

ACKNOWLEDGEMENTS

At the outset, let me pay my obeisance to 'Maa Bhagwati & Maa Durga' for catapulting me to this level of academic pursuit. Thereafter, let me express my sincere gratitude to my respected supervisor **Dr. Rakesh Kumar Gautam** for his matured guidance, relentless encouragement and constant words of motivation. He has given me all freedom to use the experimental facilities, platform, availability to discuss ideas and willingness to give his knowledge. It was really a very nice and unique experience to work under his able guidance. I humbly acknowledge my heartfelt gratitude to him.

I would like to express my grateful thanks to my RPEC members; *Prof. Sunil Mohan, Dr. Amit Tyagi* and for being kind enough to make evaluation of my work-progress, extend meaningful comments and fruitful suggestions from time to time.

I wish to acknowledge my sincere gratefulness to *Prof. A. P. Harsha*, Head, Department of Mechanical Engineering, Indian Institute of Technology (BHU), Varanasi, the former heads *Prof. A. K. Jha, Prof. A.K. Agrawal* and *Prof. V.P. Singh* for their kind gesture and extending all sorts of facilities in the Department to pursue this kind of research work.

Further, I equally owe a special debt of gratitude to *Prof. Rajiv Prakash, Prof. Devendra Kumar* and *Prof. Sandip Chatterjee* for having shown a keen interest in this work and providing various available experimental facilities of their respective labs towards this project, and further offering their incessant blessings during the entire course of this research work. It equally gives me great pleasure to acknowledge my thankfulness to *Prof. R. Tyagi, Dr. U. S. Rao, Prof. J. P. Dwivedi* and *Prof. K. S. Tripathi* for taking interest in the progress of this project. My sincere thanks also go to Ministry of Human

Resource Development, Govt. of India, for providing me financial assistance during my research tenure.

I express my sincere thanks to the technical and office staff, especially *Mr. S. P. Singh, Mr. P. N. Singh, Mr. Harishankar, Mr. Akash Mishra, Mr. J. K. Sinha, Mr. Rajendra Ji, Mr. Ram Ji, Mr. Rajnarayn Ji, Mr. Girish Sahu, Mr. Nirmal Mallick, Mr. Ishwar and Mr. Kallu Ram Ji* who helped me in various ways during this research work. I would like to thank all other people who have provided a truly conducive environment to successfully carry out this research. I shall be failing in my duty if I do not put on record my sincere appreciation and thankfulness to my seniors, lab mates and friends; *Dr. Gopal Ji, Dr. Uma Shankar, Mr. Sanjay Kumar, Mr. Rajiv Nayan Gupta, Mr. Hemant Chaudhary, Mr. Sooraj Singh Rawat, Mr. Homender, Mr. Amod Kashyap, Mr. Vivek Gupta, Mr. Ambuj Sharma, Mr. Avinash Ravi Raja, Mr. Parshant Mehra, Mr. Harikishore, Mr. Ashish Srivastava, Mr. Ravindra Prasad and Mr. Abhishek Singh*. My special thanks go to *Dr. Nishant Kumar Singh, Mr. Khemraj, Mr. Shushant Singh, and Mr. Pushkar Jha*. I found them always around me during periods of need.

I have no words to express my indebtedness and gratitude to my parents, *Sri Mohan Singh* and *Smt. Maharaji Singh* for showering their affectionate love and all possible support during my research-endeavour. They have been a guiding force all through my life, and I could always try to measure up to their expectations. I humbly dedicate this work to them. I express my sincere thanks to my elder brother and his wife, *Mr. Madhurendra Singh* and *Mrs. Mamta Verma* for their constant motivation and support during all these periods. I further express my sincere thanks to my elder sister and her husband, *Mrs. Manorama Singh* and *Mr. Ramchandra Singh* for their constant motivation, affectionate love and all possible support during my research tenure. Words at my command are not sufficient enough to express my feelings especially for my sweet

niece and nephews *Misthi, Mrinal and Mridula* their smiling faces always rejuvenates me. I wish to acknowledge my sincere thanks and gratefulness to *Sri Pyarelal Singh, Sri Radheshyam Singh, Sri Suryabali Singh, Mrs. Gulabi Devi, Mrs. Rajmani Devi, Mrs. Meera Singh, Mr. Bijendra Singh, Mr. Pramod Singh, Mrs. Krishna Singh, Mrs. Meera Singh, Mr. Suresh Singh, Mr. Rakesh Singh, Mr. Vimlesh Singh, Mr. Rajan Singh, Mr. Ravi Babu, Mrs. Sushmita, Ms. Ishmita, Ms. Smriti, Mr. Sudhanshu, Ms. Kajal and Ms. Muskan* for their everlasting encouragement and love. I sincerely crave indulgence of the readers towards the misprint & other lapses (if any) in the thesis.

My sincere thanks to all those who directly or indirectly put their effort in every bit of completion of the research work.

At last, thanks to the almighty **“God”** who has given me the author spiritual support and courage to complete this work.

(MANVANDRA KUMAR SINGH)