Preface

Study of congestion control is an important issue in any queueing model which arises naturally in telecommunication networks, transportation and manufacturing systems etc. Often bulk service rules are employed to model these types of real life situations. Sometimes congestion, which arises in the systems, may lead to balking in the queueing models. Therefore, it is important to study the performance analysis of bulk service queues with balking. The objective of the study of Chapter 2 and Chapter 3 is to analyze some bulk service queueing models with balking. Current literature on bulk service queues reveals the fact that the batch size dependent service policy successfully reduces congestion in bulk service queueing models. The main objective of Chapter 4, Chapter 5 and Chapter 6 is to analyze the batch size dependent bulk service queues with general bulk service rule and queue length dependent vacation (single vacation and multiple vacation).

The thesis consists of six main chapters and a concluding chapter. Chapter 1 is introductory chapter in which the comprehensive literature survey on several related topics are briefly exhibited. Chapter 2 deals with the steady state analysis of single server infinite buffer fixed batch size bulk service Poisson queue with system size based balking. In this chapter we employed probability generating function method and obtained system length distribution. In Chapter 3 we have presented the analysis of single server infinite buffer bulk service Poisson queue with general bulk service rule and system size based balking. Using probability generating function method we obtained the steady state joint probability distribution of the queue content and the server content.

Performance analysis of finite buffer bulk service queue with general bulk service rule under batch size dependent service and queue length dependent vacation (single vacation and multiple vacation) has been carried out in Chapter 4. In this chapter we have employed the supplementary variable technique and the embedded Markov chain technique to obtain the joint distribution of queue content and server content, and the joint distribution of queue content and type of the vacation. Several system performance measures are also presented. In this chapter we have successfully concluded, through several numerical results and discussion, that

inclusion of queue length dependent vacation further reduces congestion in bulk service queue with batch size dependent service. Similar studies have been carried out in Chapter 5 with bulk arrival bulk service queues where customers are arriving at the system following the compound Poisson process in batches of random size and are served in batches following general bulk service rule.

In modern communication system, due to advances in 3G and 4G network, it has been become important to address the queueing models where the arrivals are correlated and brusty in nature. As Markovian arrival process (MAP) is a good representation of such irregular/brusty nature of the customer's arrival, in Chapter 6 we have studied a finite buffer bulk service queue under general bulk service rule with *MAP*, batch size dependent service, and queue length dependent vacation (single vacation and multiple vacation) and investigated the effect of system parameters on congestion.

Keywords : Balking, Batch size dependent service, Blocking probability, Bulk arrival, Bulk service, Congestion, Embedded Markov chain technique, Finite buffer, General bulk service rule, Infinite buffer, Joint distributions, Markovian arrival process, Multiple vacation, Non-Poisson queue, Probability generating function, Poisson Queue, Queue length dependent vacation, Single server, Single vacation, Supplementary variable technique.