Reliability is the probability that a system will perform satisfactorily for a given period of time under stated conditions. Quality and Reliability play a key role in the present day where competitiveness is the main interest in the globalization process. Engineering system becomes more versatile and powerful than earlier days. Sophistication in high-tech industrial process lead to reliability related problems. Therefore the problem of reliability continues to exit and of course require more complex solutions. Today Engineering systems are more complicated. For example, a space shuttle consists of hundreds and thousands of components. The functioning of the system is very much linked to all the components. Then performance of system depends on performance of its constituent components. Progress in science & technology has made engineering systems more powerful than ever. The intensity of sophistication in high-tech industrial producers emerged with reliability problems.

In the recent years mathematical and statistical models were developed for evaluating system reliability based on constituent individual components, which forms the system. Thus system reliability analysis and modeling was one of the interesting areas of the Reliability analysis. Thus system reliability analysis and modeling was one of the interesting areas in reliability literature.
Apart from the mathematical modeling, life testing and estimation is of paramount interest in order to assess and answer some information about the average life of the product etc.,. In fact, life testing experiments are designed to measure the average life of the components, life testing experiments are also interested to answer such questions as ‘what is the probability that the item will fail in the interval \((0, t) / [t_0, t_0+t]\). In a life testing experiment a number of items are subjected to tests and data consist of the recorded lives of all or some of the items. Failures are obvious no matter how efficient may be the manufacturing processes. Random or chance causes failure occurs quite unpredictably at random intervals so it is quite customary to assume that the life of the items, a random variable with some probability density function say \(f(t)\), characterized by some parameters of the distribution. Most likely different types of data examined to be fit to exponential form.

In this thesis, system reliability measures like reliability function \(R_s(t)\), availability function \(A_s(t)\) & \(E(T)\) (MTTF/MTBF), Frequency of failure were attempted to be estimated using ML estimation method in the case of (i) Two component non-identical component system which is under the influence of lethal, non-lethal CCS failures along with individual failures. (ii) Three component identical system which is affected by CCS failures as well as human errors in addition to individual failures. (iii) And three component non-identical series system with CCS failures as well as human errors in addition to individual failures.

In fact estimation methods & techniques were available for estimating the parameter and reliability of the components in the literature. For many of the
probability distributions of life / time to failure various approaches of estimating the parameters are available from 1950 onwards.

It is in this direction in the present thesis a research investigation is undertaken to explore and find an estimation method / approach which is appropriate to evolve the estimates of \( R_s(t) \), \( A_s(t) \) & \( E_s(T) \) (MTTF/MTBF), frequency failure function for a given sample. On estimation of reliability indices of system is available especially when the system is under the influence of ‘individual’ as well as common cause shock failures (CCS) along with human errors.

Hence in this present research work an attempt is made to estimate the reliability measures of the two component and three component systems using M L estimation approach to evolve appropriate estimate for the reliability measures like \( R_s(t) \), \( A_s(t) \) & \( E(T) \) (MTTF/MTBF), frequency failure etc, both in the case of series and parallel system. The results obtained are not closed form. However in this thesis empirical evidence is developed using simulation method by applying Monte Carlo procedure with samples of various sizes with large \( N \). In establishing the results Monte Carlo simulation (\( N \)) was attempted to generate sample of size \( n = 5 \) (5) 30 with minimum of 10,000 (20,000) to 90,000 samples and the mean square estimate was evolved using computer package in C language.