

### Homework 18.

1. (10 points) The longitudinal impedance of a lossy circular waveguide of radius  $b$  and conductivity  $\sigma$  is

$$Z_{//} = (1 + j) \frac{1}{2\pi b} \sqrt{\frac{\omega Z_0}{2c\sigma}},$$

with  $Z_0 = 377 \text{ ohm}$ . Calculate the associated wake function. (Hint: refer to table 2.1 in Chao's book, <https://www.slac.stanford.edu/~achao/WileyBook/WileyChapter2.pdf>, to find useful Fourier transform pairs.)

2. (10 points) Derive the expression for the longitudinal loss factor of a bunch in terms of the impedance,

$$Z(\omega), \text{ and the bunch spectrum, } \tilde{\lambda}(\omega) = \frac{1}{c} \int_{-\infty}^{\infty} \lambda(s) e^{i\omega s/c} ds.$$