ABSTRACT

This thesis entitled with “**SOME PROBLEMS OF PHYSICAL DISTRIBUTION IN RELATIVISTIC COSMOLOGY**” comprises of 8 (eight) chapters devoted to the investigation of 6 (six) different models of the universe.

In **Chapter 1**, the basic idea is highlighted with the foundation and development of the cosmological problem in relativity. In the light of related work for others, we have described the physical relevance and motivations for the various problems of investigation presented in the following chapters.

In **Chapter 2**, this chapter discussed about five-dimensional Robertson-Walker universe interacting with Brans-Dicke field. To obtain determinate solution of the field equations, we have used the relation for scale factor and curvature index which can take different values of $-1, 0, +1$ by considering three different cases. Physical properties of the model are also discussed in detail. Interestingly, it is found that the fifth dimension itself acts as a source of dark energy.

In **Chapter 3**, this chapter investigate the role of bulk viscosity in present scenarios of the evolution in FRW model universe in the framework of Lyra’s geometry. We derived the field equations when the source for energy-momentum tensor is composed of a bulk viscous fluid with cosmic strings. The Einstein’s field equations are solved by assuming a constant deceleration parameter. In this work, the displacement vector is considered to be a function of time. The kinematic and physical properties of the model are also discussed by using some acceptable physical assumptions of scale factor for flat, open, and closed universe.

In **Chapter 4**, this chapter discussed the Einstein’s field equations based on Lyra’s manifold in normal guage is studied in a FRW line element for a five-dimensional cosmological model universe. Considering the power law expansion as $a(t) = t^n$ where n is a parameter and the shear scalar to be proportional to expansion scalar so as to obtain $A = R^m$ where m is an arbitrary constant, we have examined some of the energy conditions such as null energy condition (NEC), weak energy condition (WEC), dominant energy condition (DEC) and strong energy

condition (SEC) for the open and closed universe.

In **Chapter 5**, the modern astronomical research is more attractive with different fluid contents present in the universe which yields significant mysterious results that gives moral boost to study the contents of the universe with various alternate theories as well. Here we have analysed the Einstein theory as a source of discussion with thermodynamical effect within it. To study the model in a diversified way we have considered the dark energy of the universe in terms of time varying cosmological parameters of the universe. For a specific assumption the obtained model indicated a phantom phase during spatially open universe and quintessence phase for other different assumptions. We conclude from our observations that the obtained model is valid for flat and closed universe but remain conditionally valid for open universe which is acceptable one.

In **Chapter 6**, a five-dimensional Friedmann-Robertson-Walker (FRW) cosmological spacetime is considered in the scalar-tensor of gravitation proposed by Saez and Ballester using quadratic equation of state. The Einstein field equation is solved using Scale factor $R = e^{\alpha t}$ (de Sitter universe) where α is constant, which always give a deceleration parameter $q = -1$. The behavior of flat, open and closed models is presented and discussed under various scenarios.

In **Chapter 7**, this chapter deals by considering a five-dimensional homogeneous and isotropic FRW model with varying gravitational and cosmological constant with time t. Exact solution of the Einstein field equations are obtained by using the equation of state $p = (\gamma - 1)\rho$ (gamma law), where γ which is an adiabatic parameter varies continuously as the universe expands. We obtained the solutions for flat model using $R = e^{\beta t}$, where β is a constant as the scale factor. Physical parameters of the models are discussed .

In **Chapter 8**, this chapter presents the Conclusions, Limitations and Future Aspects.