

Contents

	Preface to the Third Edition	<i>IX</i>
	Preface to the Second Edition	<i>XI</i>
1	Gauge Invariance	1
1.1	Introduction	1
1.2	Symmetries and Conservation Laws	1
1.3	Local Gauge Invariance	7
1.4	Nambu–Goldstone Conjecture	17
1.5	Higgs Mechanism	30
1.6	Summary	34
2	Quantization	37
2.1	Introduction	37
2.2	Path Integrals	37
2.3	Faddeev–Popov Ansatz	59
2.4	Feynman Rules	72
2.5	Effects of Loop Corrections	77
2.6	Summary	96
3	Renormalization	99
3.1	Introduction	99
3.2	Dimensional Regularization	99
3.3	Triangle Anomalies	125
3.4	Becchi–Rouet–Stora–Tyutin Transformation	137
3.5	Proof of Renormalizability	141
3.6	't Hooft Gauges	154
3.7	Summary	162
4	Electroweak Forces	165
4.1	Introduction	165

4.2	Lepton and Quark Masses	165
4.3	Weak Interactions of Quarks and Leptons	172
4.4	Charm	181
4.5	Bottom and Top Quarks	187
4.6	Precision Electroweak Data	188
4.7	Higgs Boson	190
4.8	Quark Flavor Mixing and CP Violation	191
4.9	Summary	194
5	Renormalization Group	199
5.1	Introduction	199
5.2	Renormalization Group Equations	200
5.3	QCD Asymptotic Freedom	204
5.4	Grand Unification	216
5.5	Scaling Violations	219
5.6	Background Field Method	238
5.7	Summary	245
6	Quantum Chromodynamics	249
6.1	Introduction	249
6.2	Renormalization Schemes	249
6.3	Jets in Electron–Positron Annihilation	259
6.4	Instantons	265
6.5	$1/N$ Expansion	274
6.6	Lattice Gauge Theories	281
6.7	Summary	293
7	Model Building	297
7.1	Introduction	297
7.2	Puzzles of the Standard Model	297
7.3	Left–Right Model	299
7.4	Chiral Color	302
7.5	Three Families and the 331 Model	305
7.6	Conformality Constraints	307
7.7	Summary	311
8	Conformality	313
8.1	Introduction	313
8.2	Quiver Gauge Theories	315
8.3	Conformality Phenomenology	319
8.4	Tabulation of the Simplest Abelian Quivers	321

8.5	Chiral Fermions	322
8.6	Model Building	324
8.7	Summary	327
	Index	331