Investigations were made, in the presence of longitudinal magnetic fields, (i) on the breakdown potentials of dry air (ii) on some important plasma parameters of dry air glow discharge plasmas and (iii) on currents and voltages of dry air glow discharge plasmas.

For the investigations reported in this thesis, a stabilized high voltage dc power supply (1100 V, 100 mA) and an air core solenoid, giving an intensity of 202 G per ampere (energizing) current were fabricated by the author.

Breakdown Potentials:

Breakdown potentials of dry air, in a plane parallel geometry were determined in the presence of longitudinal magnetic fields over a wide range of \( p \times d \) values (\( p \) - pressure, and \( d \) electrode separation). At all the pressures studied the magnetic field lowered the breakdown potentials. The reduction in breakdown potentials was more
significant quantitatively, on the low pressure side of the Paschen minimum than that observed on its high pressure side. It was concluded that the reduction in ambipolar diffusion of electrons across the lines of force of magnetic field appeared to be responsible for the reduction of breakdown potentials in the presence of longitudinal magnetic fields.

The Townsend's ionization coefficients $\alpha$ and $\gamma$ were determined in the presence of longitudinal magnetic fields. The variation of $\gamma$ with increase in $E/p$ and the variation of $\alpha$ with increase in $E/p$ and in the presence of longitudinal magnetic fields are in agreement with results available in the literature.

**Electrical Probe Measurements:**

Low pressure, cylindrical, dc discharge plasmas were produced in dry air. The effect of a longitudinal magnetic field on the important plasma parameters viz. (i) Floating potential ($V_f$) (ii) Space potential ($V_S$) (iii) Electron Temperature ($T_e$) and positive ion density ($n_o$) were investigated. Langmuir probe techniques were applied for the above investigation. The $E/p$ values studied
were from 554.30 to 2716 \text{ V.Cm}^{-1}\text{torr}^{-1} and the corresponding pressures were $0.10 \leq p \leq 0.49$ torr. The intensity of the magnetic field was varied from 0 to 1775 G. It is believed that the above studies in a glow discharge in dry air (electronegative gas) are reported for the first time.

**Floating Potentials:**

The floating potential decreased with increase in $B_{11}$, except at $p = 0.10$ torr (Highest $E/p$ value investigated). The results are in agreement with the observations of Bohm et al on an argon arc plasma.

**Space Potentials:**

The space potentials decreased with increase in $B_{11}$, with an exception at $p = 0.10$ torr. The results are in agreement with those of Bohm et al. (1949 b) - Chapter V.

**Electron Temperature:**

The application of a longitudinal magnetic field on the discharge plasma was found to
increase the electron temperature. The results were explained on the basis of the influence of longitudinal magnetic fields on the ambipolar diffusion, negative ion processes, radius of the positive column and the plasma oscillations.

The above results of $T_e$ in $B_{11}$ were found to be in agreement with Bohm et al (1949 b) Chapter V - at very low pressure in an argon arc plasma, by a Langmuir probe method, and Davis (1953) - Chapter V - in a caesium discharge by spectroscopic method, and Saxena and Saxena (1975) - Chapter V - in air discharge, by a sonic probe method.

**Positive ion density:**

The positive ion density decreased with increase in the longitudinal magnetic field. This is attributed to the negative ion processes and the channel effect (Bertotti, 1961) - Chapter V. In the presence of longitudinal magnetic fields, the collision frequency will increase and hence an increase in attachment coefficient and formation of negative ions. Consequently, a reduction in concentration of electrons will occur. So the rate of production of ion pairs will decrease and hence a
reduction in positive ion density may occur.

Electron temperature of the discharge plasma in dry air in the presence of longitudinal magnetic fields was also studied by the method of Johnson and Malter (1950) - Chapter VI - double probe technique. The results were in agreement with those observed with the single probe technique.

Current and voltage characteristics:

The variation of discharge current and voltage of dry air plasma under homogeneous magnetic fields were investigated over a wide range of discharge currents, pressures and magnetic fields.

Work was done in rather two different ranges of initial discharge currents (discharge current in the absence of magnetic fields), the first part with discharge currents ranging from 6.50 to 25.50 mA and the second part with discharge currents ranging from 15.0 to 310.7 mA.

In the first part of the investigation, the $E/p$ range was $554.3 \leq E/p \leq 2716$ V.Cm$^{-1}$torr$^{-1}$ and the corresponding pressure range was $0.10 \leq p \leq 0.49$ torr. The intensity of the magnetic field was varied from 0 to 1775 G.