ABSTRACT

Retrial queues have been widely used to provide stochastic modeling of many problems arising in telecommunication, computer networks, and in daily life. The standard queueing models of telephone systems, queueing systems with losses, do not take into consideration this retrial concept and therefore cannot be applied in solving many practically important problems. In this thesis, retrial queueing models with two phases of heterogeneous service, recurrent demand option, server breakdowns and different vacation policies are discussed. The proposed models of this research work are theoretically developed and numerically justified.

A single server batch arrival retrial queue with general vacation time under Bernoulli schedule and two phases of heterogeneous service is proposed and theoretically developed in chapter 2. For the proposed model, steady state system size distribution, steady state orbit size distribution, expected number of customers in retrial group, expected number of customers in system, expected waiting time of a customer in retrial group and expected waiting time of a customer in system are carried out. The existence of the stochastic decomposition property of the proposed model is proved to show that the system size distribution of this model decomposed into distributions of two independent random variables. An application of the proposed model is also discussed. Numerical illustrations are also provided to justify the theoretical framework of the proposed model.

A single server batch arrival retrial queueing model with N – policy multiple vacations and two phases of heterogeneous service is analytically developed in chapter 3. For this proposed model steady state system size distribution is obtained. An extensive analysis of the proposed model is discussed with the potential application. Some interesting performance measures of the model are also obtained. Further some particular cases and special cases are also discussed. Numerical illustrations are also presented for the proposed model.

An $M^x/G/1$ retrial queue with two phase service subject to active server breakdowns and two types of repair time is analysed in chapter 4. For this proposed queueing system, the orbit and system size distributions are obtained. The existence of the stochastic decomposition property of the proposed model is proved to show that the system size distribution of this model decomposed into two independent random variables. Reliability analysis of the proposed model is discussed. Some particular cases and special cases are discussed. Other performance measures are also obtained. The effects of several parameters on the proposed system are analysed numerically.

The steady state behaviour of an M/G/1 retrial queue with infinite waiting space, two phases of heterogeneous service and recurrent demand option is proposed in chapter 5. The joint generating function of the number of calls in the two groups, expected number of customers in retrial group and expected waiting time of the customers in the retrial group are obtained for

the model considered. The application of the proposed model is also discussed to analyze a mobile communication protocol with the numerical illustration.

The steady state behavior of an M/G/1 retrial queue with non – persistent customers, two phases of heterogeneous service and different vacation policies is analysed in chapter 6. The steady state queue size distribution of number of customers in retrial group, expected number of customers in retrial group and expected waiting time of the customers in the orbit are obtained. Some interesting particular cases and special cases are also discussed. Numerical illustrations with an application are also presented.

A single server retrial queue with batch arrivals, two phases of heterogeneous service and modified vacation policy under Bernoulli schedule is proposed in chapter 7. The steady state system size distribution of number of customers in retrial group, expected number of customers in retrial group and expected waiting time of the customers in the orbit are carried out. Some interesting particular cases and special cases are also discussed. Finally, the effective analysis of the proposed model is discussed through numerical illustrations.

The important features of the proposed models are highlighted. The major contribution of this research work is summarized and the possible directions for future work are also indicated.