Neighborhood face-magic labelings of two classes of graphs

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We introduce a variation of type (a, b, c) magic labelings. Let $G = (V, E, F)$ and $f : V \cup E \cup F \to \{1, 2, \ldots, |V \cup E \cup F|\}$ be a bijection. Define the weight of each face as the sum of the labels of the vertices, edges, and faces surrounding that face. If the weight of every face is equal to some fixed constant, we call f a neighborhood face-magic labeling. We show that wheels W_n admit a neighborhood face-magic labeling for $n \geq 3$, and the Cartesian product $C_m \square C_n$ admits a neighborhood face-magic labeling whenever $m, n \geq 3$ and m divides n.