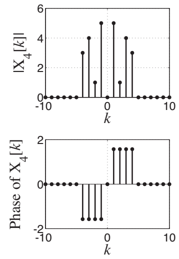
Solution of ECE 315 Test 7 F08

$X_1[k] = 3\{\text{sinc}(k/2) - \delta[k]\}$, $T_0 = T_F = 1$

$x_2(t)$ is periodic and one period of $x_2(t) = t\delta_1(t)\text{rect}(t/5)$, $-2.5 < t < 2.5$ and $T_0 = T_F = 5$

$x_3(t)$ is periodic and one period of $x_3(t) = t + 1$, $-2 < t < 2$ and $T_0 = T_F = 4$



$\{X_4[k] = 0 \ , \ |k| > 10\}$, $T_F = T_0 = 10$

For each signal $x_n(t) \xleftrightarrow{FS} X_n[k]$.

Circle all correct answers. If none of the answers is correct, circle none.

1. Which continuous-time signals are even functions? 1
2. Which continuous-time signals are not even but can be made even by adding or subtracting a constant? none
3. Which continuous-time signals are odd functions? 2, 4
4. Which continuous-time signals are not odd but can be made odd by adding or subtracting a constant? 3
5. Which continuous-time signals have an average value of zero? 1, 2, 4
6. Which of the continuous-time signals are square waves? 1
7. What is the average signal power of $x_1(t)$?

   Using

   $$(1/w)\text{rect}(t/w) * \delta_{T_0}(t) \xleftrightarrow[T_F = T_0]{FS} f_0 \text{sinc}(wkf_0) \quad \text{and} \quad 1 \xleftrightarrow[T_F \text{ is arbitrary}]{FS} \delta[k]$$

   $$3[2\text{rect}(2t) * \delta_1(t) - 1] \xleftrightarrow{FS} X_1[k] = 3\{\text{sinc}(k/2) - \delta[k]\} \ , \ T_0 = T_F = 1$$

   This is a square wave alternating between +3 and –3. Its square is a constant +9. Therefore its average signal power is 9.
8. What is the average signal power of $x_4(t)$?

   By Parseval's theorem, the average signal power is the sum of the squares of the magnitudes of the impulse strengths in the harmonic function. For this signal

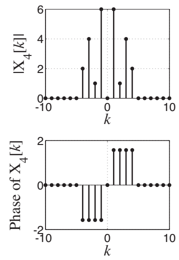
   $$P_4 = 2\times5^2 + 2\times1^2 + 2\times4^2 + 2\times3^2 = 2\times(25+1+16+9) = 102$$

Solution of ECE 315 Test 7 F08

$X_1[k] = 4\{\text{sinc}(k/2) - \delta[k]\}$, $T_0 = T_F = 1$

$x_2(t)$ is periodic and one period of $x_2(t) = t^2\delta_1(t)\text{rect}(t/5)$, $-2.5 < t < 2.5$ and $T_0 = T_F = 5$

$x_3(t)$ is periodic and one period of $x_3(t) = t + 1$, $-2 < t < 2$ and $T_0 = T_F = 4$



$\{X_4[k] = 0 \ , \ |k| > 10\}$, $T_F = T_0 = 10$

For each signal $x_n(t) \xleftrightarrow{FS} X_n[k]$.

Circle all correct answers. If none of the answers is correct, circle none.

1. Which continuous-time signals are even functions? 1, 2
2. Which continuous-time signals are not even but can be made even by adding or subtracting a constant? none
3. Which continuous-time signals are odd functions? 4
4. Which continuous-time signals are not odd but can be made odd by adding or subtracting a constant? 3
5. Which continuous-time signals have an average value of zero? 1, 4
6. Which of the continuous-time signals are square waves? 1
7. What is the average signal power of $x_1(t)$?

   Using

   $$(1/w)\text{rect}(t/w) * \delta_{T_0}(t) \xleftrightarrow[T_F = T_0]{FS} f_0 \text{sinc}(wkf_0) \quad \text{and} \quad 1 \xleftrightarrow[T_F \text{ is arbitrary}]{FS} \delta[k]$$

   $$4[2\,\text{rect}(2t) * \delta_1(t) - 1] \xleftrightarrow{FS} X_1[k] = 4\{\text{sinc}(k/2) - \delta[k]\} \ , \ T_0 = T_F = 1$$

   This is a square wave alternating between +4 and –4. Its square is a constant +16. Therefore its average signal power is 16.
8. What is the average signal power of $x_4(t)$?

   By Parseval's theorem, the average signal power is the sum of the squares of the magnitudes of the impulse strengths in the harmonic function. For this signal

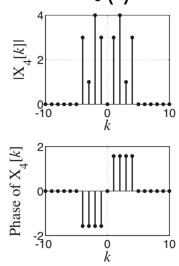
   $$P_4 = 2\times 6^2 + 2\times 1^2 + 2\times 4^2 + 2\times 2^2 = 2\times(36 + 1 + 16 + 4) = 114$$

Solution of ECE 315 Test 7 F08

$X_1[k] = 10\{\text{sinc}(k/2) - \delta[k]\}$, $T_0 = T_F = 1$

$x_2(t)$ is periodic and one period of $x_2(t) = t\delta_1(t)\text{rect}(t/5)$, $-2.5 < t < 2.5$ and $T_0 = T_F = 5$

$x_3(t)$ is periodic and one period of $x_3(t) = t + 1$, $-2 < t < 2$ and $T_0 = T_F = 4$



$\{X_4[k] = 0 \ , \ |k| > 10\}$, $T_F = T_0 = 10$

For each signal $x_n(t) \xleftrightarrow{FS} X_n[k]$.

Circle all correct answers. If none of the answers is correct, circle none.

1. Which continuous-time signals are even functions? 1
2. Which continuous-time signals are not even but can be made even by adding or subtracting a constant? none
3. Which continuous-time signals are odd functions? 2, 4
4. Which continuous-time signals are not odd but can be made odd by adding or subtracting a constant? 3
5. Which continuous-time signals have an average value of zero? 1, 2, 4
6. Which of the continuous-time signals are square waves? 1
7. What is the average signal power of $x_1(t)$?

   Using

$$(1/w)\text{rect}(t/w) * \delta_{T_0}(t) \xleftrightarrow[T_F = T_0]{FS} f_0 \text{sinc}(wkf_0) \quad \text{and} \quad 1 \xleftrightarrow[T_F \text{ is arbitrary}]{FS} \delta[k]$$

$$10[2\text{rect}(2t) * \delta_1(t) - 1] \xleftrightarrow{FS} X_1[k] = 10\{\text{sinc}(k/2) - \delta[k]\} \ , \ T_0 = T_F = 1$$

   This is a square wave alternating between +10 and –10. Its square is a constant +100. Therefore its average signal power is 100.

8. What is the average signal power of $x_4(t)$?

   By Parseval's theorem, the average signal power is the sum of the squares of the magnitudes of the impulse strengths in the harmonic function. For this signal

$$P_4 = 2\times 3^2 + 2\times 4^2 + 2\times 1^2 + 2\times 3^2 = 2\times(9+16+1+9) = 70$$