Unit 6 - Week-3- Power Efficiency, (DSB-SC) Modulation and Demodulation, Carrier Phase Offset Example for (DSB-SC), Costas Receiver

Assignment-3

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

Due on 2020-02-19, 23:59 IST.

1) Let $X(f) = \frac{1}{\pi f} * \frac{1}{\pi f}$, where $*$ denotes convolution. Let $x(t)$ denote the inverse Fourier transform of $X(f)$. Then $x(t)$ equals *1 point*

- $x(t) = \begin{cases} -1, & \text{for } t \geq 0 \\ 1, & \text{for } t < 0 \end{cases}$
- $x(t) = \pi\left(\frac{sin(\pi t)}{\pi t}\right)$
- $x(t) = e^{-t}u(t)$
- $x(t) = \begin{cases} -1, & \text{for } t \neq 0 \\ 0, & \text{for } t = 0 \end{cases}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$x(t) = \begin{cases} -1, & \text{for } t \neq 0 \\ 0, & \text{for } t = 0 \end{cases}$

2) Let $X_i(f)$ denote the Fourier Transform of $x_i(t)$, for $i = 1, 2$. Then, $\int_{-\infty}^{\infty} x_1(t)x_2^*(-t)\, dt$ equals *1 point*

- $\int_{-\infty}^{\infty} X_1(f)X_2(f)\, df$
- $\int_{-\infty}^{\infty} X_1^*(f)X_2(f)\, df$
- $\int_{-\infty}^{\infty} X_1(f)X_2^*(f)\, df$
- $\int_{-\infty}^{\infty} X_1(f)X_2^*(-f) df$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\int_{-\infty}^{\infty} X_1(f)X_2^*(-f) df$

3) If $m(t)$ has Fourier transform $M(f)$, the Fourier transform of $m(t)\sin(2\pi f_c t)$ is *1 point*

- $\frac{1}{2}M(f - f_c) + \frac{1}{2}M(f + f_c)$
- $\frac{j}{2}M(f - f_c) + \frac{j}{2}M(f + f_c)$
- $-\frac{j}{2}M(f - f_c) + \frac{j}{2}M(f + f_c)$
- $\frac{1}{2}M(f - f_c) - \frac{1}{2}M(f + f_c)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$-\frac{j}{2}M(f - f_c) + \frac{j}{2}M(f + f_c)$

4) Consider the Gaussian pulse $g(t) = e^{-kt^2}$. Let its Fourier transform be denoted by $G(f)$. Demonstrate that $\frac{d}{df}G(f) = -\alpha f G(f)$. What is the value of the constant α ? *1 point*

- $\sqrt{\frac{\pi}{k}}$
- $k\sqrt{\pi}$
- $\frac{2\pi^2}{k}$
- 1

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{2\pi^2}{k}$

5) Consider the signal $x(t) = 2 \text{ sinc } 4t$ where $\text{sinc } x = \frac{\sin(\pi x)}{\pi x}$. The Fourier transform of the signal is *1 point*

- 2 for $|f| \leq 2$ and 0 otherwise
- $\frac{1}{2}$ for $|f| \leq 2$ and 0 otherwise
- $\frac{1}{2}$ for $|f| \leq 1$ and 0 otherwise
- 2 for $|f| \leq \frac{1}{2}$ and 0 otherwise

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{2}$ for $|f| \leq 2$ and 0 otherwise

6) Given the message signal $m(t)$ and carrier frequency f_c, the modulation $x(t) = A_c m(t)\cos(2\pi f_c t)$ is termed as *1 point*

- Double sideband suppressed carrier (DSB-SC)
- Single Side Band (SSB)
- Vestigial Side Band (VSB)
- Quadrature Carrier Multiplexing (QCM)

No, the answer is incorrect.
Score: 0
Accepted Answers:
Double sideband suppressed carrier (DSB-SC)

7) The power efficiency of an amplitude modulated (AM) signal for a sinusoidal message signal with modulation index μ is *1 point*

- $\frac{\mu^2}{2+\mu^2}$
- $\frac{1}{1+\mu^2}$
- $\frac{1}{2+\mu^2}$
- $\frac{\mu^2}{1+\mu}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{\mu^2}{2+\mu^2}$

8) Consider the AM signal $A(1 + k\sin(2\pi f_m t))\ \cos(2\pi f_c t)$ with power efficiency $\frac{1}{9}$ and total power 1. The expression for the AM signal is, *1 point*

- $2\left(1 + \frac{1}{3}\sin(2\pi f_m t)\right)\ \cos(2\pi f_c t)$
- $\frac{4}{3}\left(1 + \frac{1}{2}\sin(2\pi f_m t)\right)\ \cos(2\pi f_c t)$
- $\frac{1}{3}\left(1 + \frac{1}{2}\sin(2\pi f_m t)\right)\ \cos(2\pi f_c t)$
- $\frac{3}{4}\left(1 + \frac{1}{4}\sin(2\pi f_m t)\right)\ \cos(2\pi f_c t)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{4}{3}\left(1 + \frac{1}{2}\sin(2\pi f_m t)\right)\ \cos(2\pi f_c t)$

9) Consider the message signal $m(t) = \cos(20\pi t)$. Let carrier frequency $f_c = 1$ kHz and carrier amplitude $A_c = 20$. With 50% modulation, what is the approximate power efficiency of the AM signal? *1 point*

- 50%
- 20%
- 11.11%
- 5.88%

No, the answer is incorrect.
Score: 0
Accepted Answers:
11.11%

10) Consider the envelope detector with load resistance R_l and capacitance C, employed to detect an AM signal with carrier frequency f_c and message frequency f_m. It is desirable that *1 point*

- $R_l C \ll \frac{1}{f_m}$
- $R_l C \ll \frac{1}{f_c}$
- $R_l C \gg \frac{f_m}{f_c}$
- $R_l C \ll \frac{f_m}{f_c}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$R_l C \ll \frac{1}{f_m}$