HW 11 Solutions

Chapter 10:

6. Let x be the coordinate in the plane of the junction and normal to B, with $-w/2 \le x \le w/2$. The flux through a rectangle of width 2x and thickness T is 2xTB = ϕ (x). The current through two elements at x and –x, each of width dx is

$$dJ = \left(J_0/w\right)\cos\left[e\Phi\left(x\right)/\hbar c\right]dx = \left(J_0/w\right)\cos\left(2xTeB/\hbar c\right)dx,$$

and the total current is

$$J = \left(J_0/w\right)\int_0^{w/2}\cos\left(xTeB/\hbar c\right)dx = J_0\frac{\sin\left(wTBe/\hbar c\right)}{\left(wTBe/\hbar c\right)}.$$

CHAPTER 14

1. $E_{x0} = -\dfrac{\partial\varphi}{\partial x} = kA \sin kx\, e^{kz}$, and at the boundary this is equal to E_{xi}. The normal component of **D** at the boundary, but outside the medium, is $\varepsilon(\omega)kA \cos kx$, where for a plasma $\varepsilon(\omega) = 1 - \omega_p^2/\omega^2$. The boundary condition is $-kA \cos kx = \varepsilon(\omega)kA \cos kx$, or $\varepsilon(\omega) = -1$, or $\omega_p^2 = 2\omega^2$. This frequency $\omega = \omega_p/\sqrt{2}$ is that of a surface plasmon.