Concrete, the mostly used construction material, has several desirable properties like high compressive strength, stiffness, durability under usual environmental factors. At the same time concrete is brittle and weak in tension. Plain concrete has two major deficiencies, low tensile strength and a low strain at fracture.

These shortcomings are generally overcome by reinforcing concrete. Normally the reinforcement consists of continuous deformed steel bars or pre-stressing tendons. The advantage of reinforcing and pre-stressing technology utilizing steel reinforcement as high tensile steel wires have helped in overcoming the incapacity of concrete in tension but the ductility characteristics of concrete still needs to be addressed. However, it has been only since 1960's that serious consideration has been given to the use of fibre to improve the performance of conventional, mouldable construction materials such as concrete.

Fibre reinforced concrete is concrete made primarily of hydraulic cements, aggregates, and discrete reinforcing fibres. This is a composite material consisting of a matrix containing a random distribution or dispersion of small fibres, either natural or artificial, having a high tensile strength. Due to the presence of these uniformly dispersed fibres, the cracking strength of concrete is increased, fibres acting as "crack arresters". Fibres suitable of reinforcing concrete having been produced from steel, glass and organic polymers.

Glass fibre reinforced cement composites have made striking advances in recent years, on the one hand due to several technological developments (involving the matrix, the fibre, the interface and composite production process) and on the other hand due to a better understanding of the fundamental mechanisms controlling their particular behaviour.

Self compacting concrete is a concrete that can be placed and compacted under its own weight with little or no vibration effort, while being cohesive enough to be handled without segregation or bleeding at the same time. It is used to facilitate and ensure proper filling and good structural performance in restricted areas and heavily reinforced
structural members. Self compacting concrete concept has gained a wider use in many countries for different applications and structural configurations due to the fact that it can provide a better working environment by eliminating the vibration noise. The several advantages reported in using self compacting concrete has reduced the construction time and the labour cost, eliminating the need for vibration, reduced noise pollution, improved compactability even in highly congested structural members, and finally a better construction ensuring good structural performance.

Self compacting concrete is a complex system that is usually proportioned with one or more mineral admixtures and more than one chemical admixture. Correct selection of aggregates, its size, gradation and content, along with adjustments in the rheology of the paste is essential for the self compacting concrete. To have successful design of self compacting concrete mix it is essential to have a higher level of quality control, a greater awareness of aggregate gradation, control over the mix water and use of highly advanced high range water reducing admixtures and the viscosity enhancers and have a clear understanding of the role of the various constituents in the mix and their effects on the fresh and hardened properties.

The elimination of vibration for compacting concrete during placing through the use of self compacting concrete leads to substantial advantages related to better homogeneity, enhancement of working environment and improvement in the productivity by increasing the speed of construction. The resulting concrete is characterized in the fresh state by the methods used for self compacting concrete, such as Slump-flow, V-funnel and L-box tests respectively.

In the present experimental investigation, attempts are made to study on the rheological properties, various strength properties like compressive strength, split tensile strength, flexural strength, secant modulus of elasticity and durability properties of both self compacting concrete and self compacting concrete using alkali-resistant glass fibres at 28, 90 and 180 days. Studies are made on strength properties of self compacting concrete and glass fibre self compacting concrete mixes by exposing the specimen for 28, 90 and 180 thermal cycles at 50ºC and 100ºC. Studies are made on
residual compressive strength, weight loss and pulse velocity of self compacting concrete and glass fibre self compacting concrete mixes subjected to temperatures at 200°C, 400°C and 600°C. Studies are also conducted on prototype glass fibre reinforced self compacting concrete beams and slabs.

The studies have indicated that glass fibre self compacting concretes mixes would contribute towards development of high performance and high strength concretes which is the need of the hour. The present thesis would contribute to the efforts being made in the field of concrete technology towards development of concretes possessing very much enhanced and special properties.