230A problem:

For the 1-D InGaAs/InAlAs superlattice, the effective mass for InGaAs and InAlAs are denoted as \( m_1 \) and \( m_2 \), respectively.

(a) Find the general solution of the Schrödinger equation in regions I and II.
(b) Write the boundary conditions that allow us to solve the coefficients and the eigenvalues (energies) \( E \)'s. Note that in this case, the effective mass of electron in InGaAs and InAlAs is different.

230B problem:

An n-channel MOSFET has a 10 nm thick gate oxide and uniform p-type body doping of \( 10^{17} \) cm\(^{-3} \). The device is 10 \( \mu \)m wide and the channel length is 1 \( \mu \)m. Assume Si, room temperature, and complete ionization.

(a) What is the inverse slope of the log subthreshold current vs. \( V_g \) curve?
(b) For a gate bias such that \( V_g - V_t = 2.5 \) V where the mobility is 400 cm\(^2\)/V·s, what is the MOSFET channel conductance, \( dI/dV \), at low drain bias voltages?
(c) How short can the channel length be reduced before onset of severe short-channel effects?