Abstract

The present thesis embodies the researches carried out at the Aligarh Muslim University, Aligarh. The thesis comprises of ten chapters. A brief summary of the problems is presented at the beginning of each chapter and then each chapter is divided into a number of sections. Definitions and equations have been numbered chapter wise. The section number is followed by the number of equation for e.g. (6.3.5) refers to equation number 5 of section 3 of chapter 6.

Chapter-I gives a brief survey of some of the earlier and recent works connected with the present thesis in the field of special functions and hypergeometric polynomials of several variables. It gives historical background, hypergeometric functions of several variables, the classical orthogonal polynomials, polynomials of several variables, definitions, notations and results used in the present thesis. Beside the chapter also contains brief inside of other chapters that follow.

Chapter-II deals with the study of generating functions of Jacobi polynomials of two and three variables. In this chapter, some generating functions of Jacobi polynomials of two variables have been obtained in terms of generalized Lauricella function (Srivastava and Daoust), Confluent hypergeometric function \( _1F_1 \), Gauss's hypergeometric function \( _2F_1 \), Appell's hypergeometric function \( _2F_2 \), Horn function \( H_4 \), Kampe de Feriet series and triple hypergeometric series \( F^{(3)}[x, y, z] \).

This chapter also contains generating functions of Jacobi polynomials of three variables in terms of Confluent hypergeometric function \( _1F_1 \), Appell's hypergeometric function \( _2F_2 \), Lauricella's hypergeometric functions of three variables \( F^{(3)}_A \) and triple hypergeometric series \( F^{(3)}[x, y, z] \).

Chapter-III refers to the study of double generating relations of Jacobi polynomials of several variables. For the sake of convenience, this chapter has been
divided into three sections. In the first section 3.2, double generating relations of Jacobi polynomials of one variable have been given in terms of Appell's functions, Horn functions and confluent hypergeometric functions. This section also contains some double generating relations involving Gauss's hypergeometric function $\binom{2}{1}$ and Kampe de Feriet function. In the second section 3.3, double generating relations of Jacobi polynomials of two variables have been obtained in terms of Appell's functions, Horn functions and confluent hypergeometric functions. Finally, in the last section 3.3, double generating relations of Jacobi polynomials of three variables have been studied in terms of confluent hypergeometric functions.

**Chapter-IV** is devoted to study of triple generating relations of Jacobi polynomials of several variables. This chapter is divided into three sections. In section 4.2, triple generating relations of Jacobi polynomials of one variable have been given in terms of confluent hypergeometric functions and hypergeometric functions of three variables. Section 4.3 deals with the study of triple generating relations of Jacobi polynomials of two variables in terms of confluent hypergeometric functions and hypergeometric functions of three variables. Finally in the last section 4.4, triple generating relations of Jacobi polynomials of three variables have been studied in terms of confluent hypergeometric functions.

**Chapter-V** is concerned with the study of generalized Rice polynomials of two variables, denoted by $H_n^{(a_1,b_1,a_2,b_2)}(\xi,\xi,\xi,x,y)$. In this chapter, generating functions of generalized Rice polynomials of two variables have been obtained.

**In Chapter-VI**, double generating relations of generalized Rice polynomials of one and two variables have been obtained in terms of Appell's functions, generalized Appell's type functions, Horn functions and confluent hypergeometric functions of two variables. This chapter also contains some triple generating relations of generalized Rice polynomials of one and two variables in terms of Lauricella's functions, generalized Lauricella's functions and hypergeometric functions of three variables.
Chapter-VII deals with the study of generalized Bateman's and Pasternak's polynomials of two variables. In this chapter, generating functions of generalized Bateman's polynomials of two variables denoted by \( Z_n^{(\alpha_1; \beta_1; \alpha_2; \beta_2)}(b_1, x; b_2, y) \) and \( F_n^{(\alpha_1; \beta_1; \alpha_2; \beta_2)}(p_1, z_1; p_2, z_2) \) have been studied. This chapter also contains some generating functions of generalized Pasternak's polynomials of two variables denoted by \( F_n^{(\alpha_1; \beta_1; \alpha_2; \beta_2)}(z_1, z_2) \).

Chapter-VIII is a study of pseudo-Jacobi polynomials which have been defined on the pattern of Shively's pseudo-Laguerre polynomials \([?]\). The chapter contains linear generating functions, extended linear generating functions, some special results, bilinear generating functions, trilinear generating functions, bilateral generating functions, Rodrigues formula, recurrence relations and expansion of polynomials in a series of pseudo-Jacobi polynomials.

In chapter-XI, pseudo two variables Jacobi polynomials have been defined on the pattern of Hermite polynomials of two variables due to M. A. Khan and G. S. Abukhammash \([?]\). The chapter contains generating functions, Rodrigues formula, recurrence relations, orthogonality, expansion of polynomials and integral representations for pseudo two variables Jacobi polynomials.

In the last chapter a study has been made of integral representations of certain polynomials of two variables. This chapter is divided into three sections – Integral Representations, Integral Representations of the Product of Two Polynomials of Two Variables and Hypergeometric Forms.

In the end an exhaustive and up to date list of research papers and books related to the subject matters of this thesis have been provided in the form of a bibliography.