Cardiology is the analysis or study of heart disorder and circulatory system. Cardio vascular disease (CVD) is the main cause of death globally. Ischemia is defined as inadequate blood circulation resulting in low blood and oxygen supply to heart. It is also called coronary heart disease (CHD) or coronary artery disease. In India, 37 million people are affected by this disease. It is caused by build-up of plaque, a waxy substance inside the lining of larger coronary arteries. This build-up can partially or totally block blood flow in the large arteries of the heart. The role of Electrocardiography (ECG) is pivotal in medical field for the analysis of cardiac abnormalities. The interpretation of ECG signal is performed by signal processing algorithms for diagnosis of cardiac diseases. Field Programmable Gate Array (FPGA) has emerged as a great choice for systems requiring high-performance DSP functionality as it can provide a much simpler solution to difficult DSP challenges than a standalone digital signal processor. They use highly flexible architectures that make them to have greater advantage. The ECG dataset for ischemia heart disease is obtained from PTB diagnostic ECG database. This work analyses filtering approaches, component extraction and classification of ECG signal. IIR notch filter is used for removal of power line interference and hybrid wavelet filter for removal of baseline wander. Multi-speculative design carry look-ahead adder based Finite Impulse Response (FIR) filter architecture is employed to perform filtering of ECG signal for de-noising application. Feature extraction scheme determines the amplitude and intervals in the ECG signal for subsequent analysis that determines the functioning of heart. P and T waves in an ECG signal are lower in amplitude compared to amplitude of QRS complex and contaminated with noises from various sources. Due to these problems, automated detection of P and T waves in the ECG signal is a challenging task. The effective detection of peak position of P and T wave by Differential Evolution (DE) is used. Digital fractional order differentiator (DFOD) based ECG pre-processor is used to detect QRS complexes. Transform based approaches are used for feature extraction as it is capable of analysing signal with discontinuities through variable window size and analysing signals both in time and frequency domains. Artificial Neural Network (ANN) and Naive Bayes classifier are used to classify ECG signals.