Fuzzy sets and fuzzy logic, were introduced in the mid sixties by Professor Lotfi A. Zadeh. Fuzzy sets and fuzzy logic are powerful mathematical tools for modelling and controlling uncertain systems in industry, humanities and nature; they are facilitators for approximate reasoning in decision making in the absence of complete and precise information. Their role is significant when they are applied to complete phenomena not easily described by traditional mathematics.

Zadeh’s ideas have found applications in computer science, artificial intelligence, decision analysis, information science etc.,

The article “waiting times and number of calls” by Johannsen in 1907 seems to be the first paper on the subject. But the method used in this paper was not mathematically exact. Therefore, from the point of view of exact treatment, the paper that has historic importance is A.K. Erlang’s, “The theory of probabilities and Telephone conversations”.

It should be noted that in Erlang’s work, as well as the work done by others in the twenties and thirties, the motivation has been the practical problem of congestion, see for instance, Molina (1927) and Fry (1928). During the next two decades several theoreticians developed general models which could be used in more complex situations. Some of the authors with important
contributions are Crommelin, Fellor, Jensen, Khintchine, Kolmogorov, Palm and Pollaczecek.

A detailed account of the investigations made by these authors may be found in books by Syski (1960) and Saaty (1961). Kolmogorov’s and Feller’s study of purely discontinuous processes laid the foundation for the theory of Markov processes.

Noting the inadequacy of the equilibrium theory in many situations, Pollaczeck (1934) began investigations of the behavior of the system during a finite time interval. Since then, he did considerable work in the analytical behavioral study of queuing systems of Pollaczeck (1965).

An extensive survey on the queuing systems with vacations can be found in Doshi [25]. Their concept of vacation is so general that it includes server setup time, single vacation, multiple vacations, threshold and combinations of these. But their property is not applicable to the group arrival queuing systems. It is more realistic to assume that the arrivals occur in batches, not in single. Lee and Srinivasan [50] considered a control policy on $M^{[x]}/G/1$ with multiple vacations, where $M^{[x]}$ denotes a compound Poisson process. Lee et al. [51] has dealt with $M^{[x]}/G/1$ with multiple vacations and $N$-policy model. Recently, Choudhury [20] has introduced the server setup period to $M^{[x]}/G/1$ system. This thesis “A Parametric Study on Queues in a Fuzzy Environment” consist of six chapters.
Chapter I deals with the notion of queuing theory, basic concept of fuzzy set theory, definition of fuzzy numbers, operations on fuzzy numbers, survey of literature and the necessary background of queuing problems.

Chapter II, section I of this chapter proposes a general procedure to construct the membership functions of the performance measures in FM/FM/1 queuing systems by using a pair of parametric programming.

Section 2 of this chapter proposes the method for constructing the membership functions of steady state performance measures of finite capacity queuing systems. By using $\alpha$-cut approach the fuzzy queue with finite capacity is transformed into crisp queue with finite capacity through which the membership functions of the system performance measures are derived.

Chapter III proposes the method to construct the membership functions of system characteristics of batch-arrival queuing systems with multiple servers. By using $\alpha$-cut approach and Zadeh’s extension principle a pair of parametric non-linear programs is developed through which the membership functions of the system characteristics are derived.

Chapter IV develops the method for constructing the membership functions of bulk arrival fuzzy queues with fuzzy varying batch sizes. The basic idea is based on Zadeh’s extension principle. A pair of mixed integer non-linear programs (MINLP) with binary variables is formulated to calculate the upper and lower bounds of the system performance measure at possibilities level $\alpha$. 
Chapter V develops a non-linear programming approach to construct the membership functions of steady state performance measures of batch arrival queuing systems with server setup time. The $\alpha$-cut approach is used to extract the batch arrival queuing system into a family of conventional crisp queuing system for the desired system characteristic, determined with a set of non-linear programs.

Chapter VI, section 1 of this chapter, constructs the membership function of the system characteristics of queuing model with multiple vacationing server. On the basis of $\alpha$-cut representation and by using Zadeh’s extension principle, a pair of parametric non-linear programs is developed to describe the family of crisp queues with batch arrival and multiple vacationing servers.

Section 2 of this chapter, describes the method for constructing the membership function of the Batch arrival queuing systems with single vacationing server.

In most of the chapters, the software Mat lab® 7.0.4 is used in numerical examples to avoid the computational burden when the expressions are too complicated, and the outputs are given.