ACKNOWLEDGEMENTS

First and foremost, I bow in the Lotus Feet of Huzur Radhasoami Dayal for showering His unbounded Grace and Mercy and giving me the inspiration and strength to accomplish this arduous task. I am ever grateful to Supreme Father Most Revered Prof. P.S. Satsangi Sahab, epitome of Grace and Mercy, for His incessant encouragement and motivation that will be a source of inspiration for me throughout my life. This research work is a humble effort towards fulfilling his philosophy that scholars have a responsibility to use the privileges of academia to imagine and create a better world.

I express my deep sense of gratitude to Dr. Ashok Yadav (Supervisor), for his expert comments and availability at all times. I extend my heartily thanks to him.

I am highly indebted to Prof. Ranjit Singh (Co-Supervisor), for his expert guidance, caring, patience, and providing me with an excellent atmosphere for doing research. His all-time availability for me to seek guidance in complex matters enabled me to successfully traverse this arduous path of research. It was his positive outlook, encouraging smiles and quick wise judgment, that, imbibed confidence in me at times of distress.

I express my deep sense of gratitude to worthy, learned and able administrator Prof. V. Prem Pyara, Dean, Faculty of Engineering, with his words of encouragement and memorable support at the times of despair has enabled me to submit this Thesis. I extend my hearty thanks to him.

I also express my deep sense of gratitude to worthy and learned Prof. S.K. Gaur, Head, Department of Mechanical Engineering, for taking personal interest in this research work and supporting me during challenging times.

Man of vision with a great mission of elevating the status of the Institute to the new heights, Prof. P.K. Kalra, Director, Dayalbagh Educational Institute, who has always been there, untiringly following up with me on the progress of the research work and under whose patronage I have the opportunity to accomplish this arduous task. I convey my heartfelt thanks to him for his gesture of generosity, which moved me deeply.

I am indebted to Prof. D.S. Misra, Prof. D.K. Chaturvedi, Sh. D. Prem Prasad, Prof. K. Hans Raj, Prof. A.K. Saxena, Prof. C. Patvardhan, Prof. S.K. Srivastva, Prof. D.G. Rao, Prof. Rahul Caprihan, Prof. V. Soami Das, Dr. Manmohan
Aggarwal, Sh. Padam Das and Dr. Rahul Swarup Sharma for their kind concern and interest throughout the work. I would also acknowledge Dr. Mange Ram and Mr. Deepak Gogia for taking personal interest in completing this research work.

I am highly thankful to Mr. Rohit Sharma, Mr. Harish Kumar Singh & Anuradha Singh, who introduce me to the state-of-art computing techniques, which provide invaluable in this research work, and also to Mr. Gaurav Pratap Rana, Mr. Sushobhit Singh, Mr. Yogesh Kumar Anand, Mr. Rajeev Yadav, Mr. Prem Pal Singh Tomar and Dr. Himansu Vijay for their help and support.

The support received from Dr. B.B. Rao, Principal, Technical College, DEI, Mr. G.P. Mishra, Head- Mechanical, Technical College, Mr. V.P. Malhotra, Head-Automobile, Technical College and my colleagues Dr. J.K. Arora, Dr. Ankur Das, Dr. M. Radha Krishna, Dr. A.K. Sharma, Dr. Ranjit Kumar, Mr. Ravindra Kumar Singh and Bhuvnesh Singhal encouraged me in the successful completion of my research work. The list is endless. I offer my sincere thanks to all of them.

The help and support rendered by the staff of Technology Development Centre, ministry of micro, small and medium enterprises, Agra, formerly known as product and development centre (PPDC) is memorable. I am indebted to the experienced and worthy Mr. Pravin R. Joshi, member of world foundry organization. I am also thankful to staff members of Namdhari Engineering works, Anil Metal industry, Luthra industries and other foundry industries of Agra for helping at the time of need and in the successful completion this work.

The contribution of all my family members cannot be put in words. The present work is the result of the motivation, enthusiasm and ambition instilled in me since my childhood by my respected father Sh. Raghuvir Singh and respected mother Smt. Premwati.

Lastly, I would like to thank my wife Mrs. Sneh Lata for her constant encouragement and endless patience when it was most required. My son Santript Singh Satsangi and daughter Garima Singh deserve to be mentioned here and thank for giving me some joyful moments, which lightened the work pressure.

In last, I am grateful to all who have directly or indirectly contributed in the successful completion of this work.

(PURSHOTTAM KUMAR)