PREFACE
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Fluid mechanics is the study of fluids and the forces on them. Fluid mechanics can be divided into fluid statics and dynamics, is the study of fluids at rest, and in motion respectively. Fluid mechanics, especially fluid dynamics, is an active field of research with many unsolved or partly solved problems. Many Scientists try to understand the principles and mechanisms of fluid dynamics by studying flow patterns experimentally in laboratories and also mathematically, with the aid of powerful computers.

The fluid dynamics involves the problems of fluid flow in different physical conditions in several fields like space science, aerodynamics, rocket propulsion, ship motion on water, power generation by nuclear reactors and hydroelectric power generation etc. The applications of fluid flow are very wide, as it plays a very important role in the industries of steel, plastic, electric wire, glasses etc. The system of fluid flow also helps in maintaining the temperature of computer chips, vehicle engines and high power machines. In our daily life, lubrication involves the presence of a thin liquid layer that greatly reduces friction and can eliminate squeaks in door hinges, make wheels to turn more easily and prevent engine parts from rubbing each other and thus save them from destruction and energy loss. Under different conditions, the knowledge of fluid motion helps us to solve many
As most of the fluids flow involve multiphase flow, so we have considered dusty incompressible fluid flowing through different regions. Thus seeing the wide applications of fluid flow, it is necessary to thrust on new researches of this area for its better applications in the above sectors and so we have concentrated our study on the flow of dusty incompressible fluid through the channels viz. circular circular, triangular rectangular, and parallel plates.

Two-phase flow: The term multi-phase flow is used to refer to any fluid flow consisting of more than one phase or component. Two-phase flow is a particular example of multi-phase flow. Several features make two-phase flow an interesting and challenging branch of fluid mechanics. In fluid mechanics, two-phase flow occurs in a containing gas and liquid with a meniscus separating the two phases. The commonly studied cases of two-phase flow are in large scale power systems. Coal and gas-fired power stations have very large boilers to produce steam for use in turbines. The design of boilers requires a detailed understanding of two phase flow heat-transfer and pressure drop behavior, which is significantly different from the single-phase case. Another case where two-phase flow can occur in pump cavitation, on marine propellers. When the vapor bubble collapses, it can produce very large pressure spikes, which over time will cause damage on the propeller or turbine. The term two-phase flow is also applied to mixtures of different fluids having
different phases, such as air and water, or oil and natural gas. Other interesting areas where two-phase flow is studied includes in climate systems such as clouds and in ground water flow, bubbles, rain, waves on the sea, foam fountains, mousse and oil slicks.

**Dusty fluid:** A dusty fluid is a mixture of fluid and fine dust particles. A dusty fluid is a two-phase media with suspended small dust particles in it. Its flow has many applications in various fields like flow in rocket tubes, in the use of dust in gas cooling systems, to enhance heat transfer process, environmental pollution, smoke emission from vehicles, lunar ash flow, performance of solid fuel rocket nozzles, power technology, fluidization, formation of rain drops, emission of effluents from industries, flying ash produced from thermal reactors and formation of raindrops, cooling effect of air conditioners, etc. It is also apply in gas cooling systems to enhance heat transfer process, and in the process by which rain drops are formed by the coalescence of small droplets.

The study of dusty fluids was first initiated by Landau and Lifschitz in 1959, who studied on the viscosity of a dusty gas which increases by a factor proportional to the concentration by volume of the dust particles by using Einstein formula. P.G. Saffman (1962) formulated the basic equations of motion of fluid carrying small dust particles in which dust particles are uniformly distributed. On the basis of this model, the author F. E. Marble (1963) have studied the dynamics of gas containing small solid particles and discussed many important features of one-dimensional incompressible fluid particles in two phase flow and applications of dusty gas. Michael and Millar (1966) discussed the motion of dusty gas occupying the semi-infinite space above a rigid plane boundary. Further
they have studied the flow of dusty viscous fluid between rotating coaxial cylinders using integral and Laplace transform techniques. J.T.C Liu (1966) had study the flow of dusty fluid induced by an oscillating infinite plat plate.

Some of the authors like Sambo Shiva Rao (1969), Girishwar Nath (1970) and H. T. Yang Lei and Bakhtier Farouk, and Srivastava (1972) have studied an Dusty viscous fluid flow between rotating coaxial cylinders. Dube and Sharma (1975), M. L. Mittal, G. H. Masapathi, B. Nageswara Rao, (1976) discussed the flow in a MHD channel, with hall and ionslip currents. K. K. Singh (1976) have studied unsteady flow of a conducting dusty fluid through a rectangular channel under the influence of time dependent pressure gradient. Radhakrishnamacharya (1978) have studied the pulsatile flow of a fluid containing small solid particles through a 2-dimensional channel. Kaimal (1978) studied peristaltic transport of a solid-fluid mixture at a low Reynolds number under long wavelength approximation.

effect of wall properties on peristatic transport of dusty fluid. Further they have studied the fluid between parallel plates started impulsively, oscillating etc., A. J. Chamkha (1997) have examine unsteady flow of an electrically conducting dusty fluid in a channel due to an oscillating pressure gradient, flow and heat transfer on a stretching surface in a rotating fluid with a magnetic field, natural convection on a vertical cylinder embedded in a thermally stratified high-porosity medium etc., A. D. Chernyshov (1998) has discussed unsteady flow of viscous fluid in a tube of triangular cross-section. R. N. Jana (1999) has studied hall effects on unsteady hydromagnetics flow past an eccentrically rotating porous disk in a rotating fluid.

Some of the authors, A. K. Ghosh, A. R. Khan and L. Debnath (2000) were worked on a pulsatile flow of a two-phase viscous fluid in a tube of elliptic cross-section. Also these authors have developed mathematical models to describe the dynamics of pseudo-steady states in cylindrical and spherical co-ordinates and solved the problems of dusty fluid flow through cylindrical pipes, between parallel plates, rectangular channel etc., under suitable boundary conditions. The authors V.E. Gubin and V.S. Levin (2003) have analyze fluid flow in the entrance region of circular tube, Mohammad Layeghi and Sharif (2004) have studied steady-state laminar and incompressible fluid flow and forced convection heat transfer from circular cylinder and an array of circular cylinder in the presence and in absence of porous media. H. A. Attia (2005) have discussed the different aspects like effect of suction and injection parameter on unsteady flow of a dusty conducting fluid through rectangular channel, MHD flow between two parallel plates with heat transfer,
MHD Hartmann flow of a dusty fluid with exponential decaying pressure gradient etc.,
N. C. Ghosh, and P. C. Ram, B. C. Ghosh and R. S. R. Gorla (2007) have discussed
hydromagnetics flow of a dusty viscoelastic Maxwell fluid through a rectangular channel.

The authors C. S. Bagewadi, A. N. Shantharajappa, Gireesha, B. C. Prasanna kumara
and P. Venkatesh (1999-2011) have studied an unsteady one dimensional and two dimen-
sional dusty gas flow in Frenet frame field system. Further the authors have obtained the
solutions for a dusty fluid flow in different regions like circular cylinder, parallel plates,
rectangular channel etc., in Frenet frame field system. They recently studied about Math-
ematical modeling of conducting dusty fluid flow in different regions under the effect of
different parameters like viscous dissipation, Reynolds number, Prandtl number, Eckert
number, Hertmann number etc.,

Now we consider the study of unsteady laminar flow of an incompressible electrically
conducting dusty fluid in different regions under the effect of different parameters in
Frenet frame field system as well as cartesian coordinate systems. The expressions for
velocities and temperature profile of both fluid and dust solutions under suitable boundary
conditions. The thesis consists of both fluid and dust phase are obtained analytically as
well as numerically. This study consists of following six chapters.

The FIRST chapter includes preliminaries about fluid mechanics, boundary layer the-
ory, Frenet frame field systems, Laplace transform techniques and numerical methods
which are used.
The chapter TWO deals with the study of the geometry of laminar flow of a dusty viscous conducting fluid between a non-torsional oscillating parallel plate and a long wavy wall in an anholonomic coordinate system. The expressions for the velocity distributions of fluid and dust phase for different pressure gradients are obtained analytically. The effects of strength of magnetic field and number density of the dust particles on velocity profiles at fixed time has been discussed with the help of graphs. Finally the skin fraction at the boundaries is also calculated.

The THIRD chapter consists of the study of an unsteady flow of a viscous liquid with uniform distribution of dust particles under the influence of time dependent pressure gradient through a channel having triangular cross-section. The intrinsic decomposition of flow equations are carried out in Frenet frame field System. The governing equations of the flow are solved using Laplace transform and variable separable method in different cases. The skin friction at the boundaries are also calculated. Finally, the conclusions are given on basis of the velocity profiles drawn for different values of time and number density.

The FOURTH chapter is devoted to study the laminar flow of a conducting dusty fluid with uniform distribution of dust particles between two rotating circular cylinders. The flow is due to the influence of time dependent pressure gradient and the differential rotations of the circular cylinders. The exact solutions for both fluid and dust velocities are obtained using Variable Separable method. Further, the skin friction, at the boundaries are calculated. Finally the changes in the velocity profiles with R is depicted graphically.
In the FIFTH chapter, an asymptotic analysis of a hydromagnetic boundary layer flow of an incompressible viscous conducting dusty fluid bounded by semi-infinite plate is considered. The flow is due to the influence of pressure gradient and uniform magnetic field. The analytical solution of the boundary layer equations are obtained by asymptotic behavior of Laplace transform treatment. The solutions for small times, shows that the general features of hydromagnetic boundary layer flow is unaffected by the dusty parameter as well as rotation and magnetic parameter. In subsequent large times, the structure of velocity distribution and the associated boundary layer is investigated i.e., the effect of magnetic parameter, Ekman parameter and Hall current parameter are depicted graphically.

The SIXTH chapter covers the effect of radiation on the pulsatile flow of a dusty fluid between two parallel plates. The governing non-linear partial differential equations are solved numerically using finite difference technic. The effect of uniform magnetic field and number density on the velocity profiles of both fluid and dust phase have been studied. Further, the influence of parameters like, Prandtl number, Eckert number, and Radiation parameter on temperature profiles have been depicted graphically and discussed in detail.