3. RESEARCH STATEMENT AND OBJECTIVES

3.1 Research Motivation

Fiber Reinforced Composites (FRC) have been in use in place of metals for various industrial and other applications where weight reduction is the primary criterion without compromising the strength. The synthetic fibers have taken the FRP composites to a level where the strength is often superior to some of the metals and thus are becoming a popular choice for specific applications.

Many investigations are made on polymer composites based on natural and synthetic fibers. Fibers reinforced polymer composites can be fabricated from thermoplastic or thermoset polymers in different shapes and sizes. The polymer composites are fabricated with very good mechanical strength and stiffness, along with resistance to corrosion.

It is known that polymers are insulators, which restricts their usages in applications where thermal conductivity is necessary for heat to be efficiently dissipated or stored. According to the research and study of conductive composites which are frequently used in wide applications such as heating elements, temperature-dependent sensors, self-limiting electric heaters, switching devices, antistatic materials for electromagnetic interferences, and shielding of electronic devices, etc, there is a need for time to tailor polymer-based fiber composites to be mechanically strong and thermally conductive/non-conductive as per demand by using appropriate matrix and reinforcement materials selecting proper filler material.

FRC has attracted much attention from technologists and scientists for applications in civil, military, industrial, spacecraft, and biomedical sectors. In the past two decades, the growing interest in FRC has resulted in wide research. The driving forces are,

- Cost reduction,
- Weight reduction, and
- Marketing (application of renewable materials).

Technical requirements were of less significance; hence application remained restricted to non-structural parts for a long time. Recent research, however, shows that significant improvements of these properties are possible. There is a scope of research for improvement

in the properties of FRC in the area of mechanical strength considering the effect of post-process curing and in-process curing as well as its effect on their thermal behaviour. Mechanical and thermal behaviour of the fiber-reinforced polymer composites are future challenges and attract the researchers to research this new area.

Studies also emphasized the effect of post-curing on the mechanical characterization of fiber-reinforced polymer (FRP) composite. The curing cycle has affected strongly on the mechanical properties of thermosetting polymers. The amount of cross-linking which is a strong function of curing temperature and time is directly correlated to the glass transition temperature (Tg) of the thermosetting polymer.

Investigations reveal that there is a lack of information in the area of impact of in-process curing and post-process curing on the mechanical strength of the composite material. Also, there is a need fora user-friendly laboratory set up to measure the thermal conductivity of the composite. Research survey reflects that only a few studies are available in the direction of incorporation of filler material during the fabrication of composites to improve its thermal properties and its effect on mechanical strength.

3.2 Research Objectives

The present study is emphasized on the effect of post-curing and in-process curing parameters on mechanical as well as thermal behaviour of fiber-reinforced polymer (FRP) composite. The curing cycle has a strong influence on the mechanical and thermal behaviour of thermosetting polymers. The scale (amount) of cross-linking which is a strong function of curing temperature and time is directly associated to the glass transition temperature (Tg) of the thermosetting polymer. The improvement in the thermal conductivity of the polymer with conductive filler and its effect on mechanical strength. The following objectives have been identified and addressed in the present research work.

- To gain an understanding of natural and synthetic fiber-reinforced polymer composites, and to gain an insight into the work previously done by other researchers in this particular area.
- To develop mould and punch set up for preparing the composite specimen with a facility to cure at a different set of pressure and temperature.

- To develop hot plate set up and hot air oven with temperature controllers and indicators for preparing the composite specimen to facilitate in-process curing and post-process curing respectively.
- To carry out a systematic experimental study based on the design of experiments (DOE) for the composites of jute, basalt and carbon fibers as reinforcements and vinyl ester as a matrix for post-process curing and in-process curing parameters.
- To carry out the experimental investigations to study the effect of applied load, in post-curing of the composites considering post-curing temperature and time. Also to propose statistics based correlation to predict tensile and flexural strength.
- To carry out the experimental investigations to study the effect of applied load and temperature during in-process curing to propose statistics based correlation to predict tensile and flexural strength.
- To develop laboratory set up for measuring the thermal conductivity of the composites material using the guarded hot plate (GHP) and calorimeter principle. Also to determine the thermal conductivity of developed composites
- To carry out the experimental investigation to study the effect of conductive filler material (e.g. Copper (Cu), Aluminium (Al), and silicon carbide (SiC)) in jute-Polyester composite on mechanical and thermal behaviour.

3.3 Research Scheme

Fig. 3.1 shows the research scheme of the work carried out.

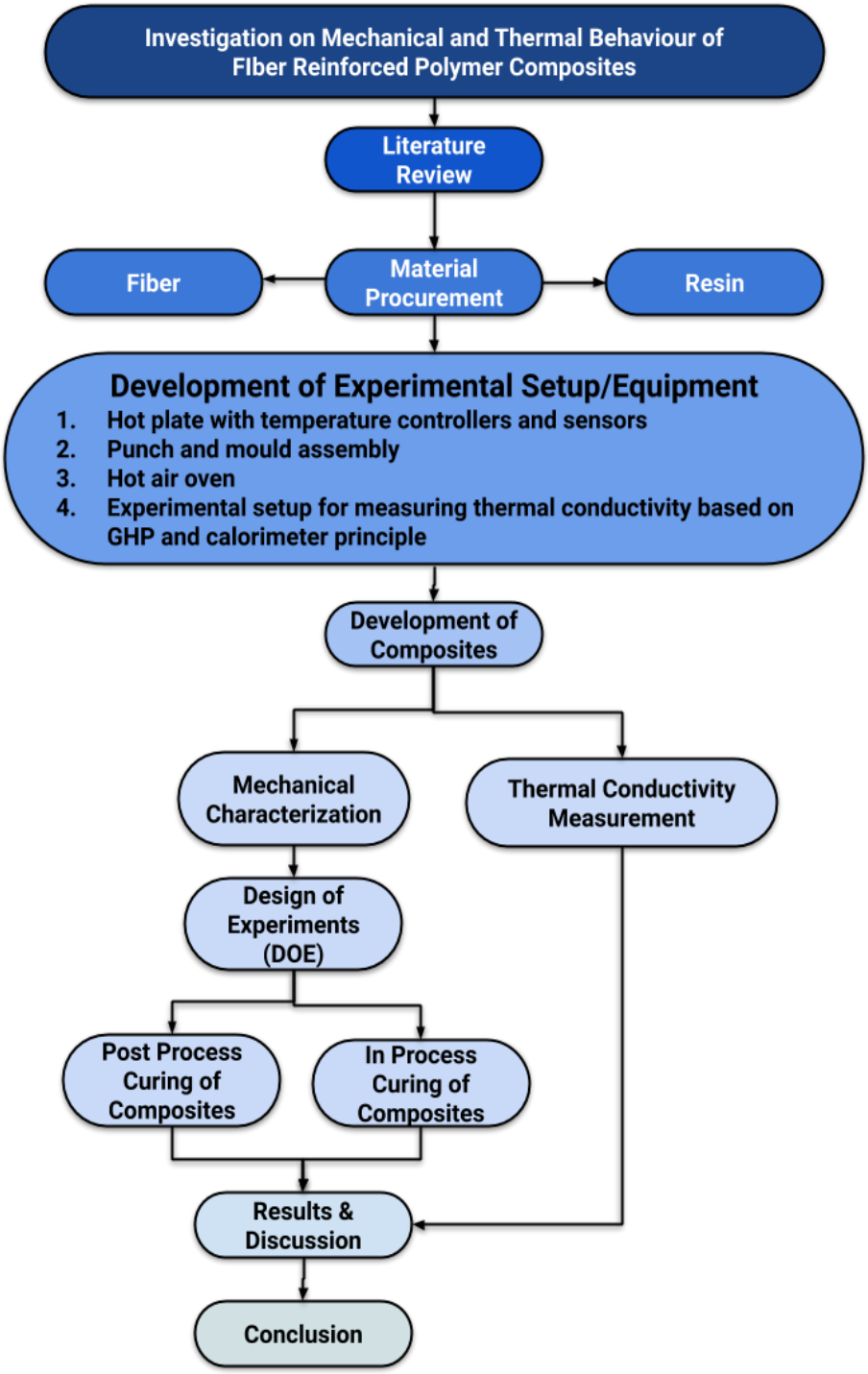

Figure 3.1 Research Scheme