Indian Institute of Technology Bombay

Dept of Electrical Engineering

Handout 9 EE 210 Signals and Systems

Home Work 3 August 28, 2015

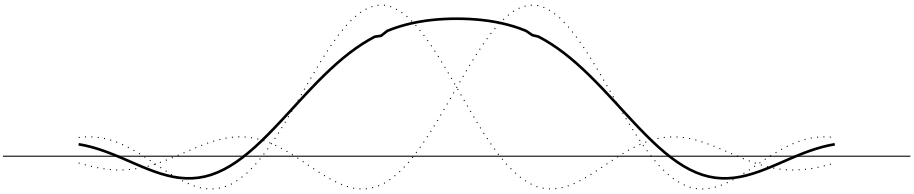
Question 1) Parseval's Theorem: Show that

$$\int |x(t)|^2 dt = \int |X(f)|^2 df. \tag{1}$$

Question 2) Find

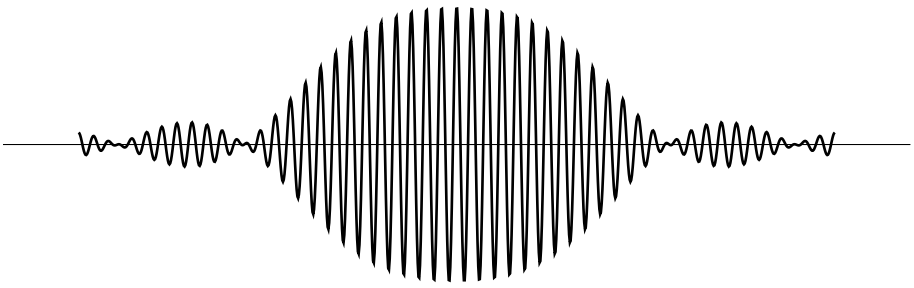
$$\int_{\mathbb{R}} \text{sinc}^2(Tt) dt.$$

Question 3) In figure, the thick line is the sum of the two dotted plots, and each dotted line is a $\alpha \text{sinc}(\frac{2}{\pi}t)$ function, shifted by t_0 units to each side of origin.



a) Compute the FT of this signal.

b) Suppose now the plot is of the form,



What do you expect the FT to be.

Question 4[*]) Recall the full wave rectifier that we discussed in the class. Let us design a filter with impulse response $h(t)$, which will convert the output of the bridge circuit to an ideal DC.

(a) Specify a filter with bounded support, i.e. $h(t) = 0$ when $|t| > B$, for some finite value $B < \infty$, such that the output of the filter is a steady (ideal) DC voltage.

(b) From part (a), design a filter which additionally requires that $h(t) \geq 0, \forall t$ and $H(f) \geq 0, \forall f$.

Question 5[*] Let us consider a half-wave recitifier, which acts like a closed switch for the positive cycles of the supply. On the other hand, negative inputs are blocked completely.

(a) If the supply frequency is f_s Hz, give the frequency components present at the output of the rectifier.

(b) Consider a $20V$ peak, $50Hz$ supply feeding the half-wave rectifier. Design an RC filter circuit such that the variations due to ripple are limited to 20% around mean DC value.