



# CONTENTS

Preface	v
<b>1 Supersymmetry</b>	<b>1</b>
1.1 Introduction	1
1.2 Dirac and Weyl spinors	2
1.3 Supersymmetry transformations. Super-Poincaré algebra	3
Problems	19
<b>2 Realisations of supersymmetry</b>	<b>21</b>
2.1 Representation on one-particle states	21
2.2 Realisation on component fields	26
Problems	34
<b>3 Superspace and superfields</b>	<b>36</b>
3.1 Introduction	36
3.2 Coordinate space representation of super-Poincaré generators	36
3.3 Superfield, covariant spinorial derivatives	38
3.4 Irreducible scalar superfield	42
3.5 Differential forms in flat superspace	43
Problems	47
<b>4 Chiral superfield</b>	<b>49</b>
4.1 Chiral and anti-chiral scalar superfields	49
4.2 Supersymmetric action for chiral supermultiplets	51
4.3 The supercurrent superfield	57
Problems	57
<b>5 Gauge superfield—Abelian case</b>	<b>59</b>
5.1 Vector or gauge supermultiplet	59
5.2 Supersymmetry transformations of component fields	60
5.3 Field strength supermultiplet	61

5.4	Kinetic energy term for vector supermultiplet	63
5.5	Fayet–Illiopoulos and mass terms	64
5.6	Supersymmetric Abelian gauge theory	64
	Problems	69
<b>6</b>	<b>Spontaneous supersymmetry breaking</b>	<b>71</b>
6.1	Introduction	71
6.2	Illustrations	72
	Problems	82
<b>7</b>	<b>Non-Abelian supersymmetric gauge theory</b>	<b>84</b>
7.1	Gauging of internal symmetry	84
7.2	Field strength superfield	85
7.3	Supersymmetric generalised non-Abelian gauge invariant action	89
7.4	$N$ -extended ss Yang–Mills theory	95
	Problems	97
<b>8</b>	<b>Integration over Grassmann variables. Supermatrices</b>	<b>98</b>
8.1	Introduction: Berezin integral	98
8.2	Rules of integration by parts	102
8.3	Variational derivative of chiral superfield	105
8.4	Supermatrices, Superdeterminant, Supertrace	106
	Problems	107
<b>9</b>	<b>Superfield propagators</b>	<b>109</b>
9.1	Introduction	109
9.2	Gauge superfield propagator	109
9.3	Chiral superfield propagator	111
	Problems	118
<b>10</b>	<b>Superfield perturbation theory</b>	<b>119</b>
10.1	Introduction	119
10.2	Wess–Zumino model	119
10.3	Abelian gauge theory. Examples	132
10.4	Effective potential	134
	Problems	137

## CONTENTS

ix

<b>11 Supergravity</b>	<b>138</b>
11.1 Introduction	138
11.2 Pure $N=1$ supergravity	139
11.3 Supergravity coupling to matter	146
Problem	156
 References	 157
 Index	 160