INTRODUCTION

In the modern era, interest in the effect of temperature on the mechanics of solid bodies has emerged due to the rapid growth and technological advancements in the field of space technology, nuclear energy application, civil structures, naval and ocean structures. Since structures are exposed to high intensity heat fluxes during the heated up period, the properties of the material of the structures change significantly, therefore the effect of thermal on the modulus of elasticity of the material cannot be ignored so that draw attention of scientist in machine designs, air crafts and rockets where certain parts of the structures have to operate under elevated temperature.

The bodies in the universe can be either rigid or deformable. A rigid body can not be stretched compressed or twisted if a body changes shape or size when applied force is change then body is said to be deformable. Deformable bodies can further be elastic or non elastic bodies. The elastic body regains its original shape and size after the removal of deforming forces; where as the non elastic bodies are unable to regain its shape and size on the removal of deforming forces. Hooke’s law is of fundamental importance as it states that within elastic limit stress is directly proportion to strain. A visco-elastic material exhibits the characteristic of viscous fluid and an elastic solid. Thus a visco-elastic material returns to its original shape after being stressed but does it slowly enough to oppose the next cycle of vibration.

The analysis of thermally induced vibration of plate is very significant in the design of structures, atomic reactors, steam turbine and other devices operating at elevated temperature. Thermally induced vibrations of non-uniform plates are also very
useful for research workers in aeronautical, chemical and nuclear engineering. The investigation has resulted in better designing of structures and machine parts subjected to cyclic loading such as aircrafts, nuclear power plants and jet engine. However for much specific designs which have been necessitated according to miniaturization in technology and more specially due to elevated temperature in industrial applications where most of material become visco-elastic. In reality, all material deviate from Hooke’s law in various way.

In the past materials were often assumed to be homogeneous and isotropic regardless of their composition because such assumptions resulted in signified calculations. However this simplified assumption often leads to inadequate or incorrect results. Since modern engineering requires very accurate solutions thus the present study considers orthotropic and non-homogeneous rectangular plates.

In the industries the materials exposed to high temperature generally deviate from Hooke’s law and behaves visco-elastically. The elastic and viscous behavior of material depends mainly on two parameters i.e. frequency (rate of loading) and temperature. The dynamic properties of linear visco-elastic materials can be represented by the complex modulus approach.

The properties of visco elastic materials such as rubber, concrete, soil, wood, cement etc. may exhibit linear visco-elasticity but metals and their alloys at high temperature exhibit non linear visco-elasticity according to their mechanical behavior. Therefore investigation of the vibration problems in visco-elastic theory is required in many structural applications of these materials due to thermal effect.
The study of visco-elastic plate based on vibration is very much comprehensive due to various geometrical shapes with complication of anisotropy, non-homogeneous, variable thickness, surrounding media, in-plane force, large deflections elastic foundation, shear deformation, simple and mixed boundary conditions.

To modern designed structures tapered plates of various geometrical shapes with complication of isotropy, visco-elastic, non-homogeneity, variable thickness, surrounding medium, in-plane force, large deflection elastic foundation, shear deformation and rotatory inertial, simple and mixed boundary conditions are frequently used as per their requirement of safety and economy.

Tomar, Sharma and Gupta [234] were discussed the transverse vibrations of non-uniform rectangular orthotropic plates. Analysis of large amplitude vibrations of non-uniform rectangular plate studied by the Banerjee [11]. The vibrations of rectangular plates of variable thickness with two opposite simply supported edges and very general boundary conditions on the other two have been discussed by the Filipich, Laura and Santos [32]. Bhasker and Kaushik [15] studied on Simple and exact series solutions for flexure of orthotropic rectangular plates with any combination of clamped and simply supported edges. Thermal effect on vibration of clamped visco-elastic rectangular plate with parabolic thickness variation in both directions was discussed by the Gupta, Kaur and Kumar [55]. Diez, Gianetti and Laura [27] calculated the fundamental frequency of transverse vibrations of a rectangular plate with edges elastically restrained against rotation and subject to uniformly distributed in-plane normal and shear stresses. The problem of vibrations of rectangular plates of bi-linearly varying thickness and with
general boundary condition has been discussed by the Gutierrez, Laura and Grossi [75]. Gupta, Johri and Vats [43, 44] solved the problem of thermal effect on vibration of non-homogeneous orthotropic rectangular plate having bi-directional parabolically and linearly varying thickness. Gupta, Panwar and Vats [51] studied the effect of thermal gradient on vibrations of a non-homogeneous rectangular plate having bi-direction linearly thickness variations.

Flexural vibration and buckling of isotropic and orthotropic rectangular plates by using orthogonal polynomials in the Rayleigh - Ritz method was studied by the Dickinson and DiBlasio[26]. Problem of vibration of rectangular plates on point and line supports using characteristic orthogonal polynomials in the Rayleigh-Ritz method discussed by Bhat [16]. Three-dimensional vibration analysis of functionally graded material plates in thermal environment was discussed by Li, Iu and Kou [144]. Free vibration of rectangular cantilever plates with symmetrically distributed point supports along the edges, lateral point support and rigid point support has been discussed by Saliba [194, 195, 196] Bowlus, Palazotto and Whitney [19] solved the vibration problem of symmetrically laminated rectangular plate with shear deformation and rotatory inertia. Lee and Lim [121] discussed on free vibration of isotropic and orthotropic square plates with square cut-outs subjected to in-plane forces. Pandey and Sherbourne [172] have studied the postbuckling behavior of optimized rectangular composite laminates . Free vibration of orthotropic square plate with a square hole has discussed by Sakiyama, Haung, matuda, and Morita [193].
The results for the rectangular plate corresponding to the six combinations of boundary conditions has presented by the Leissa [135]. Fundamental frequency of isotropic and orthotropic rectangular plates with linearly varying thickness by discrete singular convolution method have been discussed by Civalek[24]. Appl and Byers [5] have discussed fundamental frequency of simple-supported rectangular plates with linearly varying thickness. Young [246] have been solved the problem of vibration of rectangular plate with the use of Ritz’s method by. Kim, Young and Dickinson [98] used Rayleigh - Ritz method on discussion of the flexural vibration of rectangular plates. Kishor and Rao [99] analyzed non linear vibration of rectangular plate on a visco-elastic foundation. Vijaya Kumar [237] has been discussed the natural frequencies of rectangular orthotropic plates with a pair of parallel edges simply supported.

The problem of vibration of a square plate symmetrically supported at four points along the diagonals has been solved by the Raju and Amba-Rao [179]. Rossi [186, 187] studied the problem of vibration of orthotropic rectangular plate, Natural frequencies of stepped thickness rectangular plates have been discussed by Irie, Yamada and Ikari [89]. Sakata and Hosokawa [191,192] solved the vibration problems of rectangular plate. Natural frequencies of symmetrically laminated rectangular plates with free edges have been discussed by Sivakumaran[214]. The problem of transversal impact on a rectangular visco elastic plate with support edge has been studied by the Gaidur [33]. Amabili and Carra [3] have discussed the thermal effect on geometrically non-linear vibrations of rectangular plates with fixed edges. Narita [164] gave a note on vibrations of point supported rectangular plates. The problem of free vibration of a rectangular plate with visco-elastic stiffness was discussed by the Saito and Yamaguchi [190].
Rectangular plates with line support along diagonal have been analyzed by the Li and Gorman [148]. Li, Zhong, Tian and Liu [145] have discussed the finite integral transform method for exact bending solutions of fully clamped orthotropic rectangular thin plates. Effects of fibre orientation and boundary conditions on the vibration behaviour of orthotropic square plates have been discussed by the Malhotra, Ganesan and Veluswami [158]. Chow, Liew and Lam [23] solved the problem of transverse vibration of symmetrically laminated rectangular composite plates. The transverse vibrations of orthotropic non-uniform rectangular plate with continuously varying density was discussed by the Lal [101]. Kim and Dickinson [95, 96] solved the vibration problems of rectangular. Singal and Gorman [202, 203] analyzed the effect of attached masses on free vibration of fixed and rigid point supported rectangular plates. Sigh and Saxena [210, 211, 212] solved the vibration problems of different plate with variable thickness. The new simplistic elasticity approach for exact free vibration solutions of rectangular Kirchhoff plates have discussed by the Lim, Lu, Xing and Yao [146]. Buckling of sandwich panels with different boundary conditions a comparison between FE analysis and analytical solutions have been studied by Heder [84].

The vibration problems of rectangular plate with different supports solved by the Gorman [36, 37, 38, 39]. Leissa, Laura and Gutierrez [140] studied on the problem of vibrations of rectangular plates with non-uniform elastic edge supports. The vibration of rectangular plate supported at an arbitrary number of points has discussed by the Kerstens [94]. Transverse vibrations of rectangular anisotropic plates with edges elastically restrained against rotation has been discussed by Laura and Grossi [111]. Shimpi and Patel studied a two variable refined plate theory for orthotropic plate analysis. Hung [87]
discussed on vibration analysis of orthotropic rectangular plates on elastic foundations. Xing and Liu[242] have given new exact solutions of free vibrations of thin orthotropic rectangular plates. Vibration of rectangular plates supported at an arbitrary number of points studied by Kerstens [94]. Vibration analysis of multispans plates having orthogonal straight edges has been studied by Liew and Lam [152]. Singh and Chakraverty [209] discussed the transverse vibration of triangular plates using characteristic orthogonal polynomials in two variables.

The vibration problem of isotropic and orthotropic triangular plates has been discussed by the Lam, Liew and Chow [103]. Leissa and Jaber [139] discussed on the problem of vibration of completely free triangular plates. Liew and Lam [153] studied the vibration problem of isotropic and isotropic trapezoidal plates by using Rayleigh-Ritz method. Use of orthogonal polynomial in the Rayleigh-Ritz method for the study of transverse vibration of elliptic plates have discussed by Singh and Chakraverty [208]. Gupta and Sharma [61,62] studied the effect of thermal gradient on transverse vibration of non-homogeneous orthotropic trapezoidal plate of parabolically and linearly varying thickness. The fundamental frequency of thin elastic plates has been studied by the Radhakrishnam, Sudaesan, Rao and Nageshvara[178]. Leissa [123- 128,130-134] edited his views for plate vibration research in to ptics of classical theory and complication effect. Maretic[157] determined the natural frequencies of the transverse vibration and stability of a thin circular plate with respect to constant angular speed and eccentricity with use of Galerkin’s Method. Vibration of flexible plate of visco elastic medium has been discussed by the Iguchi and Luco [88]. Leissa [129] gave a view of composite plate buckling. Liew [151] gave a solution on free flexural vibration of
triangular plates with curved integral supports by using \( pb-2 \) Rayleigh-Ritz method. Gurgoeze [74] studied on viscously damped linear system subjected to damping modification. Vibration of a simply-supported elliptical plate was discussed by the Leissa [136]. Natural frequencies of simply supported circular and symmetrically laminated rectangular plates were studied by Leissa and Narita [137,138].


Banerjee [12] studied on the non linear vibrations of elastic circular plate of variable thickness. Datta[25] discussed large deflections of elliptic plates exhibiting rectilinear orthotropy and placed behavior of static and dynamic of circular plate of variable thickness elastically restrained along the edges. Hoppmann [85] has discussed
the flexural vibration of orthogonally stiffened circular and elliptic plates. Buckling of polar orthotropic annular plates has discussed by Vijaya Kumar and Rao [238]. Problem of free vibration of a composite circular plat was discussed by Vodika [239]. Recently, Gupta and Kumar [45, 46, 47, 48] solved the vibration problem of non-homogeneous visco-elastic rectangular, elliptic and circular plate of linearly varying thickness subjected to linearly thermal effect. Gupta, Kumar and Kaur[63] have studied vibration of visco-elastic orthotropic parallelogram plate with linearly thickness variation in both directions. Gupta, Aggarwal, Gupta and Kumar [64] study the non-homogeneity effect on vibration of orthotropic visco-elastic rectangular plate of linearly varying thickness. Gupta, Kumar, Khanna and Kumar[70] studied the thermal effect on vibrations of parallelogram plate of linearly varying thickness.

Huang and Thambiratham [86] discussed on the problem of free vibration analysis of rectangular plates an intermediate supports. Gutierrez, Laura and Rossit [79] studied on fundamental frequency of transverse vibration of clamped rectangular orthotropic plate with a free edge hole. Gupta, Aggarwal and Kumar[56] discussed the free transverse vibrations of orthotropic visco-elastic rectangular plate with continuously varying thickness and density. Free transverse vibration of an elastically connected rectangular simply supported double plate complex system has been studied by Onizzezuk [170]. Fundamental frequency of vibration of rectangular plate of discontinuously varying thickness has been discussed by Gutierrez and Laura [78]. Laura, Bambaill, Rossi and Rossit [107] have discussed the vibration problem of orthotropic rectangular plate with discontinuous varying thickness. Bambill, Rossit, Laura and Rossi [9] solved the vibration problem of an orthotropic rectangular plate of
linearly varying thickness and with a free edges. Narita [166] discussed combinations for
the free vibration behaviors of anisotropic rectangular plates under general edge
conditions. Gupta, Kumar and Gupta [65, 66] studied the vibration problem of visco-
elastic orthotropic parallelogram plate with parabolically and linearly thickness variation.
Gupta, Aggarwal, Gupta, Kumar and Sharma [68] studied the non-homogeneity on free
vibration of orthotropic visco-elastic rectangular plate of parabolic varying thickness.
Gupta, Kumar and Gupta [57,58] have discussed the vibration of visco-elastic
parallelogram plate with parabolic and linearly thickness variation. Gupta and Singhal
[59, 60] studied the thermal effect on free vibration of non-homogeneous orthotropic
visco-elastic rectangular plate of linear and parabolically varying thickness. Transverse
vibrations of circular plates having non uniform edge constraints were discussed by
Leissa, Laura and Gutierrez [141]. A study of isotropic plates was given by Lekhnitski
[142]. Hasegawa [82] discussed the vibration of clamped parallelogramic isotropic flat
plates.

Tomar and Gupta [231] solved the problem of axisymmetric vibration of circular
plate of linearly varying thickness on a elastic foundation according to Midlin theory.
Transverse vibration and elastic stability of circular plates of variable thickness and with
non uniform boundary conditions have been discussed by Laura and Ficcadant [110]
Sathyamoorthy [197] solved the problem of non linear vibration of elliptic plates. Effect
of thermal gradient on frequencies of a circular plate of linearly varying thickness has
discussed by Tomar and Tewari [232]. Tomar, Gupta and Kumar [233] solved the
problem of vibration of non homogeneous circular plate of variable thickness resting on
elastic foundation. Li [143] solved the problem of vibration analysis of rectangular plates.
with general elastic boundary supports. Vibration analysis of rectangular plates with general elastic boundary supports discussed by Li [143]. Free vibration analysis of rectangular plates with free edges and line support along diagonals has been studied by Li and Gorman [147].

Zarubinskaya and Horssen [247] studied for the free vibrations of a rectangular plate with two opposite sides simply supported and the other sides attached to linear spring by using the method of separation of variables. Kang and Shim [91] formulated for free vibration analysis of rectangular plates having free opposite edge simply supported when these edges are subjected to linearly varying normal stress causing pure in plane moments and other two edges may be clamped, simply supported or free or they may be elastically supported using the exact solution procedure. Highly accurate analytical type solutions are obtained for the free in plane vibration frequencies and mode shape of fully clamped rectangular plates has been discussed by Gorman [40]. Gupta and Kaur [49] studied the effect of thermal gradient on free vibration of clamped visco-elastic rectangular plate with linearly thickness variation in both directions. Sakiyama, Haung, Matuda and Morita [195] have solved the vibration problem of orthotropic square plate with a square hole. Muthurajan, Sankaranarayanasamy, Tiwari and Rao [163] studied the elastic behavior of laminated rectangular thin plates on elastic foundations with combined lateral and compressive in plane forces with the use of modify Galerkin's method which is applied to governing non linear partial differential equation to obtain non linear ordinary differential equation of motion. Free vibration analysis of isotropic rectangular plates with different thickness ratios, different boundary conditions and different aspect ratio has been investigated by Manna [159] by using high order triangular element.
Xiang and Zhang [243] gave exact vibration solution for circular Mindlin plates of different edge support conditions and various combinations of step wise thickness variations. Bala Subrahmanyam and Surjith [8] gave the exact solution for axisymmetric vibration of solid circular and annular membranes with continuously varying density. Rossi and Laura [188] have discussed the vibration problem of thin, elastic circular plate with mixed boundary conditions. Gutierrez, Laura, Felix and Pistonesi [76] solved the problem of fundamental frequency of transverse vibration of circular annular plate of polar orthotropy. Kaplunov, Nolde and Short [93] identified a perturbation approach for evaluating natural frequencies of moderately thick elliptic plates. Gupta and Ansari [72, 73] discussed on the problem of vibration of orthotropic circular plates of linearly varying thickness. Transverse vibrations of simply supported elliptical and circular plates using boundary characteristic orthogonal polynomials in two variables were studied by Singh and Chakraverty [207]. Design formulae for predicting the fundamental frequency and critical load of elliptical plates have been discussed by Singh and Venkateswara [213]. Stavasky and Loewy [219] identified the axisymmetric vibrations of isotropic composite circular plates. Theory of plates and shells were studied by Timoshenko and Woinowsky [222].

The non linear vibration of fully clamped rectangular plates, second non linear mode for various plate aspect ratio discussed by Elkadiri, Benamar and While [28]. Cheung and Zhou [22] discussed of vibration problem of tapered rectangular plate by using Rayleigh-Ritz method. Zhou and Cheung [250] solved the problem of free vibration of line supported rectangular plates using a set of static beam functions.
Transverse vibrations of rectangular membrane with discontinuously varying density has been discussed by Pronsato, Laura and Juan [177]. Larrondo, Avalos and Laura [105] studies on transverse vibrations of a simply supported rectangular plate of generalized anisotropy with an intermediate oblique support. Haung and Sakiyama [83] analyzed the problem on free vibration of a rectangular plate with variously shaped holes. Transverse vibrations of thin elliptical plate with a concentric, circular free edge hole have discussed by Laura, Gutierrez and Romanelli [116]. Gutierrez and Laura [77] solved the vibration problems of a rectangular plate subjected to a non-uniform stress distribution field. Senthil and Batra [199] have presented analytical results for rectangular thick laminated plates subjected to arbitrary boundary condition. Avalos, Larrondo and Laura [6] have analyzed the vibration of rectangular isotropic plates with free edge holes. Fundamental frequency of transverse vibration of a clamped rectangular plate of cylindrical orthotropic discussed by Bambill and Laura [10]. Approximate method for analyzing vibrating, simply supported circular plates of rectangular orthotropic given by Laura, Vera, Vega and Sanchez [118].

Yang [245] solved the problem of a circular plate with varying thickness. Lam, Liew and Chow [102, 104] have discussed vibration analysis of rectangular, circular and elliptical plates. Vibration of simply supported elliptical and circular plates using boundary characteristic orthogonal polynomials in two variables has been discussed by Singh and Chakravrtty [204]. Gutierrez and Laura [80] discussed the fundamental frequency of transverse vibration of simply supported and clamped regular polygonal plate with a central, pin point support. Transverse vibrations of an annular circular plate with free edges and an intermediate concentric circular support discussed by Vega, Vera,
Laura, Gutierrez and Pronsato[235]. Larrondo, Avalos, laura and Rossi [106, 108,109,112,113,114,115] solved the vibration problems of different plate with different varying thickness. Singh and Chakraverty [205] discussed the vibration of elliptic and circular plates with variable thickness by using of characteristic orthogonal polynomials in two dimensions. Gupta and Khanna [41, 42] discussed vibration of viscoelastic rectangular plate with linearly and parabolically thickness variations in both directions. Gupta and Kumar[54] studied the thermal effect on vibration of orthotropic rectangular plate with parabolic thickness variations. Thermal effect on vibration of viscoelastic elliptic and circular plate have been analyzed by Bhatnagar and Gupta [17,18]. Olsson [169] investigated the influence of temperature dependent of the material properties on the free vibration of transiently heated structure. In case of viscoelastic plate with variable thickness and non homogeneity by thermal field solutions the governing differential equation of motion are difficult. Tomar and Gupta [223,224, 225, 226, 227, 228, 229, 230] have solved the vibration problem of orthotropic rectangular, elliptic, circular plates of variable thickness subjected to thermal gradient. Sobotka [215,216] has solved the problem of viscoelastic plates. Li, Iu, Kou, Malekzadeh, Shahpari and Ziaee [144,156] discussed the Three-dimensional free vibration of functionally graded annular and material plates in thermal environment. Alibeigloo, Shakeri and Kari[2] have discussed the free vibrations analysis of antisymmetric laminated rectangular plates with distributed patch mass using third-order shear deformation theory. Pradeep and Ganesan[171] discussed the thermal buckling and vibration behavior of multi-layer rectangular visco-elastic sandwich plates.
Temperature dependents of elastic constants of some cermet specimen have studied by Spinner [217]. Gupta and Kumar [53] studied the effect of exponential temperature variation on vibration of orthotropic rectangular plate with linearly thickness variation in both directions. Golden, Strganac and Schapery [35] gave an approach to characterize non linear viscoelastic material behavior using dynamic mechanical tests and analysis. Vibration of heated plates with two opposite edge simply supported discussed by Ganesan [34]. Rao and Satyanarayana [181] studied the effect of thermal gradient of frequencies of tapered rectangular plates. Takeuti and Furukawa [220] discussed on thermal shock problem in a plates. Fanconneau and Marangoni [31] discussed the problem of natural frequencies of a rectangular plate subjected to effect of thermal gradient. Gupta, Panwar and Vats [52] have studied the vibrations of non-homogeneous rectangular plate of variable thickness in both directions with thermal gradient effect. Gupta, Kumar, Kumar and Khanna [67] studied the thermal effect on vibration of parallelogram plate of bi-directional linearly varying thickness. Gupta, Khanna, Kumar, Kumar, Gupta and Sharma [69] discussed on vibration analysis of visco-elastic rectangular plate with thickness varies linearly in one and parabolically in other direction. Gupta, Khanna and Gupta [50] studied the free vibration of clamped visco-elastic rectangular plate having bi-directional exponentially thickness variations.

Nowacki [168] and Parkus [173] have discussed the thermoelasticity. Two dimensional transient wave propagation in visco elastic layered media have been discussed by Abu, Turhan and Mengi [1]. Rossi, Laura, Avalos and Larrondo [7, 189] discussed on transverse vibrations of a simply supported orthotropic plate with an oblique cut out. Presscott [176] and Xu [244] analysis the idea of applied elasticity in details.
Forced vibrations of clamped, circular plate of rectangular orthotropy have been studied by Pistonesi and Laura [175]. Muge and Johnsan [161] discussed the thermal effect on chaotic vibration of plates. A treatise on the mathematical theory of elasticity was discussed by Love [155]. Narita [165] studied the free vibration analysis of cantilevered composite Plates of arbitrary planform. Axisymmetric buckling of orthotropic circular plates with variable thickness were discussed by Patel and Broth [174]. Romanelli and Laura [185] have discussed the transverse vibrations of a circular plate of rectangular orthotropy with a concentric circular support and carrying a concentrated mass.


Authors have come across various models to account for non-homogeneity of plate materials proposed by researchers dealing with vibration but none of them consider
Introduction

non-homogeneity with thermal effect on orthotropic visco-elastic plates. Thus, the subject matter of the thesis has been confined to a close study of vibration problems of visco-elastic rectangular plate with linearly and parabolically varying thickness having clamped edge boundary conditions considering thermal gradients along with linearly, parabolically and exponentially varying non-homogeneity (caused by density).

The objective of the present study is to determine the thermal effect on vibration of linearly, parabolically and exponentially varying nonhomogeneity of orthotropic plates with variable thickness of materials having visco elastic properties linearly. Rayleigh-Ritz technique has been applied to determine the frequency equation in the explicit form. Time period and deflection corresponding to the first two modes of vibrations of the clamped plates have been obtained for various values of the thermal gradients, taper constant, aspect ratio and non homogeneity constant. Five problems have been discussed using classical theory of visco-elasticity.

In chapter I, the effect of non-homogeneity on thermally induced vibration of orthotropic visco-elastic rectangular plate of linearly varying thickness has been discussed. The governing differential equation has been solved using variable-separable method. Rayleigh-Ritz technique has been used to determine frequency equation. Time period and deflection corresponding to first two modes of vibrations of clamped plates have been for different values of thermal gradients, non homogeneity constant, taper constant and aspect ratio.

In chapter II, the problem of thermal effect on vibration of non-homogeneous orthotropic viscoelastic rectangular plate of parabolic varying thickness has been studied.
Using variable-separable method differential equation has been solved. Time period and deflection corresponding to first two modes of vibrations of clamped plates have been calculated for different values of thermal gradients, non homogeneity constant, taper constant and aspect ratio with the help of Rayleigh-Ritz techniques.

The problem of effect of parabolically varies non-homogeneity on thermally induced vibration of orthotropic viscoelastic rectangular plate of linearly varying thickness has been discussed in chapter III. It is assumed that all the four edges of plate are clamped. The corresponding time period and deflection for different values of parameters for first two modes of vibrations have been obtained using Rayleigh-Ritz technique.

In chapter IV, the effect of parabolically vary non-homogeneity on thermally induced vibration of orthotropic viscoelastic rectangular plate of parabolically varying thickness has been solved using the Rayleigh-Ritz technique. Time period and deflection corresponding to first two modes of vibrations of clamped plates have been calculated for different values of thermal gradients, non homogeneity constant, taper constant and aspect ratio.

In chapter V, thermally induced vibration of exponentially varying non-homogeneous orthotropic viscoelastic rectangular plate of linearly varying thickness analyzed by Rayleigh-Ritz technique. Time period and deflection corresponding to the first two modes of vibrations of clamped plates have been obtained for various values of thermal gradients, non homogeneity constant, taper constant and aspect ratio.