ABSTRACT OF THE THESIS

Queueing theory is a branch of Applied Stochastic Process. Its progress and development both in methodology and in applications are ever growing. As a result of which it is an important area of current research. In this thesis attempts have been made to investigate some $M/G/1$ type of queueing models associated with two phases of heterogeneous services under various types of vacations. The thesis consists of 8 (eight) main chapters in two parts and a concluding chapter. The first part includes some vacation queueing models with two phases of service subject to service interruption i.e. for unreliable server queueing system and in the second part retrial queuing models for unreliable server is considered. In this course of study, various new results are obtained and some existing well known results are generalized. The following is a brief description of the work done during study in the thesis.

Chapter I - Introduction

The Chapter I is the general introduction which includes historical aspects, basic terminology, and the anatomy of the queueing system where various types of queueing processes and the techniques used in this thesis are discussed elaborately.

PART I

(Some vacation queueing models with two phases of service subject to service interruption i.e. for unreliable server queueing system)

In part I of the thesis, the $M/G/1$ type of some vacation queueing systems with two phases of heterogeneous service under Bernoulli vacation schedule subject to service
interruption associated with single as well as batch arrival queueing models are considered and the various useful aspects are discussed thoroughly. The classical vacation scheme with Bernoulli vacation schedule was originated and developed significantly by Keilson and Servi (1986) and co-workers. The part I of the thesis is divided into five different chapters which are organized as follows:

Chapter II deals with an $M/G/1$ unreliable queueing system with single vacation for two phases of heterogeneous service under Bernoulli vacation schedule and while the server is working with any phase of service, it may breakdown at any instant and the service channel will fail for a short interval of time. A Bernoulli schedule vacation model for single server queueing system is such a model where after returning from a vacation if the server doesn't find any unit in the system even then it joins the system without taking any further vacations. By applying the supplementary variable technique the following aspects have been discussed under the present study of this chapter-

(i) The stationary distribution of the queue size at a random epoch.
(ii) The queue size distribution at departure epoch
(iii) Some particular cases
(iv) The busy period distribution
(v) The waiting time distribution
(vi) The Reliability analysis
(vii) The numerical illustration

The Chapter III of the thesis has also received the attention of $M/G/1$ unreliable queue with two phases of heterogeneous service with a delay period under Bernoulli
vacation schedule but as a batch arrival generalization of the previous chapter. The following results have been obtained under the present study of this chapter-

(i) The stationary queue size distribution
(ii) The queue size distribution at departure epoch
(iii) Some particular cases
(iv) The busy period distribution
(v) The waiting time distribution
(vi) The Reliability analysis
(vii) The numerical illustration

In Chapter IV, an $M^x/G/1$ unreliable queue with two phases of heterogeneous service and Bernoulli vacation schedule under multiple vacation policy where after each vacation completion or service completion the server takes sequence of vacations until a batch of new customer arrive. Further concept of the delay time is also introduced. The following aspects have been discussed under the present study of this chapter-

(i) The stationary distribution of the queue size at a random epoch.
(ii) The queue size distribution due to busy period initiation epoch
(iii) Stochastic decomposition property
(iv) Particular case
(v) The busy period distribution
(vi) The waiting time distribution
(vii) The Reliability analysis
(viii) The numerical illustration
Chapter V of the thesis deals with an $M/G/1$ Bernoulli vacation queue with two phases of heterogeneous service and unreliable server under randomized vacation policy where after performing each Bernoulli vacation the server deactivated and leave for a vacation. After returning from that vacation if the server finds no unit in the system it leaves for another vacation. This process will be continued randomly till the server takes maximum \( \mathcal{M} \) (say) numbers of vacations. If the server found no units in the system by the end of the $\mathcal{M}$th vacation, the server waits in the system until a new unit arrive to the system. For this queueing model our study is basically concentrated in deriving the following results by introducing the supplementary variable technique:

(i) The stationary queue size distribution at a departure epoch.
(ii) The analysis of the queue size distribution.
(iii) The busy period distribution
(iv) The waiting time distribution.
(iv) The distribution of unfinished work.
(v) The Reliability analysis.
(vi) The numerical illustration

The Chapter VI deals with an $M/G/1$ Bernoulli vacation queue with two phases of heterogeneous service and unreliable server under randomized vacation policy but as a batch arrival generalization of the previous chapter. The following results have been obtained under the present study of this chapter-

(i) The stationary queue size distribution
(ii) Analysis of queue size distribution
(iii) The queue size distribution at a departure epoch
In part II of the thesis, some M/G/1 type of retrial queueing systems with Bernoulli vacation schedule for an unreliable server have been investigated. This part of the thesis is divided into two different chapters and the outlines of theses chapters are organized as follows.

The Chapter VII deals with the steady state behavior of an unreliable M/G/1 retrial queue with two successive phases of service and general retrial times under Bernoulli vacation schedule in which the primary customers finding the server busy, down, or on vacation are queued in the orbit in accordance with the FCFS (first come, first served) retrial policy. The following aspects have been obtained under the present study of this study-

(i) Embedded Markov chain
(ii) Joint distribution of the number in the orbit and state of the server
(iii) Analysis of queue size distribution
(iv) Busy period distribution
(v) The Reliability analysis
(vi) The Numerical illustration
The Chapter VIII also deals with the steady state behavior of an unreliable $M/G/l$ retrial queue with two successive phases of service and general retrial times under Bernoulli vacation schedule but as a batch arrival generalization of the previous chapter. The following aspects have been obtained under the present study of this Chapter-

(i) Joint distribution of the number in the orbit and state of the server
(ii) Stochastic decomposition
(iii) Distribution of number of customers in the system at a departure epoch
(iv) Some particular cases
(v) System Performance measures
(vi) Optimal control policy
(vii) The numerical illustration.

In Chapter IX, we have proposed some problems which can extend our investigation in our future research work on queueing theory.

At the end, a Bibliography is given which contains books, monographs and research papers closely related to our field of research.