

## 3EE200 – Formulaire pour l'écrit réparti n°2

### Cristallographie

$$2d_{(hkl)} \sin \theta = \lambda$$

$$d_{(hkl)} = \frac{1}{\sqrt{\frac{h^2}{a^2} + \frac{k^2}{b^2} + \frac{l^2}{c^2}}}$$

### Semi-conducteurs

$$f_{FD}(W) = \frac{1}{1 + \exp\left(\frac{W - W_F}{k_B T}\right)}$$

$$g_{BC}(W) = \frac{\sqrt{2}}{\pi^2} \left( \frac{4\pi^2 m_e^*}{h^2} \right)^{3/2} \sqrt{W - W_C} \quad g_{BV}(W) = \frac{\sqrt{2}}{\pi^2} \left( \frac{4\pi^2 m_h^*}{h^2} \right)^{3/2} \sqrt{W_V - W}$$

$$n = N_C \exp\left(\frac{-(W_C - W_F)}{k_B T}\right) \quad \text{avec } N_C = 2 \left( \frac{2\pi m_e^* k_B T}{h^2} \right)^{3/2}$$

$$p = N_V \exp\left(\frac{-(W_F - W_V)}{k_B T}\right) \quad \text{avec } N_V = 2 \left( \frac{2\pi m_h^* k_B T}{h^2} \right)^{3/2}$$

$$D_e = \frac{k_B T}{e} \mu_e, \quad D_h = \frac{k_B T}{e} \mu_h$$

$$W_{FN} = W_{Fi} + k_B T \ln\left(\frac{N_D}{n_i}\right), \quad W_{FP} = W_{Fi} - k_B T \ln\left(\frac{N_A}{n_i}\right)$$

$$R_H = \frac{E_y}{J_x B_z}$$

### Contact Schottky

$$\ell = \sqrt{\frac{2\epsilon_0 \epsilon_r' V_0}{e N_D}}$$

$$J = B_e T^2 \exp\left(-\frac{\Phi_B}{k_B T}\right) \left[ \exp\left(\frac{e V_D}{k_B T}\right) - 1 \right]$$

### Jonction PN

$$\ell_{P0} = \sqrt{\frac{2\epsilon}{e} \frac{V_0 N_D}{N_A(N_A + N_D)}} \quad \text{et} \quad \ell_{N0} = \sqrt{\frac{2\epsilon}{e} \frac{V_0 N_A}{N_D(N_A + N_D)}}$$

$$J(V_{app}) = J_s \left[ \exp\left(\frac{e V_{app}}{k_B T}\right) - 1 \right], \quad \text{où } J_s = e \left( \frac{D_h p_{N0}}{L_{Dh}} + \frac{D_e n_{p0}}{L_{De}} \right)$$