

DECLARATION BY THE CANDIDATE

I, **Subhashish Dey**, certify that the work embodied in this thesis is my own bonafide work and it has been carried out by me under the supervisions of **Prof. Devendra Mohan, Department of Civil Engineering** and **Prof. Ram Prasad Department of Chemical Engineering & Technology** from **July 2013 to July 2018** at 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 solemnly 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, thesis, *etc.*, or available at websites and have not included them in this thesis and have not cited as my own work.

Date:

Place:

(Subhashish Dey)

CERTIFICATE BY THE SUPERVISORS

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

(Devendra Mohan)

Supervisor

Department of Civil Engineering
Indian Institute of Technology
(Banaras Hindu University)
Varanasi- 221005

(Ram Prasad)

Co-Supervisor

Department of Chemical Engineering & Technology
Indian Institute of Technology
(Banaras Hindu University)
Varanasi- 221005

(Prabhat Kumar Singh)

Head of Department

Department of Civil Engineering
Indian Institute of Technology
(Banaras Hindu University)
Varanasi- 221005