

Contents

Title page	i
Certificate by the Supervisor	iii
Declaration	viii
Acknowledgements	ix
Abstract	xii
Contents	xvii
Chapter 1 INTRODUCTION	1
1.1 Basic Cosmology	1
1.1.1 Einstein's Field Equations	4
1.1.2 Perfect Fluid Medium	5
1.1.3 Viscous Fluid Medium	6
1.2 Homogeneous and Isotropic Cosmological Models	6
1.2.1 Standard Model and Cosmological Constant	7
1.3 Spatially Homogeneous and Anisotropic Models	9

Contents

1.3.1	Bianchi Models	10
1.3.2	Big-Bang Theory	12
1.3.3	Non-Singular Models	14
1.3.4	Steady State Theory	14
1.4	Lyra's Geometry	15
1.5	Kaluza Klein Universe	16
1.6	Dark Energy	18
1.7	f(R) and f(R,T) Theories of Gravitation	20
1.8	Cosmological Parameters	24
1.8.1	Average Scale Factor(a) and Volume Scalar (V)	24
1.8.2	Expansion Scalar (θ)	24
1.8.3	Hubble's Parameter (H)	25
1.8.4	Shear Scalar (σ^2)	25
1.8.5	Deceleration Parameter (q)	26
1.8.6	Anisotropic Parameter (A_m)	26
1.9	Phases of Universe	27
1.10	Inflationary Phase	28

Chapter 2 Bianchi Type -II Inflationary Models with Stiff Matter and Decaying

Cosmological Term	29	
2.1	Introduction	29
2.2	Metric and Field Equations	32
2.3	Model I with $\Lambda = \beta \left(\frac{\ddot{a}}{a}\right) + \frac{\alpha}{a^2}$	34
2.4	Model II with $\Lambda = \frac{\alpha}{a^2}$ and $\beta = 0$	38
2.5	Conclusion	39

Chapter 3 Anisotropic Bianchi type-III Bulk Viscous Fluid Cosmological Model

in Lyra Geometry	43
3.1 Introduction	43
3.2 Metric and Field Equations	45
3.3 Exact Solutions	46
3.4 Some Physical and Kinematical Properties of the Model	49
3.5 Conclusion	51
Chapter 4 Bianchi Type-VI₀ Dark Energy Cosmological Models in General	
Relativity	53
4.1 Introduction	53
4.2 The Metric and Field Equations	55
4.3 Solution of Field Equations	56
4.3.1 Case 3.1 When $c=0$	58
4.3.2 Case 3.2 When $c \neq 0$	59
4.4 Conclusion	61
Chapter 5 Anisotropic Cosmological Models with Matter Cosmic Strings in	
f(R,T)Gravity Theory	63
5.1 Introduction	63
5.1.1 Metric and Field Equations	67
5.1.2 Cosmological Solution	69
5.1.3 Physical Properties	71
5.1.4 Conclusion	73
5.2 String Cosmological Models with Bulk Viscosity	74
5.2.1 Models and Field Equations	74
5.2.2 Solution of Field Equations	77
5.2.3 Model I	78

Contents

5.2.4	Model II	83
5.2.5	Conclusion	88
Chapter 6 Bianchi Types I and V Bulk Viscous Fluid Cosmological Models in		
f(R,T) Gravity Theory		95
6.1	Introduction	95
6.2	Field Equations	99
6.3	Bianchi type-I Model	100
6.4	Bianchi type-V Model	106
6.5	Conclusion	109
Chapter 7 Some Kaluza- Klein Cosmological Models in f(R,T) Gravity Theory		119
7.1	Introduction	119
7.2	Metric and Field Equations	122
7.3	Generating Technique	124
7.4	Model I	126
7.5	Model II	128
7.6	Model III	130
7.7	Model IV	132
7.8	Conclusions	134
References		142
List of Publications		165