In this research, we extend the unequal finite population Bayesian bootstrap (FPBB), and propose two design-based methods to handle the missing data problem under different circumstances by incorporating the covariates to impute the synthetic population when they are correlated with the response. The proposed methods, which could be treated as a general kind of hot deck imputation method, are model robust because they do not suffer from model misspecification, which may undermine the validity of the corresponding inference severely. Therefore, we could get more reasonable imputed values. Also, it's computationally effective and less time consuming. Besides, we adjust the unequal FPBB by some nearest neighbor technique to make imputation more efficient for the population with dissimilar units. The proposed methods are validated by simulation studies, and they can give good estimation results when applied to the simulated data modeled from two industries in a monthly retail trade survey.