# ABSTRACT

Four-point probe system provides and effective way to accurately measure the sheet resistance of various materials. The commercially available four-point probe systems are, however, quite expensive. In this research, a cost effective four-point probe system has been developed and characterized.

The complete system constitutes of two sections i.e. i) mechanical part ii) electronic module. For mechanical setup, two designs of probes have been prepared and presented in the thesis. The electronic module consists of current source which is designed and tested to provide constant current for the measurements.

Two schemes for current source design have been implemented i.e. current source-I (CS-I) and current source-II (CS-II). Wilson current mirror circuit is used in current source-I whereas in current source-II a single transistor is controlled to provide constant current of four different values i.e. 6.96 mA , 7.35 μA, 70.5 μA and 225 nA.

The characterization of the two current source circuits reveal that increase in the drain supply voltage ($V_{OUT}$) increases the range of the resistance for which the current source can provide constant current and vice versa. The current has strong dependence on gate voltage ($V_{gs}$), therefore a small variation in gate voltage produces significant variations in the output current. The gate voltage of current source-II is therefore provided through a stable voltage supply and the current is controlled by varying the series resistance connected at the source terminal of the transistor. The experimental results show that current source-II operating at $V_{DD} = V_{out} = 20$ V can provide constant current with 1% accuracy for resistance values upto 1 kΩ (6.96 mA) , 24 kΩ (7.35 μA) , 250 kΩ (70.5 μA) ,65 MΩ (225 nA).