The global emergence of Measles has engendered a far-reaching epidemic of con- sequential health, societal, and economic ramifications. In spite of global efforts, the persistence of Measles remains an enduring global menace. In this research, we design a non-linear deterministic model as a lens to scrutinize the intricate dynamics of the formidable Measles pathogen. This involves a thorough exploration of under- standing of the disease, with specific attention to its modes of transmission, influen- tial risk factors, and long-lasting potential implications. We initiate by examining its fundamental analytical attributes and then proceed with numerical simulations. In the realm of analytical analysis, we establish the validity and practical signifi- cance of the model by demonstrating the boundedness and positivity of its solutions through Laplace transform. To make the model reliable and a tool for forecasting,we prove its well poseness. The threshold parameter is computed by Next generation technique, which is used to establish the conditions for the existence of equilibria and their stabilities. For validation of our analytical findings, we implement the recently devised Non-standard Finite Difference (NSFD) numerical technique. A comprehensive quantitative evaluation of the model is conducted, involving the ma- nipulation of vaccination and treatment rates through constant control strategies. The ensuing numerical experiments posit that the collaborative implementation of these control measures, coupled with appropriate awareness campaigns, accelerates the course towards the eradication of the disease. Furthermore, the investigation identifies pivotal parameters that have significant influence over the dynamics of the disease, enhancing our comprehension of the ailment's underlying mechanisms. To effectively manage and mitigate the disease in the population, we employed an ad- vanced approach considering controls as time dependent, named as optimal control strategy. For this, we construct an optimal control problem and evaluate it with the implementation of Pontryagin's Maximum Principle(PMP). This endeavor seeks to ascertain the most efficacious time-dependent controls for both susceptible and infected population. The effectiveness and efficiency of these meticulously tailored controls are illustrated graphically, before and after the optimization process. Our study contributes compelling evidence validating the efficacy of the proposed con- trol measures, successfully attaining the desired outcome of minimizing the financial burdens and curtailing the propagation of infection