Electrical Engineering Department

Signal Analysis (802321) – G1

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First Term (1435-1436), 2nd Exam, Tuesday 10/02/1436 H

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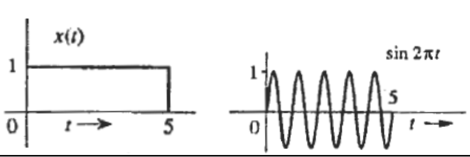
1. Choose the correct answer:

1.	To approximate a vector **g** by a vector **x**, we use: $\mathbf{g} \approx c\,\mathbf{x}$	a) $c = \lvert g\rvert\,\lvert x\rvert \cos\theta / \lvert g\rvert^2$
		b) $c = \lvert g\rvert\,\lvert x\rvert \cos\theta$
		c) $c = \mathbf{g}\,.\,\mathbf{x} / \lvert x\rvert^2$
		d) $c = \lvert x\rvert^2 / \mathbf{g}\,.\,\mathbf{x}$
2.	To approximate a real signal $g(t)$ by a real signal $x(t)$ over the period $[t_1, t_2]$, we use: $g(t) \approx c\,x(t)$	a) $c = \frac{1}{E_x}\int_{t1}^{t2} g(t)x(t)dt$
		b) $c = \frac{1}{E_g}\int_{t1}^{t2} g(t)x(t)dt$
		c) $c = \frac{1}{\sqrt{E_g E_x}}\int_{t1}^{t2} g(t)x(t)dt$
		d) $c = \frac{1}{\sqrt{E_x}}\int_{t1}^{t2} g(t)x(t)dt$
3.	The inner product of the two complex signals $g(t)$ and $x(t)$ is:	a) $\lvert g(t)\rvert\,\lvert x(t)\rvert \cos\theta$
		b) $\int_{t1}^{t2} g(t)x(t)dt$
		c) $\int_{t1}^{t2} g(t)x^*(t)dt$
		d) $\frac{1}{E_x E_g}\int_{t1}^{t2} g(t)x^*(t)dt$
4.	For the two signals $g(t)$ and $x(t)$, if the correlation coefficient c_n lies between –1 and 0, then:	a) $g(t)$ and $x(t)$ are similar
		b) $g(t)$ and $x(t)$ are dissimilar
		c) $g(t)$ and $x(t)$ have maximum similarity
		d) $g(t)$ and $x(t)$ have maximum dissimilarity
5.	Given the two signals below. The correlation coefficient equals: 	a) 1
		b) 0.628
		c) 0.961
		d) Zero (the two signals are orthogonal)

6.	Simplify the following expression: $$\left[\frac{\sin\frac{\pi}{2}(t-2)}{t^2+4}\right]\delta(t+1)$$	a) (–1/5) $\delta(t+1)$ b) (1/5) $\delta(t+1)$ c) –1/5 d) 1/5
7.	In the cascade interconnection of systems:	a) The total output is the output of the last system b) The total output is the sum of the outputs of all systems c) The output of the second system is fed back and added to external input d) The input is processed by all systems simultaneously
8.	In memoryless systems, the output at any instant n depends on input samples at:	a) The same and / or past time b) The same time only c) The same and / or future time d) The past time only
9.	The system $y(t) = x(4 - t)$ is:	a) Causal and memoryless b) Causal and nonememoryless c) Noncausal and memoryless d) Noncausal and nonememoryless
10.	The system $y(t) = x(4 - t)$ is:	a) Linear and time-invariant b) Linear and time-variant c) Nonlinear and time-invariant d) Nonlinear and time-variant
11.	Which one of the following systems is linear?	a) $y[n] = \cos(x[n])$ b) $y[n] = x^3[n]$ c) $y[n] = \log(x[n])$ d) $y[n] = (n-1)\,x[n]$
12.	Which one of the following systems is causal?	a) $y(t) = x(-t+2)$ b) $y(t) = x(-2t)$ c) $x(t) = \sum_{n=t-1}^{\infty} x(n)$ d) $x(t) = \sum_{n=-\infty}^{t-1} x(n)$
13.	For the periodic signal $x(t)$ with the Fourier series representation: $$x(t) = \sum_{k=-\infty}^{\infty} a_k e^{jk\pi t}$$ The fundamental period equals:	a) 1 sec b) 2 sec c) π sec d) None of the above
14.	Fourier series is expressed in terms of sine waves only if:	a) $x(t)$ and $\{a_k\}$ are real b) $x(t)$ is real but $\{a_k\}$are complex c) $x(t)$ is real but $\{a_k\}$are imaginary d) $x(t)$ and $\{a_k\}$ are complex

15.	Given the impulse train signal $\delta_{To}(t)$ where $T_0 = 3$ sec, the Fourier series coefficients of $\delta_{To}(t)$ are:	a) $a_k = 1/3$ for all values of k
		b) $a_0 = 1/3$, $a_k = 2/3$ for $k \neq 0$
		c) $a_k = 3$ for all values of k
		d) $\delta_{To}(t)$ does not have Fourier series
16.	Given the signal $x(t) = \cos^2 3\pi t$ If the fundamental frequency in radian per second is 3π:	a) $a_0 = ½$, $a_1 = 0$, $a_2 = ½$
		b) $a_0 = 0$, $a_1 = ¼$, $a_2 = 0$
		c) $a_0 = ½$, $a_1 = ¼$, $a_2 = 0$
		d) $a_0 = ½$, $a_1 = 0$, $a_2 = ¼$
17.	Which one of the following periodic signals is absolutely integrable:	a) $x(t) = \ln t$, $0 \le t \le 1$
		b) $x(t) = \ln t$, $½ \le t \le 1$
		c) $x(t) = t^{-2}$, $0 \le t \le 1$
		d) $x(t) = 1/(2t)$, $0 \le t \le 1$
18.	Fourier series is expressed using the following formula if: $x(t) = a_o + 2\sum_{k=1}^{\infty} A_k \cos(k\omega_0 t + \phi_k)$	a) $x(t)$ and $\{a_k\}$ are real
		b) $x(t)$ is real but $\{a_k\}$are complex
		c) $x(t)$ is complex but $\{a_k\}$are real
		d) $x(t)$ and $\{a_k\}$ are complex
19.	Given a square wave with the following characteristics: $x(t) =$ 1 , $\lvert t\rvert \le 1$ 0 , $1 \le \lvert t\rvert \le 2$	a) $T_1 = 1$, $T = 2$
		b) $T_1 = 1$, $T = 4$
		c) $T_1 = ½$, $T = 2$
		d) $T_1 = ½$, $T = 4$
20.	For the signal $x(t)$ given in Q.19:	a) $a_0 = ½$, $a_k = (1/k\pi) \sin (k\pi/2)$ for $k \neq 0$
		b) $a_0 = ½$, $a_k = (1/k\pi) \sin (k\pi)$ for $k \neq 0$
		c) $a_0 = 1$, $a_k = (1/k\pi) \sin (k\pi/2)$ for $k \neq 0$
		d) $a_0 = 1$, $a_k = (1/k\pi) \sin (k\pi)$ for $k \neq 0$
21.	If the signal $x(t)$ given in Q.19 is shifted down by ¼ , then the new Fourier series coefficients b_k will be:	a) $b_k = a_k - ¼$, for all values of k
		b) $b_k = a_k - ¼$, for $k \neq 0$
		c) $b_k = a_k - ¼$, for $k = 0$
		d) $b_k = a_k$
22.	If the signal $x(t)$ given in Q.19 is time-reversed, then the new Fourier series coefficients c_k will be:	a) $c_0 = a_0$, $c_k = a_{-k} = a_k$
		b) $c_0 = a_0$, $c_k = a_{-k} = -a_k$
		c) $c_0 = -a_0$, $c_k = a_{-k} = a_k$
		d) $c_0 = -a_0$, $c_k = a_{-k} \neq -a_k$
23.	If the signal $x(t)$ given in Q.19 is time-compressed by 2, then the new Fourier series coefficients d_k will be:	a) $d_k = a_k$, but ω_0 is doubled
		b) $d_k = a_k / 2$, and ω_0 is doubled
		c) $d_k = a_k$, and ω_0 is divided by 2
		d) $d_k = a_k / 2$, but ω_0 remains the same
24.	If the signal $x(t)$ given in Q.19 is shifted to the left by ½ , then the new Fourier series coefficients e_k will be:	a) $e_0 = a_0$, $e_k = a_k\ e^{jk(\pi/4)}$ for $k \neq 0$
		b) $e_0 = a_0$, $e_k = a_k\ e^{-jk(\pi/4)}$ for $k \neq 0$
		c) $e_0 = 0$, $e_k = a_k\ e^{-jk(\pi/4)}$ for $k \neq 0$
		d) $e_0 = a_0$, $e_k = a_k\ e^{-jk(\pi/2)}$ for $k \neq 0$
25.	If $\{a_k\}$ are the Fourier series coefficients of a signal $g(t)$, the Fourier series coefficients of the signal $dx(t)/dt$ are:	a) $jk\omega_0\, a_k$
		b) $-jk\omega_0\, a_k$
		c) $(1/jk\omega_0)\, a_k$
		d) $(-1/jk\omega_0)\, a_k$