EE301 Signals and Systems **In-Class Exam**
Exam 3 **Thursday, Apr. 22, 2004**

Cover Sheet

Test Duration: 70 minutes.
Coverage: Chaps. 5 and 7.
Open Book but Closed Notes.
Calculators NOT allowed.
This test contains **one** problem with 15 parts.
All work should be done in the blue books provided.
You must show all work for each problem to receive full credit.
Do **not** return this test sheet, just return the blue books.

For EACH of the part of this problem:

- You need only plot the magnitude of the DTFT over $-\pi < \omega < \pi$, but it is very important to keep in mind that a DTFT is always periodic with period 2π.
- You must clearly label the DTFT magnitude plot requested and show as much detail as possible, clearly pointing out regions over $-\pi < \omega < \pi$ for which the DTFT is zero.
- You MUST show all work and explain how you got your answer concisely but with sufficient detail to receive full credit.
- The unit of T_s is seconds for all parts.

(a) $x_1(t) = \cos(4t)$. Plot the magnitude of the DTFT of $x_1[n] = x_1(nT_s)$ for $T_s = \frac{2\pi}{6}$.

(b) $x_2(t) = \dfrac{\sin(4t)}{\pi t}$. Plot the magnitude of the DTFT of $x_2[n] = x_2(nT_s)$ for $T_s = \frac{2\pi}{16}$.

(c) $x_3(t) = \dfrac{\sin(4t)}{\pi t}$. Plot the magnitude of the DTFT of $x_3[n] = x_3(nT_s)$ for $T_s = \frac{2\pi}{12}$.

(d) $x_4(t) = \dfrac{\sin(4t)}{\pi t}$. Plot the magnitude of the DTFT of $x_4[n] = x_4(nT_s)$ for $T_s = \frac{2\pi}{8}$.

(e) $x_5(t) = \dfrac{\sin(4t)}{\pi t}$. Plot the magnitude of the DTFT of $x_5[n] = x_5(nT_s)$ for $T_s = \frac{2\pi}{6}$.

(f) $x_6(t) = \dfrac{d}{dt}\left\{\dfrac{\sin(4t)}{\pi t}\right\}$. Plot the magnitude of the DTFT of $x_6[n] = x_6(nT_s)$ for $T_s = \frac{2\pi}{12}$.

(g) $x_7(t) = \dfrac{d}{dt}\left\{\dfrac{\sin(4t)}{\pi t}\right\}$ Plot the magnitude of the DTFT of $x_7[n] = x_7(nT_s)$ for $T_s = \frac{2\pi}{8}$.

(h) $x_8(t) = \left\{\dfrac{\sin(4t)}{\pi t}\right\}^2$. Plot the magnitude of the DTFT of $x_8[n] = x_8(nT_s)$ for $T_s = \frac{2\pi}{16}$.

(i) $x_9(t) = \left\{\dfrac{\sin(4t)}{\pi t}\right\}^2$. Plot magnitude of the DTFT of $x_9[n] = x_9(nT_s)$ for $T_s = \frac{2\pi}{12}$.

(j) $x_{10}(t) = t\ \left\{\dfrac{\sin(4t)}{\pi t}\right\}^2$. Plot magnitude of the DTFT of $x_{10}[n] = x_{10}(nT_s)$ for $T_s = \frac{2\pi}{24}$.

(k) $x_{11}(t) = t\ \left\{\dfrac{\sin(4t)}{\pi t}\right\}^2$. Plot magnitude of the DTFT of $x_{11}[n] = x_{11}(nT_s)$ for $T_s = \frac{2\pi}{16}$.

(ℓ) $x_{12}(t) = \left\{\dfrac{\sin(4t)}{\pi t}\right\}^2 \cos(6t)$. Plot magnitude of DTFT of $x_{12}[n] = x_{12}(nT_s)$ for $T_s = \frac{2\pi}{24}$.

(m) $x_{13}(t) = \left\{\dfrac{\sin(4t)}{\pi t}\right\}^2 \cos(6t)$. Plot magnitude of DTFT of $x_{13}[n] = x_{13}(nT_s)$ for $T_s = \frac{2\pi}{16}$.

(n) $x_{14}(t) = \left\{\dfrac{\sin(2t)}{\pi t}\right\}\left\{\dfrac{\sin(4t)}{\pi t}\right\}$. Plot the magnitude of the DTFT of $x_{14}[n] = x_{14}(nT_s)$ for $T_s = \frac{2\pi}{18}$.

(o) $x_{15}(t) = \left\{\dfrac{\sin(2t)}{\pi t}\right\} * \left\{\dfrac{\sin(4t)}{\pi t}\right\}$, where $*$ denotes convolution. Plot the magnitude of the DTFT of $x_{15}[n] = x_{15}(nT_s)$ for $T_s = \frac{2\pi}{8}$.