Q3. given that $E = \frac{V}{d}$

$A = 1cm^2 = 10^{-4} m^2$, $d = 0.3mm$, $V = 2$ Volt

$= 0.3 \times 10^{-3} m$

$n = 2 \times 10^{19} m^{-3}$, $\mu_e = 0.36\ m^2/V.s$, $\mu_h = 0.17\ m^2/V.s$

$I_e = n_e e \mu_e E A$, $I_h = n_h e \mu_h E A$ $\quad n_e = n_h = n$

$I = I_e + I_h = ne(\mu_e + \mu_h) E A$

$I = ne(\mu_e + \mu_h) \frac{V}{d} A = 2 \times 10^{19} \times 1.6 \times 10^{-19} (0.36 + 0.17) \frac{2}{0.3 \times 10^{-3}} \times 10^{-4}$

$I = 3.2(0.53) \frac{2 \times 10^{1}}{0.3} = \frac{3.392}{3}$

$\boxed{I = 1.13\ Amp}$

Q2 We know that

$\sigma = e(n_e \mu_e + n_h \mu_h)$

$\sigma = 1.6 \times 10^{-19} (4.41 \times 10^{22} \times 0.39 + 1.3 \times 10^{16} \times 0.19)$

$= 1.6 \times 10^{-19} (1.7199 \times 10^{22} + 0.247 \times 10^{16})$

$= 1.6 \times 10^{-19} (1719.9 \times 10^{19} + 0.000247 \times 10^{19})$

$= 1.6\ (1719.900247)$

$= 2751.84 \simeq 2752$