PREFACE
Fluid mechanics is a branch of applied mechanics which is concerned with the statics and dynamics of liquids and gases. Analysis of the fluid behaviour is based upon the fundamental laws of applied mechanics that relates to the conservation of mass, energy and momentum. Fluid dynamics is an important and rich branch of science and engineering, as every living being in the universe has existence because of fluid. In fluid mechanics, especially fluid dynamics is an active field of research with many unsolved or partly solved problems.

Fluid dynamics branches out into several sub-disciplines itself, including aerodynamics and hydrodynamics which play an important role in nature and in technical applications. For example, in atmospheric circulation, oceanic currents, tidal flows in rivers, wind and water loads on buildings and structures, gas motion in flames and explosions, aero and hydrodynamic forces acting on airplanes and ships, flows in water and gas turbines, pumps, engines, pipes, valves, bearings, hydraulic systems, calculating forces and moments on aircraft, determining the mass flow rate of petroleum through pipelines, predicting weather patterns, understanding nebulae in interstellar space and reportedly modelling fission weapon detonation.

Boundary layer is the layer of fluid in the immediate vicinity of a bounding surface.
where the effects of viscosity are significant in fluid mechanics. The theory of boundary layer was first initiated by a German Scientist Ludwig Prandtl in the year 1904. Over the past century, many engineering, fluid mechanical problems have been solved using analytical and numerical approach. Specifically, the flow of an incompressible boundary layer flow and heat transfer over a stretching sheet has important industrial applications, in extrusion of plastic sheet, glass blowing, drawing plastic film, paper production, metal spinning and cooling of the metallic plate in a bath.

On this regard Sakiadis (1961) initiated the boundary layer behavior on a continuous solid surface moving at constant speed which is quite different from Blasious flow past a flat plate. Crane (1970) was the first to obtain an elegant analytical solution to the boundary layer equations for the problem of steady two-dimensional flow due to a stretching surface in a quiescent incompressible fluid. The heat transfer analysis for the flow over a linearly stretching sheet with the power law variation of surface temperature was investigated by Grubka and Bobba (1985). The problem of nonlinear stretching sheet for different cases of fluid flow and heat transfer has been analyzed by different researchers. Among them Anjali Devi and Thiyagarajan (2006) have made an investigation on the study of nonlinear stretching sheet for hydromagnetic flow and heat transfer with an assumption that the magnetic strength is non-linear.

In fluid dynamics, the stagnation-point flow and the flow due to a stretching sheet are equally important in theoretical and application points of view. The stagnation flow occurs whenever the flow impinges on any solid object and the local velocity of the fluid at the stagnation-point is zero. Such type of fluid flows are common in plastic sheet extrusion, cooling of metallic plates, boundary layer along the material surface handling conveyers.
On basis of this many authors investigated the effects of external parameters on boundary layer stagnation-point flow over a stretching sheet in various contexts. Hiemenz (1911) was the first to study the two-dimensional stagnation-point flow against an infinite flat plate and found numerical result. Following these works, various aspects of stagnation-point flow and heat transfer over a stretching sheet are investigated by many researchers. Mahapatra and Gupta (2001) considered the stagnation-point flow towards a stretching sheet in presence of magnetic field. Ayub et al (2008) solved the problem of stagnation-point flow of viscoelastic fluid towards a stretching surface analytically using the homotopy analysis method (HAM). The study of heat transfer has become important industrially for determining the quality of final product which is greatly dependent on the rate of cooling. So keeping this in mind, the steady two-dimensional MHD stagnation point flow towards a stretching sheet with variable surface temperature was considered by Anuar Ishak et al (2009). Ali et al (2011) found the solution for stagnation-point flow and heat transfer towards stretching sheet with induced magnetic field.

The study of flow through porous medium is important to a wide range of technical problems, such as flow through packed beds, sedimentation, environmental pollution, centrifugal separation of particles, and blood rheology. The study of flow and heat transfer in fluid past a porous surface has attracted many researchers. In view of its wide range of applications in engineering practice, particularly, in chemical industries; such as the cases of boundary layer control, transpiration cooling and gaseous diffusion. Based on these applications, Tamayol et al (2010) presents a similarity solution for boundary layer flow through a porous medium over a stretching porous wall. Chauhan and Agrawal (2011) studied the MHD flow through a porous medium adjacent to a stretching sheet and they
have discussed the effect of porous medium on the flow. Mahmoud (2011) deal with the
heat transfer problem of variable surface heat flux while studying the two-dimensional
stagnation point towards a permeable stretching surface subject to a transverse magnetic
field in the presence of heat generation or absorption. The effects of thermal radiation
on non-Darcian two-dimensional stagnation-point flow and heat transfer of a micropolar
fluid towards a stretching sheet with Ohmic dissipation in the porous medium over a
non-isothermal stretching sheet was investigated by Pal and Chatterjee (2012).

The study of flow and heat transfer past an exponentially stretching sheet has gained
tremendous interest among researchers due to its wider applications in technology. For
example, in case of annealing and thinning of copper wires, the final product depends on
the rate of heat transfer at the stretching continuous surface with exponential variations
of stretching velocity and temperature distribution. Such studies have been carried out by
Magyari and Keller (1999) and have obtained the similarity solutions which describe the
steady plane boundary layers on an exponentially stretching continuous surface with an
exponential temperature distribution. The numerical solution was obtained by Al-odat et
al (2006) for the effect of magnetic field in the thermal boundary layer on an exponentially
stretching continuous surface with an exponential temperature distribution. Following
them many researches like Bidin (2009), Ishak (2011), Reddy (2011) have investigated the
numerical solutions for the boundary layer flow problem over an exponentially stretching
sheet. Later, an analytical solution for the radiation effects on hydromagnetics Newtonian
liquid flow due to an exponential stretching sheet was discussed by Kameswaran et al
(2012) and have observed that the increase in values of magnetic parameter results in
thickening of the species boundary layer. Recently, the slip effects on MHD boundary layer
flow over an exponentially stretching sheet with suction/blowing and thermal radiation was analyzed by Mukhopadhyay (2012) and investigated that the temperature is found to be decrease with increase in thermal slip parameter. Mustafa et al (2013) presents a theoretical study on the stagnation-point flow of nanofluid over an exponentially stretching sheet. Malvandi et al (2013) deals with the analytical study of boundary layer stagnation point flow of nanofluid toward an exponentially stretching surface with non-uniform heat generation/absorption. Rehman et al (2013) investigates the problem of boundary layer stagnation point flow and heat transfer of couple stress fluid containing nanoparticles and flowing over an exponentially stretching surface in a porous medium.

The above mentioned investigations deal with the flow and heat transfer only for fluids induced by stretching sheet. The fluid flow embedded with dust particles is encountered in a wide variety of engineering problems concerned with atmospheric fallout, dust collection, nuclear reactor cooling, powder technology, acoustics, sedimentation, performance of solid fuel rock nozzles, rain erosion, guided missiles and paint spraying etc. In the recent years, attention of researchers in fluid dynamics has been diverted towards the study of the influence of dust particles on motion of fluids. Saffman (1962) initiated the work by formulating the governing equations for the flow of dusty fluid and has discussed the stability of the laminar flow of a dusty fluid in which the dust particles are uniformly distributed. Datta and Mishra (1980) initiated the work on two-dimensional stagnation point flow for a dusty fluid near an oscillating plate. An analysis of hydromagnetic flow of a dusty fluid over a stretching sheet with a view to throw adequate light on the effects of fluid-particle interaction, particle loading, and suction on the flow characteristics was carried out by Vajravelu and Nayfeh (1992). In recent years Gireesha et al (2011, 2012)
have discussed the stretching sheet problems for both steady and unsteady flows with non-uniform heat source/sink.

On the basis of these observations one can we conclude that, so far no one has consid­ered an unsteady flow and heat transfer of a fluid-particle suspension with some physical situations like the effects of magnetic field, thermal radiation, heat source/sink, viscous dissipation and porous medium over a horizontal/vertical exponential stretching sheet and near the stagnation point. In addition, heat transfer analysis has been carried out for two types of thermal process. This entire work is mainly divided into following SIX chapters.

The FIRST chapter includes introduction and some basic concepts like compressible fluids, incompressible fluids, steady and unsteady flow, dusty fluid, dimensionless parameters, shear stress, boundary layer theory, heat transfer analysis, numerical techniques used etc., are given in detail.

The SECOND chapter deals with the effect of thermal radiation on MHD boundary layer flow and heat transfer of an incompressible, viscous, dusty fluid over an exponentially stretching surface. The governing partial differential equations are reduced to coupled non-linear ordinary differential equations using similarity transformations, before being solved numerically by Runge-Kutta-Fehlberg fourth-fifth method. The effect of thermal radiation is carried out for two cases of heat transfer analysis known as (i) Prescribed exponential order surface temperature (PEST) and (ii) Prescribed exponential order heat flux (PEHF). The numerical solutions are obtained for the velocity and temperature fields for both fluid and dust phase. The effects of physical parameters on velocity and temperature field have been studied and analyzed with the help of graphs and tables.
The chapter THREE is focused on study of two-dimensional boundary layer flow and heat transfer of a dusty fluid embedded in a porous medium over an permeable exponentially stretching sheet in the presence of internal heat generation/absorption and viscous dissipation. The stretching velocity and wall temperature are assumed to vary according to specific exponential forms. The system of equations governing the flow and temperature are reduced to system of coupled nonlinear ordinary differential equations using suitable similarity transformations. An effective numerical method, Runge-Kutta-Fehlberg 45 is used to solve the obtained differential equations. The heat transfer analysis is carried out for two heating process, namely PEST and PEHF. The effects of the flow parameters on velocity field, temperature field, skin friction and rate of heat transfer in terms of Nusselt number for both PEST and PEHF cases have been studied and analyzed with the help of graphs and tables.

The FOURTH chapter covers a similarity solutions for an unsteady boundary layer flow and heat transfer of a dusty fluid over permeable exponentially stretching sheet embedded in a porous medium when subjected to suction/injection. Thermal radiation, viscous dissipation and internal heat generation/absorption effects are considered in the energy equation. In order to arrive at nonlinear ordinary differential equations, similarity transformations are defined differently compared to the steady case and these nonlinear differential equations along with pertinent boundary conditions are solved numerically using Runge-Kutta-Fehlberg 45 method. The heat transfer analysis is carried out for two thermal processes, namely (i) variable exponential order surface temperature (VEST) and (ii) variable exponential order heat flux (VEHF). Further the numerical results for skin friction at the wall and rate of heat transfer in terms of Nusselt number are obtained and
are tabulated. A selective set of graphical results are presented and discussed to show interesting features of the problem.

The FIFTH chapter devoted to study the effects of MHD flow and heat transfer of a fluid-particle suspension over a vertical exponential stretching sheet. The expressions for the velocity and temperature distributions of fluid and dust phases are obtained numerically using RKF-45 method. The significant aspects in this chapter is the investigation of heat transfer processes which is carried out under two thermal process for both steady and unsteady cases. Comparison with known results for certain particular cases is excellent. Finally the effects of the pertinent parameters which are of physical and engineering interest are presented in graphical and tabular form.

The SIXTH chapter deals with the studies on an unsteady stagnation-point flow and heat transfer due to an exponentially stretching sheet in a porous medium saturated with a fluid-particle suspension. The flow is considered near the free stream region and the stretching velocity and the free stream velocity is assumed to vary exponentially with the distance from the stagnation point. The heat transfer analysis for both fluid and dust phases in the presence of thermal radiation with viscous dissipation and heat generation/absorption for two dimensional flows is carried out for two cases. The similarity transformations are used to reduce the governing equations into set of ordinary differential equations. The obtained ordinary differential equations are then solved numerical by using RKF-45 method. Based on these the effects of flow parameters on velocity and temperature are discussed in detail.