LECTURE 19

1) $C = \frac{\varepsilon_0 \varepsilon_{r_1} A}{d_1} = \frac{\varepsilon_0 \varepsilon_{r_2} A}{d_2}$

so - $d_2 = \frac{\varepsilon_{r_2}}{\varepsilon_{r_1}} d_1 = \frac{10.1}{1} \times 10^{-4}$ m

$d_2 = 1$ mm

$E = \frac{V}{d}$ so $V_{MAX} = E_{BREAKDOWN} \cdot d_2$

$= 50 \times 10^6 \times 1 \times 10^{-3}$ V

$= 50$ kV

2). a) $\mu = \frac{q\tau}{m^*}$ so $\tau = \frac{\mu m^*}{q}$

$\tau = \frac{0.12 \times 0.98 \times 9.11 \times 10^{-31}}{1.6 \times 10^{-19}}$

$= 6.7 \times 10^{-12}$ s

$= 670$ ps.

b) → notes, self study.

LECTURE 19

2) c) $v_d = -\mu E$ $\qquad E = \frac{V}{L} = \frac{10}{0.02} = 500\ V m^{-1}$

so $v_d = -\mu E = -0.12 \times 500 = -60\ ms^{-1}$

d): $n = \frac{\sigma}{q\mu}$. $\qquad \sigma = \frac{L}{RA}$

so $n = \frac{L}{q\mu RA} = \frac{0.02}{1.6\times10^{-19} \cdot 0.12 \times 3.33\times10^{3} \times 5\times10^{-6}}$

$= \frac{0.02}{1.6 \times 0.12 \times 3.33 \times 5} \times 10^{22}\ m^{-3}$

$= 0.00625 \times 10^{22}\ m^{-3}$

$= 6.25 \times 10^{19}\ m^{-3}$

3) SELF STUDY.

4) SELF STUDY → SEE n_i calculator .xls for hint...