Investigations in solid mechanics play a vital role in many areas of engineering sciences, biomechanics, and material science etc. and provide pillars to designers and engineers to assure safety, reliability, and optimization in terms of cost and material etc. The intent of solid mechanics is to investigate the behavior of solid matters under the influence of different kinds of external forces. Solid mechanics has a large number of applications in different fields of science and technology for human kind. Application of fundamental laws of mechanics to real-life problems is known as engineering mechanics.

Theory of elasticity, plasticity, and creep has been used to deal with anisotropic materials. These theories have been enriched with new investigations in the field of solid mechanics in the last few decades. Among the various kinds of materials, the demand for functionally graded materials has increased due to their highly thermal stability and resistance under high rotation in various areas such as aerospace, nuclear reactors, and designing of engines and turbines etc. In recent years, micro-materials also acquired special attention due to their application in block structure, granular materials, human bones, and tissues etc. Due to a wide range of applications of these materials, present work is carried out to investigate the influence of various physical and geometric parameters on circumferential stresses and shear stresses for cylinders and disks made of functionally graded material using infinitesimal and transition theories. Micropolar theory has been used to observe the effect of various parameters on circumferential, shear, and couple stresses for the cylinder made up of micro-material.

In the present thesis, we have analyzed elastic-plastic and creep stresses in functionally graded materials with different geometries. In order to study small deformations, infinitesimal theory has been used. The equation governing the elastic-plastic stresses with Von-Mises' yield criterion are nonlinear in nature and cannot be solved analytically. Thus, to solve such problems, numerical methods can be used. Various numerical methods such as finite element method, finite difference method, and shooting method can be used for solving such problems. In chapter 2, chapter 3, and chapter 4, we have used finite difference method and comparison has been made with the shooting method. Further, for elastic-plastic and creep stresses with finite deformations in functionally graded cylinder investigating transition theory has been used which does not require any yield criterion. At transition, the governing equation attains some criticality. Once the critical points are recognized, the asymptotic solutions at these critical points give the
solution corresponding to the transition state. This theory is applied to a large number of problems related to cylinders, disks, shells, etc. under different loading conditions. Finally, micropolar theory has been used for studying circumferential, shear and couple stresses in cylinders made up of orthotropic micro-material under torsion using finite difference method.