Chapter 6

Summary of the Thesis

Main aim of thesis has been to explore some interesting linear and quasi-linear phenomenon of low-frequency electromagnetic waves in magnetized electron-ion plasma, as well as in dusty magneto-plasmas. These investigations find significance and applications in space and laboratory systems. Complex (dusty) plasmas are rather widespread in the universe. The subject of dusty plasma has grown rapidly because of its potential applications in laboratory, space, and astrophysical environments. Most interesting applications in space plasmas are found in nebulae, interstellar and intergalactic media, planetary atmospheres, cometary tails, asteroid zones, earth's lower atmosphere, etc. Low frequency electromagnetic waves are important in energy research i.e., fusion devices, as well as in industrial and modern plasma processing technology such as Coulomb crystal formations for the productions of new material of the future. This thesis identifing a relevant domain for successfully filling significant void spaces that are still existing in the domain of low frequency electromagnetic waves which may have a dust component. In this thesis we have used the Generalized (r, q) distribution function, to study the kinetic theory of Alfvén waves in the case of solar wind proton heating and dust heating.

In second chapter, the power dissipated through Landau damping is estimated within the framework of kinetic theory. The calculation are based on the "Generalized (r, q) distribution function", leading to theoretical results which shows the radial evolution of the power dissipated through Alfvén waves that are in good agreement with data from space observations. We present various plots in which the radial evolution of the power dissipated by Alfvén waves and the radial evolution of power which needs to be supplied to the solar wind are compared to one another. These are in good

agreement specially for slow solar wind streams.

In Chapter three, using standard theoretical methods, I have studied power dissipated phenomenon, using Quasilinear theory.I have considered a dusty plasma with different dust specie. I have considered the energy transfer from Alfvén waves to different dust species subsequently the related heating rates are calculated. Here again Generalized (r, q) distribution function is used. The dependence of the heating rate on the charge, mass and dust density is also investigated. The dependencies of the heating rate on the spectral indices r and q of the distribution function is also investigated for different cases and these results are shown graphically.

In fourth chapter, the theory of kinetic Alfvén waves in dusty plasmas is formulated taking into account the dust charge fluctuations. Kinetic Alfvén waves with finite Larmor radius effects have been examined rigorously in a uniform dusty plasma in the presence of an external/ambient magnetic field. The dust gas is assumed to be cold and un-magnetized. The dispersion relation, which is derived on the basis of the two-potential theory, shows the existence of a new cut-off frequency due to the motion of the magnetized ions and un-magnetized dust grains. The influence of the dust charge fluctuations on the damping of the electromagnetic kinetic Alfén wave is analyzed, which arises on account of the electrostatic parallel component of the waves. The dust charge fluctuation damping is seen to be contributed dominantly by the perpendicular motion of electrons and ions in the dusty magnetoplasma.

In chapter five, I have investigated the dust-Coulomb crystal formation, which is important in numerous laboratory experiments. I have calculated the wake potential which is most important in new developments of dusty plasmas. Here, we have considered collective phenomena in solid state plasmas. The dielectric permeability for an n-type ion-implanted piezoelectric semiconductor in the presence of crossed electric and magnetic fields is investigated. Using a test-particle approach, the Debye-Hckel and wake potentials in the presence of a density inhomogeneity and external static

uniform electric and magnetic fields are derived. It is pointed out that a periodic wake field and ordered periodic structures of the charged collide particulate can form within the semiconductor. It is also found that the external fields and the density nonuniformity have significant effects on the static and dynamical electrostatic potentials. This latter result is interesting because it opens the future perspectives of investigating the physical properties of the sample with this type of the internal structure. The possibility of the long-ranged order formation of colloids of the implanted ions, leading to modification of the electrical, thermodynamic, and optical properties of the soft matter, has been pointed out. The physics of dusty plasma also may play an important role in the research of Bio-Physics/ Bio-medical Engineering.