

Contents

1	Introduction	1
1.1	Theory of General Relativity	1
1.2	Cosmology	3
1.3	Bianchi Type Models	4
1.4	Λ CDM Model	6
1.5	Dark Energy and Dark Matter	6
1.6	Energy-momentum tensors	8
1.7	Lyra Geometry and the field equations of $f(R, T)$ gravity	8
1.8	Work Related with Lyra's Geometry	13
1.9	$f(R)$ and Gauss - Bonnet gravity	20
1.10	$f(\mathcal{G})$, $f(R, \mathcal{G})$, $f(\mathcal{G}, T)$, $f(\mathcal{T})$ gravity	21
1.11	Cosmological Parameters	22
1.11.1	Hubble Parameter	22
1.11.2	Co-moving co-ordinate systems	23
1.11.3	Deceleration Parameter	23
1.12	Dynamical Parameters	25
1.12.1	Expansion scalar	25
1.12.2	Shear scalar	25
1.12.3	Anisotropy Parameter	26
1.13	Observational Constraints	26

1.13.1	Type Ia Supernovae Observation	26
1.13.2	Cosmic Microwave Background Radiation	27
1.13.3	Planck’s observation	27
1.14	Aims and Objectives	29
1.15	Methodology and tools	29
1.16	Importance of proposed study	30
2	Bianchi Type-V Modified $f(R, T)$ Gravity Model in Lyra Geometry with Varying Deceleration Parameter	31
2.1	Introduction	31
2.2	Metric and the field equations of $f(R, T)$ gravity	32
2.3	Cosmological solutions of the field equations	33
2.4	Conclusion	41
3	Bianchi Type-V Dark Energy Modified $f(R, T)$ Gravity Model in the presence of Massive Scalar Field in Lyra Geometry	42
3.1	Introduction	42
3.2	Metric and the $f(R, T)$ gravity	44
3.3	Cosmological solutions of the field equations	45
3.4	Physical and dynamical parameters of the model	47
3.5	Conclusion	54
4	Bianchi Type-V Cosmological Model with Heat Conduction in Lyra Geometry	56
4.1	Introduction	56
4.2	Metric and the field equations of $f(R, T)$ gravity	57
4.3	Results and Discussion of the cosmological solutions of the field equations	58
4.3.1	Case-I: Solutions with heat conduction (i.e. $h_1 \neq 0$)	58
4.3.2	Case-II: Solutions without heat conduction (i.e. $h_1 = 0$)	67

4.4	Conclusion	73
5	Bianchi Type-V Dark Energy model in Lyra Geometry in presence of Magnetic Field	74
5.1	Introduction	74
5.2	Metric and the field equations of $f(R, T)$ gravity	75
5.3	Solutions and the Physical behavior of the model in $f(\tilde{R}, T)$ gravity	77
5.4	Conclusion	87
6	Bulk Viscous Bianchi Type-V Cosmological Model with Special Type of Scale Factor in Lyra Geometry	88
6.1	Introduction	88
6.2	Metric and the field equations of $f(R, T)$ gravity	90
6.3	Solutions of the field equations	91
6.4	Physical properties of the model in $f(R, T)$ gravity	93
6.5	Conclusion	98
7	Bianchi Type-V Dark Energy Model with varying EOS parameter in Lyra Geometry	99
7.1	Introduction	99
7.2	Metric and the field equations of $f(R, T)$ gravity	101
7.3	Solutions and physical properties of the field equations	102
7.4	Energy Conditions	110
7.5	Statefinder parameters	111
7.6	Conclusion	112
8	Summary of the Concluding	114
9	Future Scope	117
	Bibliography	117

