Preface

The present investigations have been carried out to fulfill the requirements for the award of Ph. D. in Mathematics of Bodoland University, Kokrajhar, India, under the supervision of Dr. Mukunda Dewri, Assistant Professor, Department of Mathematical Sciences, Bodoland University, Kokrajhar, India. The thesis entitled **A Study on Bianchi type –V Cosmological Models in Lyra's Geometry** comprises nine chapters.

Chapter-1 is introductory in nature. This chapter defines and discusses the techniques, design, and deterministic results relevant to the present investigations. Hence, we have presented a brief survey of Bianchi-type Cosmological models, Dark Energy and Dark Matter, and Lyra Geometry. In this chapter a brief survey of $f(R)$ and $f(R,T)$ is also mentioned.

Chapter – 1.1 deals with some work related to Lyra geometry in the framework $f(R,T)$ gravity.

Chapter – 1.2 contains the objectives of the research work and methodology.

Chapter 2 is based on the title **Bianchi Type-V Modified $f(R,T)$ Gravity Model in Lyra Geometry With Varying Deceleration Parameter**. For $f(R,T)$ gravity, a completely homogeneous and anisotropic Bianchi type V model based on Lyra's geometry is examined in this chapter. We use $f(\widetilde{R},T) = f_1(\widetilde{R}) + f_2(T)$ with a linearly varying deceleration parameter to investigate the deterministic solution of the field equation and the current rapid expansion of the universe. The physical and geometrical properties of $f(R,T)$ gravity are also examined.

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Chapter 3 is based on the title **Bianchi type -V Dark Energy Modified $f(R,T)$ Gravity Model in the Presence of Massive Scalar Field in Lyra Geometry**. This chapter investigates the Bianchi type-V modified $f(R,T)$ cosmological gravity models in Lyra's geometry based on $f(R,T)$ gravity. The present accelerated expansion of the model is

also explored in the presence of a massive scalar field.

(The article related to this chapter is accepted in the journal -Trends in Sciences on 11 February 2022).

Chapter 4 is based on the title **Bianchi Type-V Cosmological Model with Heat conduction in Lyra Geometry**. In this study, the EFE is employed to generate the current universe's hidden DE in the setting of Lyra geometry for a Bianchi type V cosmological model with $f(R,T)$ gravity. We presented the metric potentials A, B, and C in power-law connection to derive the deterministic solution of the EFE. These are the two most prevalent instances in which a model can anticipate current cosmic data behavior. Heat conduction in the context of Lyra geometry for the Bianchi type-V cosmological model and the model's physical and geometrical characteristics are also examined. Trace, the Ricci scalar-tensor, was also explored.

Chapter 5 is based on the title **Bianchi Type-V Dark Energy model in Lyra Geometry in the presence of Magnetic field**. This chapter studies the Bianchi type V DE cosmological model with the electromagnetic field in Lyra's geometry based on $f(R,T)$ gravity. The magnetic field source is oriented along the x axis, with $F_{23} \neq 0$. Field equations are derived in Lyra geometry with electromagnetic field in $f(R,T)$ gravity, by choosing $f(\widetilde{R},T) = f_1(\widetilde{R}) + f_2 T$ with $f_1 = \mu\widetilde{R}$ and $f_2 = \mu T$. The hybrid form of scale factor has been used to investigate physical and dynamical aspects in $f(R,T)$ gravity.

(The article related to this chapter is accepted in Journal of Scientific Research on 8 March 2022).

Chapter 6 is based on the title **Bulk Viscous Bianchi Type-V Cosmological Model with Special Type of Scale Factor in Lyra Geometry**. This chapter deals with the bulk viscous Bianchi type-V cosmological model with exponential scale factor in Lyra's geometry based on $f(R,T)$ gravity by considering a time-dependent displacement field. To determine the nature and physical properties of the model, we considered Harko et al. (2011) [the linear form $f(R,T) = f_1(R) + f_2(T)$]. The barotropic equation of state for

pressure, density, and bulk viscous pressure are proportional to energy density. The kinematical properties of the model are also discussed in the presence of bulk viscosity. The evolution of energy conditions is also studied and examined the behavior of that in order to explain the late-time cosmic acceleration.
(Front. Astr. Space Sci. (2022), Volume 9, doi: 10.3389/fspas.2022.831431.)

Chapter 7 is based on the titled **Bianchi Type-V Dark Energy Model with varying EOS parameter in Lyra Geometry**. In this study, we explore the DE of the cosmological model in the context of $f(R,T)$ gravity theory with Logamediate inflation. The quadratic EOS is generally taken to study further the model's behavior in the Bianchi type-V model. Analyse the behavior of the energy conditions; a combination of pressure and density is also checked correctly with a suitable choice of constants. Apart from that, the state finder parameter is discussed as observational data to know the geometrical diagnostic of the present model in $f(R,T)$ gravity.

Chapter 8 deals with a brief chapter-wise summary of the research work.

Chapter 9 indicates the current work's motivation and some probable scope of future attempt.