In this study highly stoichiometric and monophase $AgInSe_2$ thin films were prepared by selenization of Ag-InSe precursors and the effect of the annealing temperature on the structural, electrical and optical properties have been investigated. The Se incorporation during selenization process as a function of temperature and the compositions of the samples were determined by energy dispersive X-ray analysis (EDAX). As prepared and selenized films were characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM), Hall effect and photoresponse measurements at room temperature. XRD analysis depicted that the crystal structure of $AgInSe_2$ film was monophase with preferred orientation along the (1 1 2) direction and the lattice parameters a = 6.09, b = 6.09 and c = 11.67 Å. The structural evolution was clearly diagnosed by the increase of film thickness during selenization process. It was observed from SEM measurements that the average values of grain size ranging from 0.5 to 4 μm on the surface of $AgInSe_2$ thin films by increasing selenization temperature from 300 to 450 °C. Room temperature conductivity and carrier concentrations of selenized samples determined by means of Hall measurements were found in the range of 0.03-0.88 $(\Omega\text{-cm})^{-1}$ and 1.35×10^{15}-7.09×10^{18} (cm^{-3}), respectively. The band gaps of these samples were investigated by spectral photoresponse measurement under light bias in the range of 1.05-2.10 eV. The two stage selenization process is introduced as an applicable approach to fabricate pure monophase $AgInSe_2$ thin films for the usage in thin-film solar cell applications.