INTRODUCTION

Plasma is the most common state of matter. Tonks and Langmuir have introduced the term "plasma" for the first time in 1929. Tonks L and I. Langmuir, (1929). The plasma physics is one of the most fascinating branches of the modern physics due to its wide applications in controlled thermonuclear fusion, magneto hydrodynamic (MHD) power generator, astrophysical plasma, space physics, industrial and chemical research etc. Choudhuri, R.A (1999) In recent years, the plasma research is of main attraction due to its importance in the solution of global energy crisis using the technology based on the controlled thermonuclear fusion. In this direction, many experimental devices like, Tokamak, ITER (International Thermonuclear Energy Reactor) and IFMIF (International Fusion Materials Irradiation Facility) are designed to achieve the controlled fusion. In confining plasma for fusion, there are large numbers of obstacles in theory as well as in experiments. The plasma instabilities are the main hindrances for getting successful fusion in laboratory. At the same time, the plasma instabilities are also important for the understanding of various problems in astrophysics and space physics. Thus the study of instabilities is one of the most important fields of research in plasma physics.

The plasma is defined as a collection of free electrons and ionized atoms or molecules that exhibit collective behavior due to the long range Coulomb force Bittencourt, J.A (1986) In plasma the waves and instabilities can be generated by making some disturbances in the entire media. If their amplitude grows with time usually in an exponential way, then the system is said to be unstable providing a particular type of instability Krishan V. (1999).
Recently, there are many indications \textbf{Jung, Y.F} (2001) that quantum effects can play a significant role in dense astrophysical objects. Traditionally, quantum effects are important when the de Broglie wavelength of the charge carriers is comparable to the dimensions of the system. Here quantum-mechanical effects can play a significant role. Density correlations due to quantum fluctuations should therefore be included in any investigation of collective interactions in quantum plasmas \textbf{Garcia, L.G, Haas, F. L.P. de Oliveira, J. Goedert, (2005)} The latter may exist in the interiors of astrophysical compact objects (e.g., white dwarfs and neutron stars, which are end products of stellar evolutions). Basically, if a plasma is cooled to an extremely low-temperature, the de Broglie wavelength of the charge carriers may be comparable to the various scale-lengths of the systems, viz., the Debye length of the plasma, Larmor radius, etc. In such situations, the ultra cold plasma must behave as a Fermi gas and the quantum mechanical effects are expected to play a vital role in the behavior of the collective interactions of the charged particles. However, plasma is plasma if the Debye length is smaller than the size of the plasma systems. So, one could say that when the de Broglie wavelength of carriers is comparable to the Debye length, the quantum mechanical effect must be significant in the Debye shielding. Since in astrophysical environments the quantum effects cannot be ignored \textbf{Shukla, P.K, Mamun, A.A (2002)}, it is necessary to investigate the hydro magnetic instabilities in astrophysical objects.

In the past few years, the study of various kinds of waves and instabilities of quantum plasma has become very popular and interesting field. The investigation of problems related to hydro magnetic instabilities like self-gravitational instability, Kelvin-Helmholtz (K-H) instability, and Rayleigh-Taylor (R-T) instability has become more advantageous due to their
importance in several physical processes. Chandrasekhar has given the detailed contribution of these instabilities including effects of various parameters. Thereafter many investigators have tried to explain the problem based on these instabilities taking the different phenomena for different type of mediums.

The self-gravitational instability is the fundamental instability responsible for formation of stars and galaxies in the interstellar media. Gurevich L.E and A. D. Chernin (1987). Jeans has given the fundamental concept of modern cosmology, which enables to estimate the scale of condensation in the gaseous plasma medium regarding the formation of stars and galaxies.

The K-H instability arises when there is a tangential discontinuity in velocity in two streaming superposed magnetized fluids. It is of much interest in understanding and investigation of the various problems of K-H instability in space plasma, laboratory plasma, and astrophysical plasmas. Lakhina, S. G (1994)

Along with this, many investigators discuss the R-T instability of two superposed plasma fluids. The R-T instability lies between the interfaces of two superposed fluids in which the heavy fluid is supported by a light fluid. The R-T instability is important in Tokamak physics, space physics and astrophysics.

Thus with all the above studies, it is a matter of interest to investigate some new problems and their results associated with these hydro magnetic instabilities viz. self-gravitational instability, K-H instability and R-T instability of quantum plasma.