

TABLE OF CONTENTS

Introduction	xi
Chapter I : Functional integrals defined as limits of discretized expressions	
1.1. Introduction	1
1.2. Definitions	5
1.3. An explicit calculation showing the discretization dependence of the functional integral	9
1.4. Path integral from the operator formalism	13
Chapter II : Correspondence rules and functional integral representations	
2.1. Correspondence between phase space functions and operators	17
2.2. Correspondence rules and discretizations	23
2.3. Equivalence classes of discretizations	28
2.4. The inverse problem	33
2.5. Determination of a correspondence rule	39
Chapter III : Functional integral representations of expectation values.	
Time-ordered products	
3.1. Definitions	44
3.2. Representation of matrix elements by functional integrals	47
3.3. A generalized time-ordered product	50
Chapter IV : Perturbation expansions	
4.1. Setting up a perturbation expansion	52
4.2. Perturbation expansions and discretizations	59
4.3. Correspondence rules not satisfying $\Omega(u,0)=1$	67
4.4. Extension to field theory and definition without limiting procedure	73
Appendices 4.1 - 4.4	76

Chapter V : Short time propagators and the relations between them	
5.1. Introduction	85
5.2. On the validity of $\hat{U} = \mathbb{I} - i\epsilon \hat{H}$	86
5.3. Relations between short time propagators	93
5.4. Covariant formulation, curvature and normal coordinates	99
5.5. Short time propagator from a WKB-type expansion	104
Appendix 5.1.	115
Chapter VI : Covariant definitions of functional integrals	
6.1. Introduction	116
6.2. Feynman's definition and its generalizations	117
6.3. Graham's covariant interpretation of path integrals	120
6.4. Covariant discretizations	128
6.5. On the use of Fourier series in path integrals	132
Appendix 6.1.	
Chapter VII : Functional integral methods in Fokker-Planck dynamics	
7.1. Introduction	139
7.2. From Langevin to Fokker-Planck equation	142
7.3. Correlation and response functions	144
7.4. Perturbation expansion on arbitrary initial conditions	148
7.5. The Onsager-Machlup function as Lagrangian for the most probable path	152
7.6. Derivation of functional integral representations from stochastic differential equations	157
Appendix 7.1	165
Chapter VIII : Product integrals	
8.1. Introduction and relation with the usual functional integrals	167
8.2. First example: a modified Langevin equation	170
8.3. Second example: partition function of a spin 1/2 system	172
Appendix 8.1.	
Chapter IX : The semiclassical expansion in phase space	185
9.1. Introduction	185
9.2. The general method	187
9.3. The covariant and gauge invariant method	197
9.4. Explicit time dependence	214
9.5. Applications	217
Appendices 9.1-9.5	228

Chapter X : The semiclassical expansion in configuration space	253
10.1. Perturbation theory in configuration space	255
10.2. The free generating functional $Z_o^N[J]$	260
10.3. Cancellation of the singularities	269
10.4. The first order correction and the short time propagator	272
Appendices 10.1-10.2	273
Chapter XI : Other approaches	280
Chapter XII: Computation of the propagator on the sphere S^3	287
References	303