The basic aim of this research is to develop a manufacture friendly process for fabrication of efficient CIGSeS thin film solar cells with reduced thickness. For this reason, two step process has been considered the process of choice for preparation of the absorber layer. Extensive research has been carried out on CIGS thin film solar cells in order to establish the thin film technology as the cheaper alternative for silicon PV modules. Device quality CIGS absorber films with thickness in the range of 1.5 -2.5 μm are routinely prepared at the laboratory level as well as commercially. If the thickness of this absorber can be reduced further the cost of the PV module will be reduced significantly. The reason for this significant reduction is the reduction in use of costly rare metal, indium. The problem of availability of indium may become more severe as the production volumes of CIGS PV modules increases. Experiments were carried out to optimize the selenization time and temperature profile along with the thickness of the sodium layer. Efficiencies as high as 9% were achieved through this work for absorber thickness of 0.9 microns. 66% reduction in absorber thickness and corresponding material usage resulted in only 35% reduction in efficiency. The buffer layer thickness was also optimized for the device. Further the effect of process parameters on properties of molybdenum back contact films was studied with the aim to achieve a single layer molybdenum back contact film.