The reported work presents the mathematical modeling and experimental study of an axial discharge sealed off CW CO2 laser. The equations relating the modes energy verses intra-cavity optical intensities in equilibrium are used for modeling. It is based on the four-temperature model. An energy balance equation involving the terms of power loading, temperature of discharge tube walls and optical power removed, is derived and the variation in the output power as the parameters involved in the energy balance equation are varied, is predicted using the model. The derived equations are then programmed in the C++ and data obtained is plotted in excel. The output power as a function of tube wall temperature and discharge current has been measured experimentally as well as by using model. The experimental and predicted results are then compared and are found in accordance. In addition to this the laser is also operated in pulsed mode and the pulse energy as a function of pulsed repetition rate is measured. The

efficiency of the laser is also calculated experimentally as well as theoretically. The energy and power measurements are performed using P-444 Pyroelectric probe and P-444 with PH-30 Power Head (DigiRad Division of Terahertz Technologies Inc.) respectively.