Fundamentals of Nanoelectronics, II: Energy Band Model

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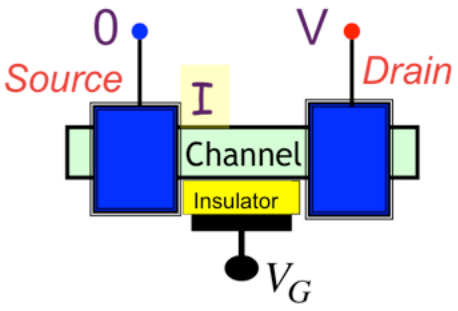
L2.8 Quiz

Answers

2.8. Quantum Capacitance

$$N = \int_{-\infty}^{+\infty} dE\, D(E - U)\, f_0(E) \qquad \textbf{(A)}$$

$$U = U_0(N - N_0) + \beta(-qV_G) \qquad \textbf{(B)}$$



2.8a. The result that the electron density can be changed by a factor of ten with a gate voltage ~ 60 mV is obtained under the assumption that

(a) β=1 in Eq.(B)

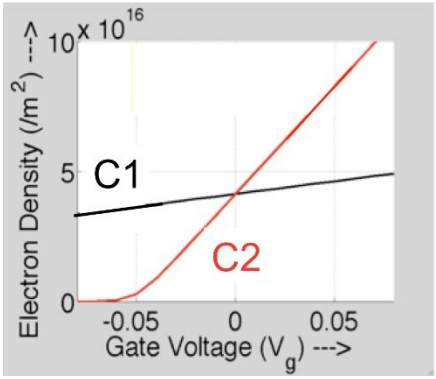
(b) U_0 is negligible in Eq.(B)

(c) The non-degenerate approximation for the Fermi function can be used in Eq.(A)

(d) All three above, namely, (a) , (b) and (c)

(e) Only (a) and (c)

2.8b. The plots C1, C2 for electron density versus gate voltage were obtained by solving Eqs.(A,B), with all the same parameters, except that one uses U_0=0 and one uses $U_0 \neq 0$.



Consider the following statements:

(1) Plot C2 was obtained with U_0=0

(2) Plot C1 was obtained with $U_0 \neq 0$

(3) The quantum capacitance is proportional to

(4) The quantum capacitance is proportional to

(a) Only statement 3 is correct

(b) Only statement 4 is correct

(c) Only statements 1, 2 and 3 are correct

(d) Only statements 1, 2 and 4 are correct

(e) None of the above