Unit 7 - Week-4 Quadrature Carrier Multiplexing (QCM) and Demodulation of QCM signals, Single Sideband Modulation (SSB), Hilbert Transform

Assignment-4

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

Due on 2020-02-26, 23:59 IST.

1) Let P_m denote the power of the message signal $m(t)$. The total power of the AM signal $A_c\left(1 + k_a m(t)\right)\cos(2\pi f_c t)$ is *1 point*

- $k_a^2 A_c^2 P_m$
- $\frac{1}{2}k_a^2 A_c^2 P_m$
- $\frac{1}{2}k_a^2 A_c^2 P_m + \frac{1}{2}A_c^2$
- $k_a^2 A_c^2 P_m + A_c^2$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{2}k_a^2 A_c^2 P_m + \frac{1}{2}A_c^2$

2) Consider the message signal $m(t) = \cos(20\pi t)$. Let carrier frequency $f_c = 1kHz$ and carrier amplitude $A_c = 20$. With 25% modulation, what is the efficiency of the AM signal *1 point*

- 25%
- 3.03%
- 12.33%
- 5.88%

No, the answer is incorrect.
Score: 0
Accepted Answers:
3.03%

3) Synchronization between phase of locally generated carrier and that of the incoming signal for DSB-SC modulation is achieved using *1 point*

- Superheterodyne Receiver
- Single Sideband Modulation
- Envelope Detection
- Costas Loop

No, the answer is incorrect.
Score: 0
Accepted Answers:
Costas Loop

4) The maximum efficiency of an amplitude modulated (AM) signal without envelope distortion is *1 point*

- 1
- $\frac{1}{2}$
- $\frac{1}{3}$
- $\frac{1}{4}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{3}$

5) 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*

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

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

6) The maximum power efficiency of a Double Sideband – Suppressed Carrier (DSB-SC) signal is *1 point*

- 1
- $\frac{1}{2}$
- $\frac{1}{3}$
- ∞

No, the answer is incorrect.
Score: 0
Accepted Answers:
1

7) Consider the signal $x(t) = A_c\cos(2\pi f_c t) + K\sin(2\pi f_m t)$ passed through a square law device with output $y(t)$ corresponding to input $x(t)$ given as $y(t) = x^2(t)$. The output is passed through a bandpass filter with center frequency f_c. What is the DSB-SC signal generated? *1 point*

- $2A_c(1 + K\sin(2\pi f_m t))cos(2\pi f_c t)$
- $2A_c K\cos(2\pi f_c t)\sin(2\pi f_m t)$
- $2A_c\cos(2\pi f_c t) + K\sin(2\pi f_m t)$
- $2A_c K(1 + \cos(2\pi f_c t))\sin(2\pi f_m t)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$2A_c K\cos(2\pi f_c t)\sin(2\pi f_m t)$

8) Consider the signal $A_c\cos(2\pi f_c t) + K\sin(2\pi f_m t)$ passed through a square law device with input-output relation $y(t) = x^2(t)$, where $y(t)$ is the output corresponding to an input $x(t)$. The output is passed through a bandpass filter with center frequency f_c. What is the condition on the carrier frequency such that a DSB-SC signal can be generated through filtering? *1 point*

- $f_c < 3f_m$
- $f_c > 2f_m$
- $f_c < 2f_m$
- $f_c > 3f_m$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$f_c > 3f_m$

9) The output voltage $v_2(t)$ of the non-linear device can be expressed in terms of the input voltage $v_1(t)$ as $v_2(t) = a_1 v_1(t) + a_2 v_1^2(t)$, where a_1, a_2 are known constants. Consider an input voltage signal $v_1(t)$ defined as $v_1(t) = A_c\cos(2\pi f_c t) + m(t)$, where $m(t)$ is the message signal of bandwidth W and $A_c\cos(2\pi f_c t)$ is the carrier wave. The output $v_2(t)$ is fed as input to a filter tuned to f_c. What is the amplitude sensitivity k_a of the AM signal thus generated with carrier frequency f_c? *1 point*

- $\frac{a_2}{a_1}$
- $\frac{a_1}{a_2}$
- $\frac{2a_1}{a_2}$
- $\frac{2a_2}{a_1}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{2a_2}{a_1}$

10) The frequency response of the Hilbert transformer $H_{HT}(f)$ equals *1 point*

- $j\,\mathrm{sgn}(f)$
- $\mathrm{sgn}(f)$
- $-\mathrm{sgn}(f)$
- $-j\,\mathrm{sgn}(f)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$-j\,\mathrm{sgn}(f)$