This thesis is devoted to the design, study and implementation of metamaterial structures at microwave frequencies. The focus of this work is on investigating the possibility of using metamaterial structures to improve the performance of antennas operating at the microwave frequencies. Five types of metamaterial structures are presented. Initially, the parameters of the proposed metamaterial unit cell are extracted and then applied to the monopole antenna.

The work is followed by designing a compact MIMO UWB antenna using Complementary metamaterial. After that, the design and implementation of periodic structures (EBG and AMC) on monopole antenna are investigated. At the end, the work deals with the application of Composite right/ left hand (CRLH) structures on monopole antenna for quad bands. All the designed structures are fabricated and the measurement results compare well with the simulated ones