Acknowledgements

Present thesis has many direct and indirect contributions from a number of people, who helped me throughout my academic and personal life. I owe my thesis to my mother (Late) Mrs. Santosh Chauhan and my father Mr. Kumar Pal Chauhan, who strived hard, to make this moment possible. The love of my younger brother since childhood gave additional encouragement to achieve this treasured moment.

First I would like to express my heartiest gratitude and thanks to my thesis supervisor Prof. Ashok K. Singhvi, who guided me in my Ph.D. and taught me the in and out of research. He always encouraged me to excel in the field and corrected whenever I was going in wrong direction. He gave me a new perspective about doing things in science and tackling the problems. His fatherly attitude and devotion towards work will always inspire me to do good work in the coming years.

I also like to convey my sincere thanks to Dr. Y. S. Mayya, Head, RPAD section, BARC, who is like second guide and a teacher to me. He taught me to look and think about the problems mathematically. His enthusiasm to do problems on his own and his guidance motivated me to tackle even difficult mathematical problems quite easily.

I am very fortunate to get the company of two extremely knowledgeable and helpful persons, Dr. T. Palani Selvam (BARC) and Dr. Navin Juyal. Dr. Palani has helped me and taught me about Monte Carlo simulations. He gave me timely suggestions on improvements in simulations, which helped me in getting the correct result. Dr. Navin Juyal has helped me throughout my Ph.D. duration. He gave me insight into the geological processes and helped me in understanding them. Regular discussions with him helped me gaining knowledge in geological aspects of luminescence dating. Besides these his presence in the lab created a lively work environment, which rejuvenates everyone to work at full pace.

I am also thankful to Mr. Pranav Adhayaru and Mr. Hitesh Waghela for their collaboration and extended help in my project. I also want to thank to all my
Lab mates and colleagues for their extensive cooperation. Dr. Yogesh Nagar, Dr. Madhav Krishan Murrari, Mr. Anil Kumar Tyagi and Dr. Bhavesh Patel helped me in initial stages to get started with my research carrier. Their experimental, theoretical, computational skills along with their cooperation provided me opportunity to learn about different aspects of the research. Discussions with Dr. P. Morthekai, Mr. Rabiul Haque Biswas, Mr. D. P. Shinde, Dr. Suchinder Sharma and Dr. Linto Alappat during lab meetings has helped in sorting and carrying out further work on several problems. Besides this, the company of all the colleagues provided excellent working environment in the lab. The discussions with Neeraj Awasthi have greatly helped me in enhancing my geology knowledge. His company provided me great support in everything. I would also like to thank and acknowledge the work done by Mr. Chithrabhanu P. and Ms. Nita Sebastian with me. Their companionship provided me the flexibility to work on some of the different topics. In addition, I would like to thank Manan, Anand, Khanjan, Dhara and Dhwani for working on electronics of EMCCD based system and making it working. I am grateful to Dr. R.P. Singh and Dr. Ashok K. Diktiya for the help provided by them in some of my experiments.

I also greatly acknowledge the help from the workshop and specially want to thank Mr. Rajesh Kaila, Mr. Vishnu, Mr. Vipul and Mr. Chandel for their assistance in mechanical fabrication for instrumental development. I thank the Computer centre, Stores and Accounts section for the support provided to me from time to time.

I am grateful to PRL and Department of Science and Technology (DST) for funding my participation in the conference on Luminescence and Electron Spin Resonance Dating (LED) 2008 and 2011 respectively. These conferences have really helped me gain understanding in the subject.

I would also like to thank my M.Sc. friends Richa, Daipayan, Shibu, Nitin and Lopa for being with me in all odds and extending their help whenever I need it. They have helped me from time to time in my personal as well as academic matters.

I also want to extend my gratitude and thanks to all my batch mates, Vimal, Sandeep, Srikant, Pankaj, Arvind Singh, Anand, Amzad, Ashok, Rohit,
Rabiul, Vineet, Bhaswar, Soumya, Suratna and Suman who are with me since the first day in the PRL and gave their suggestion, help and lively atmosphere in hostel and during all the celebrations we did in last five years. I would also like to thank other colleagues, Sharma ji, Awasthi, Jyoti, Bhavik bhai, Vishal bhai, Sharad, Arvinder, Naveen Gandhi, Ritesh, Gyana, Prashant, Alok, Pravin, Tapas, Rajesh, Waliur, Rohit Srivastava (senior), Shreyas, Nita, Midhun, Lakshmi, Bhavya, Arivazhagan, Kusuma, Lokesh, Harinder, Manan, Srinivas, Sumita, Ashwani, Arvind Saxena, Zeen and Akhilesh who extended their well wishes and provided their support from time to time. All of these have really made my PRL days memorable for lifetime.

In the end, the last but not least I would like to convey my heartiest thank to PRL family for being with me during all the Ph.D. tenure and provided all their support and means required from time to time.