INTRODUCTION

There is no tangential force in ideal fluids, but in actual fluids it is not true. When some alteration is made in the form of the fluid, some resistance is felt. This characteristic of the actual fluid is known as viscosity. So the viscosity of a fluid is that property in virtue of which it is able to offer resistance to shearing stress. All fluids and gases possess viscosity in varying degree.

Saffman (1) discussed the stability of laminar flow of a dusty gas in which the dust particles are uniformly distributed. Michael (2) investigated the Kelvi-Helmlultz in stability of the dusty gas. Michael and Miller (3) have discussed the motion induced in the dusty gas in two cases. When the plane move parallel to itself (i) in simple harmonic motion (ii) impulsively from rest with uniform velocity. Michael & Norcy (iv) considered the problem of the motion of a dusty gas contained between two co-axial cylinders which start to rotate impulsively from rest. Rao (v) discussed unsteady laminar flow of a dusty viscous liquid under the influence of exponential pressure gradient through a circular cylinder. P.D. Verma & A.K. Mathur (vi) considered laminar flow of a dusty viscous liquid in
circular tube and the dust particles are at rest.

Lew (7) discussed the various flow in a porous circular cylinder while Krishan Lal derived an expression for temperature distribution when viscous incompressible fluid is flowing through channel bounded by two coaxial cylindrical pipes. Sowerby (8) studied possuile and cuitte flow.

Flow of fluid through circular section was discovered by Lamb (9) Dean (2.3) studied the flow of Newtonian fluid in a circular pipe axially symmetric. Pream Prakash (10) Ram Ballabh (11) Narshimqn (12) discussed the problem in case of Laminar non-newtonia fluid in porous pipe. Tao (13) discussed Laminar forced convection. J.N.Kapoor and P.N.Srivastava (14) investigated the unsteady state motion when both the co-axial cylinder are stationery and the motion is due to application of transverse pressure gradient.
SYNOPSIS OF THESIS

The whole work of the main part of the thesis is divided into two chapters. The chapters are further divided into a number of sections, as given below:

CHAPTER I: MOTION THROUGH TUBE HAVING SECTOR AS ITS CROSS SECTION

This chapter contains five sections in which the following problems have been dealt with:

Section 1. Heat transfer of combined free and forced convection in a cylinder whose cross section is a sector

The problem of fully developed Laminar convection flow of incompressible viscous fluid under pressure gradient in a vertical circular cylinder with varying was solved by Tao (1960), Morton (1960) and Dalip Singh discussed the flow in incompressible viscous fluid under a pressure gradient in a vertical elliptical cylinder.

In this section solution for fully developed laminar flow through a vertical cylinder whose cross section is a sector with boundaries \( \theta = 0, \theta = \alpha \)
\[ \gamma = \alpha \text{ of linear axial wall temperature gradient} \]

with and without generation are treated. The solution are obtained in terms of Lommel, Bessel and associated functions, corresponding values of \( Ra, E \) and \( Nu \) are tabulated for \( F = 0 \) and \( F = 1 \). The graphs have also been drawn in the above cases.

Section 2: Unsteady laminar forced convections in a pipe having sector as its cross section.

Heat transfer problems of forced convections in channels have contributed an attractive and useful subject of investigation for several years. It may however be said that the laminar forced convection problems of channels is one of the most fundamental and important problems in heat transfer as it forms the basis of the investigation of several other problems of heat transfer.

Only the cases of round conduits have been investigated in detail by several research workers for unsteady flow. The cases, of non circular ducts have not been investigated.

In this section is to analyze the problem of forced convections in liquid flows through sufficiently long straight channel of sector as its cross-section. The results are obtained in terms of tabulated Lommel, Bessel and associated functions.
Section 3: Propagation of small disturbances in a viscoelastic fluid contained in an infinite cylinder having sector as its cross-section due to slow angular motion of the circular plate fixed at the base.

Lundquist, Bhatnagar and Kumar, and Kumar have considered the propagation of disturbances in viscous incompressible fluids in the presence of magnetic field. P.M. Srivastava have discussed propagation of disturbances in an idealized viscoelastic fluid contained in an infinite circular cylinder when only relaxation phenomenon of the fluid was considered.

In this section we study the propagation of disturbances in the viscoelastic fluid contained in a infinite cylinder having the cross-section to be sector due to slow angular motion about the Z-axis. The Z-axis is a line passing through the centre whose sector is a point. The base is a circular plate which is fixed to the cross section and is given the rotary motion about Z-axis for \( \Theta \) is represented by \( W(t) \) where \( W(t) = W_0 \sin nt \) and \( W_0 \) is a constant.

Section 4: Temperature distribution of viscous liquid under oscillatory rate of heat addition superposed on the steady temperature incompressible fluid between curvilinear quad-
rilateral cross-sectional cylinder.

Solution for temperature distribution in a circular pipe have been given by various authors notably Gretz, Nusselts, Goldstein. All these are cited in (1). Krishna Lal considered the temperature distribution in coaxial cylinders. S.N.Dube considered temperature distribution in channel bounded by coaxial circular pipe for viscous incompressible fluid flowing through it by neglecting the dissipation due to friction when an oscillatory rate of heat addition is superposed on the steady temperature.

In this section expression for the temperature distribution in a channel bounded by curvilinear quadrilateral cross-sectional cylinder similarly situated for viscous incompressible fluid flowing through it by neglecting the dissipation due to friction when an oscillatory rate of heat addition is superposed on the steady temperature.

Section 5 : Unsteady flow of a dusty viscous liquid in a elliptic tube

Saffman 1962 discussed the stability of laminar flow of a dusty gas in which the dust particles are uniformly distributed. He assumed that the dust particles are uniform in size and shape and the
bulk concentration of the dust is very small to be neglected. On the other hand the density of the dust material is large compared to gas density so that mass concentration of dust is an appriciable fraction of unity. Mechael investigated the Kelvin-Helmholtz instability of the dusty gas. Michael and Miller (1966) have discussed the motion induced in the dusty gas in two cases. When the plane more, parallel to itself (i) in simple harmonic motion (ii) impulsively from rest with uniform velocity, Michael & Morcy (1968) have considered the problem of the motion of a dusty gas contained between two coaxial cylinders which start to rotate impulsively from rest. Rao (1969) discussed unsteady laminar flow of a dusty viscous liquid under the influence of exponential pressure gradient through a circular cylinder.


In this section we have considered dusty viscous liquid flow in elliptic tube. Initially the fluid and the dust particles are at rest. At T=0 a constant pressure gradient is impressed on the system. The change in the velocity profiles with line in determined.
CHAPTER II: MOTION IN TUBE HAVING ELLIPTIC OR

CONFOCAL ELLIPTIC CROSS SECTION

Section 1. Laminar convection in a uniformly heated vertical elliptical cylinder.

Heat transfer problem of combined free and forced convection due to a fully developed laminar flow with constant wall temperature has been investigated for many years. On the other hand the situation with varying wall temperature has been studied only recently.

The problem of fully developed laminar convection flows of incompressible viscous fluid under a pressure gradient in a vertical circular cylinder with varying wall temperature was solved by Tao and Morton. Dalip Singh discussed the flows of incompressible viscous fluid under a pressure gradient in a vertical elliptical cylinder.

In this section we have obtained solutions for fully developed laminar flow through a vertical cylinder whose cross-section is confocal vertical elliptical cylinder under a pressure gradient. The solutions are established in terms of Mathieu functions.
Section 2: Unsteady laminar forced convections in confocal elliptical pipe

Heat transfer problem of forced convections in channels have contributed an important and useful subject. Laminar forced convection problem under fully developed conditions is one of the most fundamental and important problems in heat transfer as it forms the basis of several other problems of heat transfer.

Tao (1961) considered laminar forced convections in round and flat conduits. Laminar forced convections in unsteady liquid flow in elliptic pipes has not yet been considered.

In forced convections, the energy of the motion is appreciably comparable with the amount of heat transferred in the fluid. The presence of the arbitrary source of heat in the channel which has the intensity \( Q \) accounts for the heat generation in the fluid.

In this section is to analyze theoretically the problem of the forced convections in unsteady liquid flow in an confocal elliptical pipe.

The results are obtained in terms of Mathieu functions for any value of \( Q \) in general. As a particular case they have been obtained when heat source is in the
channel and pressure gradient varies as negative exponential power of time.

Section 3. Temperature distribution of viscous liquid under oscillatory rate of heat addition on steady temperature incompressible fluid between two elliptic cylinders.

Solution for temperature distribution in a circular pipe have been given by various authors notably Gretz, Nusselts, Goldstein. All these are cited in (1). Krishna Lal considered the temperature distribution in coaxial cylinders. S.N. Dube considered temperature distribution in channel bounded by coaxial circular pipe for viscous incompressible fluid flowing through it by neglecting the dissipation due to friction when an oscillatory rate of heat addition is superposed on the steady temperature.

In this section expression for temperature distribution in a channel bounded by two elliptical cylinders similarly situated for viscous incompressible fluid flowing through it neglecting the dissipation due to friction when as oscillatory rate of heat addition is superposed on the steady temperature.
Section 4: Theoretical consideration of the temperature distribution in a coaxial elliptic pipe when rate of heat generation is exponentially decreasing with time with the help of Mathieu-transforms.

Solution for the temperature distribution have been given by various authors Gretz, Mussel, Goldstein. Krishnalal has derived the expression for temperature distribution when viscous incompressible fluid is flowing through channel bounded by two coaxial pipes. R.K. Gunta derived the expression for temperature distribution in case of elliptic cylinder under very restricted conditions.

In this section expression for temperature distribution are derived when viscous incompressible fluid is flowing through confocal elliptic section, the dissipation due to friction is neglected and the rate of heat addition is function of time. The results has been obtained in terms of Mathieu function.

Section 5: Unsteady laminar forced convections in an elliptic pipe.

Heat transfer problems of forced convections in channels have contributed an attractive, important and useful subject for the last few years. Laminar forced convection problem under fully developed conditions is one of the most fundamental and important
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