ABSTRACT

Following are the major/significant contributions in the thesis. Keeping in view the topic of our Ph.D thesis, an attempt has been made to construct new designs which are either three or four or some higher associate class PBIB designs by using different construction techniques/methodologies.

In chapter second, we introduced a series of four associate class PBIB designs and also reduces it to a series of three associate class PBIB designs by using the method of duality. In both series, constructed designs are more efficient than base design and new designs are also significant from the point of view that r and k are less than equal to 10, which is rare.

In chapter third, two series of higher associate class PBIB designs have been constructed by using method of symmetric differences and expressing blocks in general form in both of the series with an appreciable levels of all kinds of efficiencies as well as average efficiency factor (A.E.F).

In chapter four, PBIB designs of a series of four associate class by using partial geometry (r, k, t) for r = 3 with finite graphs also gives an appropriate levels of all kinds of efficiencies and average efficiency factor for less number of replications. Also, a new class of three and higher associate class PBIB designs by introducing the concept of Boolean algebra along with some particular restrictions. Here, we have also introduced a new link between field of discrete mathematics with a field of statistics by developing PBIB designs using Boolean algebra.

In fifth chapter, ‘s’ associate class PBIB designs are constructed without any restriction on parameters of PBIB designs as well as such designs are adjustable for various associate classes. We have used a unique construction methodology for the construction of blocks along with an association scheme of these designs.
Secondly, in one of the series of three associate class PBIB designs constructed by using method of juxtaposition of association matrices of an already existing series of four associate class PBIB designs gives 100% efficiency between treatments which are first associates and higher level of average efficiency factors of both the series also attract remarkable attention towards the new designs.

In sixth chapter, we have kept number of replications and blocks fixed and allowed the block size to vary as numbers of treatments vary. As number of treatments as well as block size increase rapidly as compare to number replications, the efficiencies of new designs also increase, which is a significant feature.

In the last chapter, we have been able to successfully obtain the general solution of normal equations in general form and get the solution of these equations in a symbolical form. We have also verified that Dey (1986), Rao (1947b) and Garg et al (2013) are all particular cases of our general form for \( m = 2, 3 \) and 4 respectively. For \( m = 5 \), we have obtained the solution of normal equations in symbolical form in detail. Also, we have given the general structure of analysis of \( m (m \geq 2) \) associate class PBIB design to get various types of efficiencies along with average efficiency factor (A.E.F) without solving the complex computational calculation of normal equations in this chapter.