Many semiconductor devices are designed to confine electrons within a thin layer that is only a few nanometers thick. When a potential difference is applied across such a layer, the electrons respond as though they are trapped within a microscopic capacitor. If our "capacitor" plates are separated by a distance, L, that is of the order of the de Broglie wavelength of a trapped electron, we must apply a quantum treatment to the study of its behavior. We can treat this "capacitor" like an infinite square well,

$$V(x) = \begin{cases} 0, & 0 \leq x \leq L, \\ \infty, & \text{otherwise.} \end{cases}$$

Applying a potential difference of ΔV_0 across it introduces an additional potential energy of,

$$V'(x) = \frac{e\Delta V_0}{L}x.$$

Use perturbation theory to determine the first-order correction to the energy of the nth eigenstate associated with the perturbation.