EEE434/591: Quantum Mechanics

1. Calculate the energy shift in the ground state of a one-dimensional harmonic oscillator, when perturbation $V = \lambda x^4$ is added to

$$H = \frac{p^2}{2m^*} + \frac{1}{2} m^* \omega^2 x^2 \ .$$

2. The bottom of an infinite well is changed to have the shape

$$V(x) = \varepsilon \sin(\pi x / b), \quad 0 \le x \le b \ .$$

Calculate the energy shifts for all the excited states to first order in ε. Note that the well originally had $V(x) = 0$ for $0 \le x \le b$, with $V \to \infty$ elsewhere.