Dedicated to my beloved Parents…

DECLARATION

I, **Porinita Dutta**, hereby declare that the present thesis entitled **"A Study on Mixture of Certain Discrete Probability Distributions"** is the record of work done by me under the supervision of Prof. Munindra Borah, Professor, Department of Mathematical Sciences, Tezpur University, Tezpur. The contents of the thesis represent my original work that has not been previously submitted for any degree or diploma in any other university or institution of higher education.

This thesis is being submitted to the Tezpur University for the degree of Doctor of Philosophy in Mathematical Sciences.

Place: Napaam, Tezpur

Date: **(Porinita Dutta)**

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Place: Napaam, Tezpur
Date:

With Regards

(PORINITA DUTTA)
Department of Mathematical Sciences
Tezpur University, Assam, India.

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List of Publications

- Dutta, P. and Borah, M. Some Properties and Application of Size-biased Poisson-Lindley Distribution, *International Journal of Mathematical Archive*-**5(1)**, 89-96, 2014.
- Dutta, P. and Borah, M. On Certain Recurrence Relations Arising in Different Forms of Size-biased Poisson-Lindley Distribution, *Mathematics Applied in Science and Technology*-**7(1)** 1-11, 2015.
- Dutta, P. and Borah, M. A Study on Some Properties of Poisson Size-biased Quasi Lindley Distribution, *IOSR-Journal of Mathematics*-**11(3)**, Ver.V, 23-28, 2015.
- Dutta, P. and Borah, M. Zero-modified Poisson-Lindley Distribution, *Journal of Assam Statistical Review*-**28(1)**, 63-77, 2014.
- Dutta, P. and Borah, M. A Comparative Study on Zero-truncated Poisson-Lindley and Quasi Poisson-Lindley Distributions, *International Journal of Mathematical Achieve*-**6(6),** 1-6, 2015.
- Dutta, P. and Borah, M. Certain Properties of Generalized Poisson-Lindley Distribution, (Communicated in *Journal of Indian Statistical Association*).
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