191
16. Derivations on the Algebra of Differential Forms	191
17. Fiber Bundles and Connections	200
18. Principal Fiber Bundles and $G$ -Bundles	210
19. Principal and Induced Connections	229
20. Characteristic Classes	251
21. Jets	266
CHAPTER V. Riemann Manifolds	273
22. Pseudo-Riemann Metrics and Covariant Derivatives	273
23. Geometry of Geodesics	289
24. Parallel Transport and Curvature	298
25. Computing with Adapted Frames and Examples	310
26. Riemann Immersions and Submersions	327
27. Jacobi Fields	345
CHAPTER VI. Isometric Group Actions or Riemann $G$ -Manifolds	363
28. Isometries, Homogeneous Manifolds, and Symmetric Spaces	363
29. Riemann $G$ -Manifolds	371
30. Polar Actions	385
CHAPTER VII. Symplectic and Poisson Geometry	411
31. Symplectic Geometry and Classical Mechanics	411
32. Completely Integrable Hamiltonian Systems	433
33. Poisson Manifolds	439
34. Hamiltonian Group Actions and Momentum Mappings	451
List of Symbols	477
Bibliography	479
Index	489