DE2.3 Electronics 2 for Design Engineers

Tutorial Sheet 2 – Fourier Transform, Sampling & DFT
(Lectures 3, 4 & 5)
* indicates level of difficulty

1.* Derive from the Fourier transform of the signals *f(t)* shown in Fig. Q1 (a) and (b).

(a)   (b)

Figure Q1

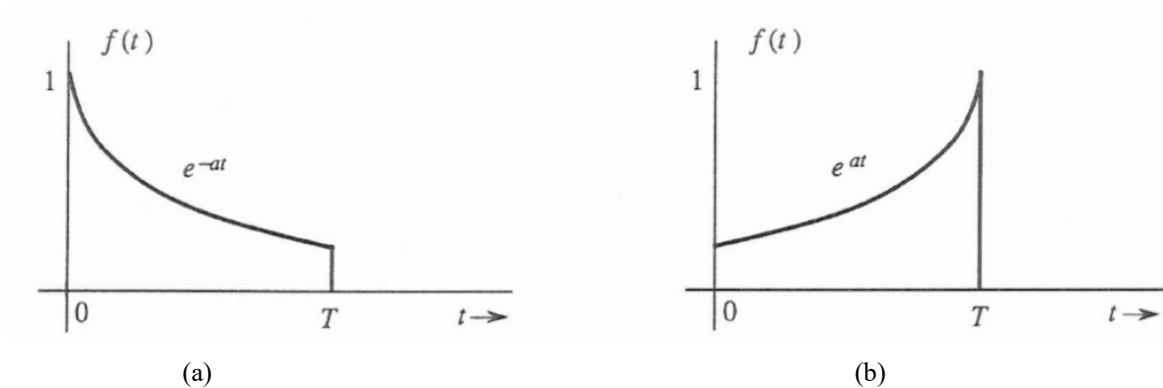2.** Derive the inverse Fourier transform of the spectra shown in Fig. Q2 (a) and (b).

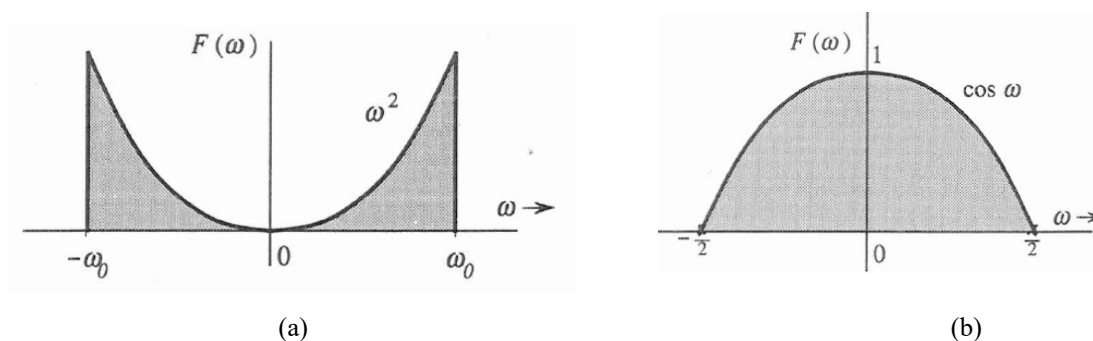(a)   (b)

Figure Q2

3.** Sketch the following functions:

a) $rect(\dfrac{t}{2})$ b) $rect(\dfrac{t-10}{8})$

c) $sinc(\dfrac{\pi\omega}{5})$ d) $sinc(\dfrac{\omega-10\pi}{5})$.

4.** Fig. Q4 (a) and (b) shows Fourier spectra of signals $f_1(t)$ and $f_2(t)$. Determine the Nyquist sampling rates in each case.

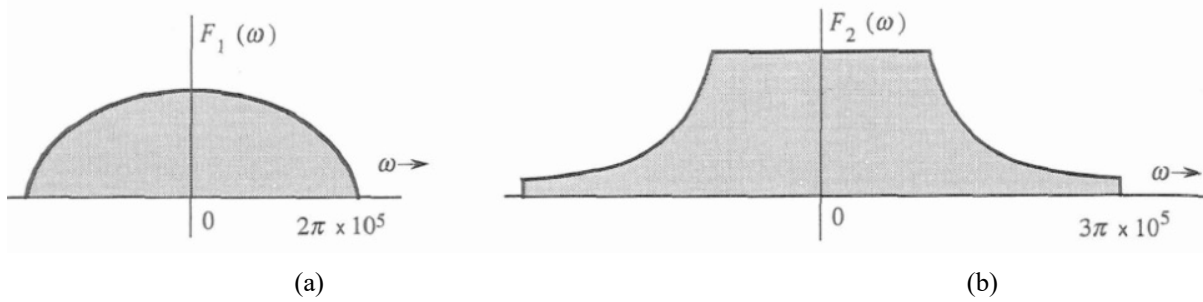(a)   (b)

Figure Q4

5.*** For a signal $f(t)$ that is time-limited to 10 ms and has an essential bandwidth of 10 kHz, determine N_0, the number of signal samples necessary to compute its DFT with a frequency resolution f_0 of 50 Hz.