STATEMENT BY AUTHOR

This dissertation has been submitted in partial fulfillment of requirements for an advanced degree at Homi Bhabha National Institute (HBNI) and is deposited in the Library to be made available to borrowers under rules of the HBNI.

Brief quotations from this dissertation are allowable without special permission, provided that accurate acknowledgement of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the Competent Authority of HBNI when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

Nageshwar Singh
DECLARATION

I, hereby declare that the investigation presented in the thesis has been carried out by me.

The work is original and has not been submitted earlier as a whole or in part for a degree / diploma at this or any other Institution / University.

Nageshwar Singh
List of Publications arising from the thesis

Journal


**Other publications relevant to the work**


(Nageshwar Singh)
DEDICATIONS

Dedicate to my parents,

Late *Shri Ram Ishwar Singh*

And

Late *Smt. Chandra Baso Devi*
ACKNOWLEDGEMENTS

It is a matter of great pleasure for me to express thanks and gratitude to all those who have contributed to this thesis work, directly or indirectly.

First of all, I wish to express my profound gratitude to Shri H. S. Vora for his encouragement and motivation throughout my Ph.D. work. I am thankful to him for his wholehearted help in planning and carrying out various experiments, analysing the results, amending his software as per my investigational needs, and finally in documenting the results in this thesis. His indefatigable enthusiasm has always been a source of inspiration for me.

I am extremely thankful to Dr. P. D. Gupta, Director, RRCAT, for allowing me to conclude my Ph.D. work in the dye laser field, despite my transfer to Materials and Advanced Accelerator Sciences Division.

I am very much indebted to Dr. S. B. Roy, for his helping nature. It would have been impossible to complete the thesis work without his kind-heartedness.

I am highly grateful to Dr. P. A. Naik for his encouragement, and valuable help in manuscript formulations during initial stage of my career. He went through my manuscripts thoroughly, critically, and gave several valuable suggestions which helped a lot in improving my skill in presenting the scientific results in journals.

I wish to acknowledge Dr. S. K. Dixit, for valuable suggestions and guidance in completing this thesis.

I also wish to thank Shri Bijendra Singh, for the fruitful scientific discussions. I would like to give special thanks to Dr. Rajeev Khare for some of his critical comments, which have led to some of the publications. I wish to admit help on gain medium flow through dye cells by Shri Hemant K. Patel. The wholehearted help out by Shri Abhay Kumar on thermal and flow analysis of dye laser gain medium at the vital time is fully acknowledged.

I thank Dr. H. S. Rawat, for the critical review of some of the manuscripts pertaining to this thesis, and also Dr. Rama Chari, Dr. S. R. Mishra, Dr. Anand Moorti, Dr. M. P. Singh, and Dr. T. Ganguli for their valuable suggestions from time to time on the manuscripts. I am highly thankful to Dr. M. K. Chattopadhyay for his wholehearted help during the compilation of this thesis.

Thanks are due to Dr. L. Abhinandan for fabrication of the mechanical components of dye laser, and some critical adapters during the experiments; to Shri S.S. Mahras for fabricating the pinched dye cell, which was a challenging task; to Dr. S. Chatterjee and his team for fabricating and polishing the dye cells and other optical windows; to Shri B. Q. Khattak for dye solution spectroscopic measurements and analysis; and to Dr. C. Mukherjee for mirrors coating and reflectivity measurements.

My special thanks to Shri Rajiv Jain for his prompt conceptualization and device installation for the PC based dye solution temperature data acquisition system and related software, as per experimental needs. I would like to thank Shri P. Saxena and his electronics team members Shri V. K. Dubey, Shri I. Singh, and Shri D. Shukla for their
quick electronic supports involved in power supplies and all other measuring devices, Shri R P Kushwaha and Shri R K Mishra for maintaining the CVL power supply during initial stage of the work. I wish to extend my thanks to Shri S. R. Daulatabad for his initial help in dye laser alignments. I am also grateful to Mr. Devendra Srinagar in formatting and improving the aesthetics of my thesis presentations.

Thanks are due to Dr. R. Bhatnagar, ex-head, erstwhile LSED, for introducing me to the field of dye laser technology and to Dr. K. Dasgupta, BARC for providing help in high resolution spectral measurements during my early stage of career. I wish to acknowledge Shri A. Chakraborty for help in CVL operation and maintenance, and in dye laser experiments during the final stages of the thesis work.

I am thankful to all the staff of erstwhile Laser Systems Engineering Division for providing help in maintaining CVL system and other experimental setups used during this work; and members of the LSED Mechanical Work Shop for their help in fabrication of different components as and when required during the experiments. Particularly, I thank Shri A. K. Sarkar and his team for their help in design, fabrication, and assembly of dye circulation system and some of the optical work stations.

I take this opportunity to thank all the members of my Ph.D. advisory committee (Dr. S. M. Oak, Dr. K. Dasgupta, Dr. S. K. Deb, Dr. G. S. Lodha and Dr. S. M. Gupta) for their valuable suggestions during the yearly review presentations.

I wish to acknowledge a friendly environment created by my present colleagues Smt. Parul Arora, Dr. M. A. Manekar, Dr. Vishnu Sharma.

My thanks are due to all my close friends who encouraged and supported me during this work. I specially acknowledge Mr. Mukesh Kumar for his help in many numerical calculations and 2D/3D visualization of some of the figures. I also wish to express appreciation to Mr. Amalendu Sharma for help in solving some of the numerical problems involved in dye laser, through C language programming.

I am indebted to my parents for their blessings from heaven, elder brother and his family for their support, in difficult times in my life, and my nephew Deepak for the love he showered on me. I wholeheartedly thank my wife Dr. Pratibha Singh for her support, understanding, and willingness to allow me to sacrifice the precious family time during compilation of the thesis work. I thank my one and a half year old daughter Kuchu for providing cheerful atmosphere at home and relaxation from all stresses during writing of the thesis.

Last but not the least, I wish to express my profound reverence to Shri K. C. Kaushik, then Principal, Hindu College, Sonipat, Haryana for nurturing and supporting me during the most difficult period of my life. To fulfill his very strong wish to see me climbing great heights, it will be my endeavor to strive to prove worthy of his expectations.

Nageshwar Singh