ACKNOWLEDGEMENT

First and foremost, I would like to express my deepest sense of gratitude to the omniscient and omnipresent power of the universe, the Almighty God my Saviour Jesus Christ, inspiration behind all knowledge and ideas. Then, I remember the prayers of my Grandfather Late Mr. Prabhu Charan (A Great Servant of God) which were offered to the Lord for my birth and the time till he was with us.

Words fail to express my sense of indebtedness and profound gratitude towards my Advisor Dr. O.P. Verma, Assistant Professor, Department of Molecular and Cellular Engineering, Jacob School of Biotechnology & Bioengineering, Sam Higginbottom Institute of Agriculture, Technology & Sciences (Deemed to-be University), Allahabad, U.P. for his painstaking effort in shaping this thesis to its present form. It is only through his immaculate guidance, immense dedication, and thoughtful ideas, constructive sharp criticism, unceasing encouragement and candour discussion that I have been able to fulfil this uphill task. His great help and thorough interest in my thesis at its each and every stage need no words.

I shall be grossly lacking in my duties unless I put into words my gratitude and humbleness to Bishop Rev. Prof. (Dr.) R. B. Lal, Honourable Vice Chancellor, Sam Higginbottom Institute of Agriculture, Technology & Sciences (Deemed to-be University), Allahabad, U.P., whose fatherly affection, constructive suggestions, encouragement, assistance and candid approach of critical analysis of the subject steered me to drive to the goal. He shall remain an ideal throughout my life.

I cordially thank Prof. (Dr.) S.B. Lal and Prof. (Dr.) Newman Fernandez, Pro- Vice Chancellors, Sam Higginbottom Institute of Agriculture, Technology & Sciences (Deemed to-be University), Allahabad, U.P., for their invaluable support, encouragement and unfailing help, concern and benevolent advice rendered to me.

I take this opportunity to express my profound and heartiest thanks to Prof. (Dr.) A.K.A. Lawrence, Registrar, Sam Higginbottom Institute of Agriculture, Technology & Sciences (Deemed to-be University), Allahabad, U.P., for providing facilities to carry out my research work at NBFGGR, Lucknow.
My regards and thanks to Prof. (Dr.) B.P. Masih (Member), Dean, Jacob School of Biotechnology & Bioengineering, Sam Higginbottom Institute of Agriculture, Technology & Sciences (Deemed to-be University), Allahabad, U.P., by devoting his precious time to my difficulties have virtually overwhelmed my sense of gratefulness.

Words are inadequate in expressing my profound sense of thankfulness to Prof. (Dr.) P.W. Ramteke (Co-Advisor), Head, Department of Biological Science and Dean, PG Studies for his invaluable scientific advice and encouragement at both academic and personal level.

I express my profound sense of gratitude and indebtedness to Prof. (Dr.) George Thomas (Member), Head, Department of Molecular and Cellular Engineering, Jacob School of Biotechnology & Bioengineering, Sam Higginbottom Institute of Agriculture, Technology & Sciences (Deemed to-be University), Allahabad, U.P., for imparting his expertise and scientific advice.

It is my proud privilege to express my sincere thanks to Dr. Alok Milton Lall, Head, Department of Biochemistry & Biochemical Engineering and Prof. (Dr.) Rubina Lawrence, Head, Department of Microbiology & Fermentation Technology, Jacob School of Biotechnology & Bioengineering, Sam Higginbottom Institute of Agriculture, Technology & Sciences (Deemed to-be University), Allahabad, U.P. for their critical academic advice and incessant encouragement throughout my thesis work.

In walk of life, we meet several people and gain several experiences. Memory of only a few rare personality and unique moments remain evergreen in the core of heart. An association with Dr. P.K. Varshney, Senior Scientist, NBFG, Lucknow, U.P. has helped me a lot in completing my research work.

Success in any endeavour needs prior orientation. This is particularly true for research activities. I express my deepest sense of gratitude and regards to Dr. Abhishek Mathur, Research Scientist, ITLS, Dehradun for his support and suggestion during my research work.

A healthy surrounding begets freshness in mind. Warmth of friends and colleagues become sometimes more essential than physical inputs. So I am also indebted to all my colleagues for their love, devotion and help, especially to Mr. V. Prashad, Mr. A. Kumar, Mr. Dayashankar and Mr. R.E. Marshall for their help and co-operation during the research work.
I remember the affection, love and sacrifice showered by my parents Mr. Ashok Prabhu Charan and Mrs. Alka Charan and then my in-laws Mr. Oliver Daniel and Mrs. P.S. Daniel.

I had been fortunate enough to have a number of genuine well wishers such as Er. Abhishek Sharan, Mrs. Nitika Sharan, Er. Rahul Davis, Mr. S.B. Tiwari, Mr. A. Mishra, Mr. Parmeshwar, Mr. Dilshad Khan, Ms. Sneha Shinu and cordial colleagues who had been infinite sources of encouragement, constructive criticism and immaculate fun and stood beside me in the rainy days.

I have special words of mention for my beloved brother Er. Ashish Vivian Charan and sister Er. Aradhana Irene Charan, my sister-in-law, Miss Olive Daniel and cousins Mr. Sudhanshu Lall, Mr. Vincent George Burge and Miss Cinderella Zenia Burge for their support and co-operation during my research work.

I want to acknowledge the efforts of my dear and loving wife Mrs. Rini Charan who has been a great help in my Research work and finally to my daughter Miss Anugrah Esther Charan who is and will be my strength after my Lord and Saviour Jesus Christ.

Date:

Place: Allahabad

Er. Amit Alexander Charan