Need for Ordinary Portland Cement is increasing day by day due to perennial demand of concrete in and around the world by construction industry. There were number attempts made and still going on to find the possible and feasible alternative to the main ingredient of concrete namely cement. Geopolymeric materials are one such option in which total replacement of cement with other mineral admixtures could be made possible with the association of alkaline activators. Hence in the present work an attempt was made to replace cement in a high volume with silica fume (SF), ground granulated blast furnace slag (GGBFS). Detailed parametric study was carried out by considering type of magnitude of thermal curing (60, 80 and 100 °C), alkaline liquid to binder ratio (0.25, 0.30 and 0.35), silicate to hydroxide ratio (0.5, 1 and 1.5) and concentration of NaOH (8, 14 and 16) as parameters to assess the strength and durability characteristics of geopolymer concrete. All the samples were subjected to compressive strength after the desired duration of rest period. Resistance against compression was studied at different ages namely 3, 7, 28 and 56 days to understand the effect of geopolymerization. Durability properties like sorptivity and porosity were also studied. Optimum combination of mix was arrived and for which beam was cast to study the load deflection characteristics of GPC. Among the two mineral admixtures used GGBFS based GPC performed better than the silica fume based GPC. It was concluded that mineral admixture based geopolymer concrete was found to be superior to that of control concrete. To ensure the quality of concrete, statistical analysis was done and to assess the economic feasibility cost analysis was done introducing an index called economy index. Carbon footprint analysis was also done to prove GPC as eco-friendly material. The optimum values of alkaline liquid to mineral admixture ratio, silicate to hydroxide ratio and magnitude of thermal curing were arrived.

Keywords: GGBFS, SF, Alkaline activator, GPC, Thermal curing, and Compressive strength