Unit 5 - Week 2- Cross- and Auto-correlation, (ESD), Introduction to Amplitude Modulation (AM), Spectrum of AM, Envelope Detection, Power Efficiency, (DSB-SC) Modulation and Demodulation

Assignment-2

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-02-12, 23:59 IST.

1) Consider $x(t) = \cos\left(2t + \frac{\pi}{4}\right)$. The coefficients of its Fourier series are *1 point*

- $\frac{j}{2\sqrt{2}}, \frac{-j}{2\sqrt{2}}$
- $\frac{1}{2\sqrt{2}}, \frac{1}{2\sqrt{2}}$
- $\frac{1+j}{2\sqrt{2}}, \frac{1-j}{2\sqrt{2}}$
- $\frac{1}{2}, \frac{-1}{2}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1+j}{2\sqrt{2}}, \frac{1-j}{2\sqrt{2}}$

2) Let $X(f)$ denote the Fourier transform of the signal $x(t)$. The Fourier transform of its auto-correlation $R_{xx}(\tau)$ is *1 point*

- $X(f)^2$
- $|X(f)|^2$
- $|X(f)|$
- $X(f)X(-f)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$|X(f)|^2$

3) Consider the signal $x(t) = e^{-at}u(t)$. Its auto-correlation function $R_{xx}(\tau)$ is *1 point*

- $\frac{1}{2a}e^{-a\tau}u(\tau)$
- $\frac{1}{2a}e^{-a|\tau|}$
- $\frac{1}{2a}e^{-a\tau}$
- $e^{-2a\tau}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{2a}e^{-a|\tau|}$

4) Consider the signal $x(t) = e^{-at}u(t)$. Its energy spectral density $S_{xx}(f)$ is *1 point*

- $\frac{1}{2a}e^{-a\tau}u(\tau)$
- $\frac{1}{a+j2\pi f}$
- $\frac{1}{a^2+4\pi^2 f^2}$
- $a^2 + 4\pi^2 f^2$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{a^2+4\pi^2 f^2}$

5) Consider the serial RC circuit with output denoting the voltage across the capacitor. Its impulse response, i.e. output for unit impulse input voltage, is *1 point*

- $\frac{R}{C}e^{\frac{-t}{R}}u(t)$
- $\frac{1}{RC}e^{\frac{-t}{RC}}u(t)$
- $\frac{C}{R}e^{\frac{-R}{C}}$
- $\left(1 - e^{\frac{-t}{RC}}\right)u(t)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{RC}e^{\frac{-t}{RC}}u(t)$

6) Consider the trigonometric series representation of a periodic signal $x(t)$ with fundamental frequency f_0 given as $a_0 + \sum_{n=1}^{\infty}(a_n\cos(2\pi n f_0 t) + b_n\sin(2\pi n f_0 t))$. The coefficients b_n are given as *1 point*

- $2f_0\int_{-\frac{1}{2f_0}}^{\frac{1}{2f_0}} x(t)\sin(2\pi n f_0 t)dt$
- $2f_0\int_{-\frac{1}{2f_0}}^{\frac{1}{2f_0}} x(t)\cos(2\pi n f_0 t)dt$
- $f_0\int_{-\frac{1}{2f_0}}^{\frac{1}{2f_0}} x(t)\sin(2\pi n f_0 t)dt$
- $f_0\int_{-\frac{1}{2f_0}}^{\frac{1}{2f_0}} x(t)e^{-j2\pi n f_0 t}dt$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$2f_0\int_{-\frac{1}{2f_0}}^{\frac{1}{2f_0}} x(t)\sin(2\pi n f_0 t)dt$

7) Fourier series can be found for *1 point*

- Continuous time aperiodic signals
- Discrete time periodic signals
- Continuous time periodic signals
- Discrete time aperiodic signals

No, the answer is incorrect.
Score: 0
Accepted Answers:
Continuous time periodic signals

8) Consider the signal $x(t) = \text{sgn}(t)$, which is defined as *1 point*

$$\text{sgn}(t) = \begin{cases} 1 & t > 0 \\ 0 & t = 0 \\ -1 & t < 0 \end{cases}$$

Its Fourier transform is

- $2\pi\,\text{sgn}(f)$
- $j2\pi f$
- 1 for $|f| \leq 1$ and 0 otherwise
- $\frac{1}{j\pi f}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{j\pi f}$

9) Consider the Guassian filter $x(t) = e^{-at^2}$. Its Fourier transform is *1 point*

- $\sqrt{\frac{\pi}{a}}e^{\frac{-\pi^2 f^2}{a}}$
- $\sqrt{\pi a}e^{-4a\pi^2 f^2}$
- $\sqrt{\frac{\pi}{a}}e^{-4a|f|}$
- $\frac{1}{1+a^2 4\pi^2 f^2}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\sqrt{\frac{\pi}{a}}e^{\frac{-\pi^2 f^2}{a}}$

10) Let $X(f)$ denote the Fourier transform of the signal $x(t)$. The Fourier transform of $x(t)e^{j2\pi f_c t}$ is *1 point*

- $X(f + f_c)$
- $\frac{d}{df}X(f)\Big|_{f=f_c}$
- $X(f - f_c)$
- $X(f)e^{j2\pi f_c}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$X(f - f_c)$