Preface

The current literature on dynamic entropy has focused mainly on Shannon entropy [109] and Kullback-Leibler relative information [70], perhaps because of their simplicity. In view of this we explore the motivations and implications of using various generalized classes of dynamic entropy measures in this thesis. It has been seen that the use of different dynamic entropy measures based on non-additive entropy, inaccuracy, and weighted information measures may lead to different models or statistical results than those obtained by dynamic Shannon and dynamic Kullback-Leibler information measures. The subject of present study is to introduce the concept of different dynamic entropy measures, including Havrda-Charvat entropy [57], Kerridge inaccuracy measure [67], and weighted information measures in the context of the characterization theorems and characterization of residual and past lifetime distributions. Also we have focused on the dynamic cumulative residual measures problem for residual and past lifetime distributions and have also provided the characterization theorems.

The thesis comprises seven chapters including the first chapter on introduction and literature survey, and the last chapter on conclusion and further scope of work. The thesis has been organized as follows;

Chapter 1 is introductory in nature presenting a brief account of the available literature and the various information measures proposed by the researchers. Some
basic concepts of reliability, including that of proportional hazard model (PHM), proportional reversed hazard model (PRHM) and length biased model, have also been discussed.

In **Chapter 2**, we have considered Havrda and Charvat [57] measure of entropy which is a one parameter generalization of the Shannon entropy and is non-additive in nature. We have proposed a residual measure of entropy based on it and have proved a characterization theorem that the proposed measure determines the distribution function uniquely. Also we have characterized some specific probability distributions based on the proposed measure. The work reported in this chapter has been published in the papers entitled, **Non-additive Entropy Measure Based Residual Lifetime Distributions** in *JMI International Journal of Mathematical Sciences*, 2010, 1 (2), 1-9, and, **A Generalized Entropy-Based Residual Lifetime Distribution** in *International Journal of Biomathematics*, 2011, 4 (2), 171-184.

In **Chapter 3**, we have conceptualized the idea of dynamic measure of inaccuracy, both residual and past. In case of residual inaccuracy measure we have studied the characterization result using proportional hazard model; and in case of past inaccuracy measure we have studied this using proportional reversed hazard model. Also we have characterized some specific distributions based on these measures. The work reported in this chapter has been published in the papers entitled, **A Dynamic Measure of Inaccuracy Between Two Residual Lifetime Distributions** in *International Mathematical Forum*, 2009, 4 (25), 1213-1220, and, **A Dynamic Measure of Inaccuracy Between Two Past Lifetime Distributions** in *Metrika*, 2010, 74 (1), 1-10.

The aforementioned information measures do not take into account the qualitative aspect of the random variable. They consider only its probability density. Based on the notion of weighted distribution, Di Crescenzo and Longobardi [31] intro-
duced the concept of weighted entropy, weighted residual entropy and weighted past entropy. In Chapter 4, the results of Chapter 3 have been extended to weighted distributions. Taking weights $w(x) = x$, we have introduced length biased measures of residual and past inaccuracies and have studied their respective characterization theorems, and other properties. The results reported in this chapter have been published in the papers entitled, **Length Biased Weighted Residual Inaccuracy Measure** in *Metron*, 2010, LXVIII (2), 153-160, and, **On Length Biased Dynamic Measure of Past Inaccuracy** in *Metrika*, 2012, 75 (1), 73-84. Also some results were presented at *International Conference in Mathematics and Applications* held in *Bangkok* on Dec. 19-21, 2009.

Since the cumulative distribution function based information measures are more stable in comparison to probability density function based measures. Based on that an alternative notation of entropy called *cumulative residual entropy (CRE)* is proposed in Rao et al. [98]. In Chapter 5, we have generalized the concept of cumulative residual entropy measure to one parameter and two parameters entropies, and have studied their dynamic versions and characterization results. The exponential, Pareto and finite range distribution, which are commonly used in reliability modeling, have been characterized in terms of generalized cumulative residual entropy measures. The work reported in this chapter has been published in the papers entitled, **On Dynamic Renyi Cumulative Residual Entropy Measure** in *Journal of Statistical Theory and Applications*, 2011, 10 (3), 491-500, and, **Some Characterization Results on Generalized Cumulative Residual Entropy Measure** in *Statistics and Probability Letters*, 2011, 81 (8), 72-77. Also some results were presented at *International Congress of Mathematicians (ICM)* held in *Hyderabad* on Aug. 19-27, 2010.

In Chapter 6, we have considered dynamic cumulative inaccuracy measures, both residual and past and have studied the characterization results respectively under proportional hazard model and proportional reversed hazard model. Also we
have characterized certain specific probability distributions using relation between
different reliability measure. It is expected that dynamic cumulative inaccuracy
measures introduced will further extend the scope of study. The work reported in
this chapter has been published in the paper entitled, **On Dynamic Cumulative
Residual Inaccuracy Measure** in proceedings of the *World Congress on
Engineering (WCE)*, held in *London* on July 4-6 2012, and, some results have been
communicated for publication.

In **Chapter 7**, we have concluded the findings of the work carried out in this thesis
and also have presented further scope of work. During the present investigation,
several ideas have originated which have the potential to extend the study further.
We can consider the proposed dynamic measures further for discrete cases, since
practically discrete cases are suitable from application point of view. Further the
discrete measures of the dynamic versions proposed can possibly find wider applica-
tions in different areas of interest. The work reported in this thesis can be extended
to bivariate and multivariate domains. Also we can employ the concept of order
statistics to the different dynamic measures reported in the thesis.