14.18 (a) Let $\omega_c = \frac{3}{2}\gamma^3 \frac{c}{\rho}$. Eq. (14.79) reads

$$\frac{d^2 I}{d\omega d\Omega} = \frac{e^2}{3\pi^2 c} \frac{9\gamma^6}{4} \left(\frac{\omega}{\omega_c}\right)^2 \frac{1}{\gamma^4} (1+\gamma^2\theta^2)^2 \left[K_{2/3}^2(\xi) + \frac{\gamma^2\theta^2}{1+\gamma^2\theta^2} K_{1/3}^2(\xi) \right],$$

where $\xi = \frac{\omega\rho}{3c}\left(\frac{1}{\gamma^2}+\theta^2\right)^{3/2} = \frac{\omega}{2\omega_c}(1+\gamma^2\theta^2)^{3/2}$. We can write the above as

$$\frac{d^2 I}{d\omega d\Omega} = \frac{\sqrt{3}e^2\gamma}{c} \frac{\sqrt{3}\gamma}{4\pi^2} \left(\frac{\omega}{\omega_c}\right)^2 (1+\gamma^2\theta^2)^2 \left[K_{2/3}^2(\xi) + \frac{\gamma^2\theta^2}{1+\gamma^2\theta^2} K_{1/3}^2(\xi) \right].$$

Comparing with Eq (14.91), we know that

$$\int \frac{\sqrt{3}\gamma}{4\pi^2} \left(\frac{\omega}{\omega_c}\right)^2 (1+\gamma^2\theta^2)^2 \left[K_{2/3}^2(\xi) + \frac{\gamma^2\theta^2}{1+\gamma^2\theta^2} K_{1/3}^2(\xi) \right] d\Omega = \left(\frac{\omega}{\omega_c}\right) \int_{\omega/\omega_c}^{+\infty} K_{5/3}(y)\, dy.$$

We can apply the above result to Prob. 14.17 (b), where

$$\frac{d^2 P}{d\omega d\Omega} = \frac{\sqrt{3}e^2\gamma}{2\pi c} \frac{\omega_B}{\cos^2\alpha} \frac{\sqrt{3}\gamma}{4\pi^2} \left(\frac{\omega}{\omega_c}\right)^2 (1+\gamma^2\psi^2)^2 \left[K_{2/3}^2(\xi) + \frac{\gamma^2\theta^2}{1+\gamma^2\theta^2} K_{1/3}^2(\xi) \right], \text{ with } \xi = \frac{\omega}{2\omega_c}(1+\gamma^2\psi^2)^{3/2}.$$

To perform the angular integration, notice that most contribution comes from the region $\psi = 0$, which corresponds to $\theta = \pi/2 - \alpha$. Therefore, $d\Omega = \sin\theta d\theta\, d\phi = \cos\alpha\, d\theta d\phi$. Therefore, the integral for the helix motion should contain an extra $\cos\alpha$ contribution. Finally, we should have

$$\frac{dP}{d\omega} = \frac{\sqrt{3}e^2\gamma}{2\pi c} \frac{\omega_B}{\cos^2\alpha} \cdot \cos\alpha \frac{\omega}{\omega_c} \int_{\omega/\omega_c}^{+\infty} K_{5/3}(y)\, dy = \frac{\sqrt{3}e^2\gamma\omega_B}{2\pi c\cos\alpha} G\left(\frac{\omega}{\omega_c}\right).$$

(b) Using the identity $\int_0^{+\infty} y^2 K_{5/3}(y)\, dy = \frac{16\pi}{9\sqrt{3}}$, we can find the integral as

$$\frac{dP}{d\omega} = \frac{\sqrt{3}e^2\gamma\omega_B}{2\pi c\cos\alpha} \cdot \omega_c \int_0^{+\infty} G\left(\frac{\omega}{\omega_c}\right) d\left(\frac{\omega}{\omega_c}\right); \text{ and}$$

$$\int_0^{+\infty} G(x)\,dx = \int_0^{+\infty} dx\, x \int_x^{+\infty} dy\, K_{5/3}(y) = \int_0^{+\infty} dy \int_0^y dx\, x K_{5/3}(y) = \frac{1}{2}\int_0^{+\infty} y^2 K_{5/3}(y)\, dy = \frac{8\pi}{9\sqrt{3}}.$$

Thus $\frac{dP}{d\omega} = \frac{\sqrt{3}e^2\gamma\omega_B}{2\pi c\cos\alpha} \cdot \frac{3}{2}\gamma^3\omega_B\cos\alpha \cdot \frac{8\pi}{9\sqrt{3}} = \frac{2e^2\omega_B^2\gamma^4}{3c}$

More mathematical details can be found in Synchrotron Radiation by Wiedemann.