Nanoscale MOSFETs 2017 – Excercise 7

The 2-band-model:

$$Im(k_x) = \sqrt{\frac{2m^*}{\hbar^2}\left[\frac{\frac{E_g^2}{4} - E^2}{E_g}\right]}$$

$$T_{WBK} = \exp\left(-2\int_{x_1}^{x_2} k_x(x)\,dx\right)$$

1. For tunneling in a constant e-field – show that the classical turningpoints x1 and x2 are given by $x_{1,2} = \pm\frac{qE_g}{2\varepsilon}$, where e is the magnitude of the electric field.
2. Show that the energy E in Eq.1 can be written as $E = -q\varepsilon x$.
3. Perform the integration and demonstrate that $T_{wbk} = e^{-\left(\frac{\pi\sqrt{m^*}E_g^{\frac{3}{2}}}{2\sqrt{2}q\hbar\varepsilon}\right)}$
4. For a double gate GaAs TFET with t_{ox}=2 nm and t_{ch}=5 nm, calculate the transmission if V_{gs}-V_t=0.1V.
5. For a double gate InAs TFET with t_{ox}=2 nm and t_{ch}=5 nm, calculate the transmission if V_{gs}-V_t=0.1V.
6. Taking quantization into account, repeat the calculations.