Heat transfer characteristics of Copper-II and Zinc-Oxide nanofluids have been investigated for flow over a heated flat plate. The heated plate was subjected to a constant heat flux from cartridge heaters spaced evenly along the length of the plate. The flow channel's cross-sectional area was a 5cm x 5cm square. An investigation of the heat transfer occurring in a plane along the centerline of the plate in the direction of the flow was performed. The heat transfer coefficients were calculated and plotted verses the Reynolds number and compared with the results obtained from identical experiments performed with distilled de-ionized water. In order to thoroughly characterize the nanofluids, nanoparticle size from the fluids was investigated to inspect for possible agglomeration. The particle size was measured by using both a transmission electron microscope (TEM) and a dynamic light scattering system (DLS). Nanofluid viscosity was measured and equations for the viscosity of the nanofluids were developed as a function of temperature. The significance of correct effective viscosity and thermal conductivity values of nanofluids were investigated through sensitivity analysis of potential results variance. A computational model using a commercial CFD software FLUENT was developed and evaluated against the experimental findings. The model and experimental results were found to be in good agreement. Enhancement of convective heat transfer with nanofluid ranged from 4 to 16 percent depending on the particle and their concentrations.