CHAPTER – V
SUMMARY AND CONCLUSIONS
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The theory of reliability was introduced during world war – II. The basic aim of reliability theory is to assess the effectiveness of the system. The origin of reliability analysis was quoted by LLOYD and LIPOW as “unreliability has consequences in cost of inconvenience, and in certain instances personal and national security. Generally, the cost of the failing item but of the associated equipment which is damaged or destroyed as result of the failure”. The reliability is based on the concept of probability theory.

Common Cause Shock failure is one of the most dominant causes of failures which can severely degrade the system reliability. Many of the researchers studied the concept of Common Cause Shock failure in addition to individual failures in the theory of reliability. It is rightly pointed out that reliability analysis do not much emphasize human errors. Human error is defined as a failure to perform a prescribed
task which could result in damage of equipment and property. Common Cause Shock failures and human errors are supposed to degrade the system reliability to a great extent. Therefore, there is a need to account such failures in the reliability analysis. Billinton and Allan [7] considered the role of Common Cause Shock failures and discussed the need for considering such failures in the reliability theory. Dhillon [29,41] studied the concept of Common Cause failures as well as human errors.

In this research work, the author is aimed to consider human error as well as Common Cause Shock failures in addition to individual failures to derive the important measures of reliability namely, Reliability function, MTBF, Availability function (both transient and steady state) and frequency of encountering different states of the system.

Chapter - I deals with the concept of reliability and its related measures. Different types of configurations are discussed in this chapter.

Chapter - II reports a comprehensive survey of literature on Common Cause Shock failures and human errors. The review of literature survey and several research papers connecting with the present work have been discussed in this chapter.

Chapter - III presents Markovian model for two-unit identical system under the influence of Common Cause Shock failures as well as human errors in addition to individual failures and derived the expression for reliability, MTBF, availability and frequency of encountering different states of the system.
Chapter - IV presents Markovian model for three-component system in the presence of Common Cause Shock failures as well as human errors along with individual failures and obtained reliability measures viz; reliability, MTBF, availability and frequency of failures.

- Reliability function for both two and three component system in the presence of Common Cause Shock failures as well as human errors in addition to individual failures for series and parallel configurations is obtained and presented.

- MTBF of the system under the influence of Common Cause Shock failures and human errors along with individual failures for both series and parallel configurations is derived and results are presented in this thesis.

- The expression for availability (both time-dependent and steady-state) of the two-component and three-component system in the case of Common Cause Shock failures as well as human errors and individual failures for series and parallel configurations is developed and the results are obtained and presented.

- The frequency of encountering different states of the system in the case of Common Cause Shock failures along with human errors and individual failures for both series and parallel systems is obtained and incorporated in this thesis.
Selected plots are presented to demonstrate the effect of Common Cause Shock failures as well as human errors in addition to individual failures on system reliability and availability for both series and parallel configurations and numerical results are also added to support the model.

Finally, the scope of the present research work is to extend the system into three-non-identical component system, which is affected by Common Cause Shock failures and human errors in addition to individual failures to derive the reliability measures.
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<td>3.</td>
<td><strong>Availability and Frequency Measures of a Two Unit System with CCS Failures and Human Errors</strong>, G.Y. Sagar, S.M. Verma and A.A. Chari</td>
<td>International Conference on 'Statistical Science, OR &amp; IT' in Conjunction with the XXVI Annual Convention of ISPS: Tirupati, 7-9, January 2007</td>
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