

DECLARATION BY THE CANDIDATE

I, **Bharat Singh Patel**, certify that the work embodied in this thesis is my own bona fide work and carried out by me under the supervisions of **Dr. Cherian Samuel** and **Prof. S.K. Sharma** from September 2012 to November 2017, at the Department of Mechanical Engineering, Indian Institute of Technology (BHU), Varanasi. The matter embodied in this thesis has not been submitted for the award of any other degree/diploma. I declare that I have faithfully acknowledged and given credits to the research workers wherever their works have been cited in my work in this thesis. I further declare that I have not willfully copied any other's work, paragraphs, text, data, results, etc., reported in journals, books, magazines, reports dissertations, theses, etc., or available at websites and have not included them in this thesis and have not cited as my own work.

Date:

Place: IIT (BHU), Varanasi

(Bharat Singh Patel)

CERTIFICATE BY THE SUPERVISORS

It is certified that the above statement made by the student is correct to the best of our knowledge.

Dr. Cherian Samuel
Assistant Professor
(Supervisor)

Prof. S.K. Sharma
Institute Professor
(Co-Supervisor)

Prof. A.K. Jha
Head of Department