

Unit 9 - Week-6 Narrowband FM Generation, Spectrum of FM Signals, Carson's Rule for FM Bandwidth, Narrowband FM Generation, FM Demodulation, Introduction to Sampling, Spectrum of Sampled Signal, Aliasing, Nyquist Criterion

Course outline

How does an NPTEL online course work?

Week-0

Week 1-Basic tools for communication, Fourier Series/Transform, Properties, Parsevals Relation, Properties of Fourier Transform, LTI Systems

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

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

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

Week-5 Generation of SSB , Complex pre-envelope of QCM, VSB , Introduction to AM

Week-6 Narrowband FM Generation, Spectrum of FM Signals, Carson's Rule for FM Bandwidth, Narrowband FM Generation, FM Demodulation, Introduction to Sampling, Spectrum of Sampled Signal, Aliasing, Nyquist Criterion

- Lec 30- Generation of Narrowband FM signal
- Lec 31- Generation of Wideband FM signal through frequency multiplication
- Lec 32- Spectrum of Frequency Modulated (FM) signals
- Lec 33- Bandwidth of Frequency Modulated (FM) signals: Carson's rule
- Lec 34- Demodulation of Frequency Modulated Signals
- Lec 35 Analog-to-Digital conversion of signals
- Lec 36- Sampling, Aliasing, Nyquist Theorem

Quiz : Assignment-6

Feedback For Week 6

Solution 6

Week 7- Signal Reconstruction from Sampled Signal ,Introduction to Pulse Amplitude Modulation, Spectrum of PAM Signal and Reconstruction, Quantization, Uniform Quantizers – Midrise and Midtread, Quantization noise, Lloyd Max Quantization Algorithm, Non-uniform Quantizers

Week 8- Delta Modulation, Differential Pulse Code Modulation, Frequency Mixing and Translation in Communication Systems, Heterodyne and Super Heterodyne Receivers, Frequency Division Multiplexing, Time Division Multiplexing, T1 TDM System: Case Study

Week 9 - Basics of Probability, Conditional Probability, Independent Events - Mary-PAM Example, Independent Events-Block Transmission, Independent Events-Multiantenna Fading

Text Transcripts

DOWNLOAD VIDEOS

Week 10- Bayes Theorem, Maximum A posteriori Probability (MAP) Receiver, Random Variables and PDF, Power of Fading Wireless Channel, Mean & Variance of Random Variables and Application:Average & RMS Delay Spread

Week 11 - Transformation of Random Variables, Gaussian Random Variable ,Special Case: IID Gaussian Random Variables, Application: Uniform Linear Arrays, Random Processes and (WSS) and WSS Exampl

Week 12- Power Spectral Density(PSD) for WSS Random Process, PSD Application in Wireless, WSS Random Process Through LTI System, Special Random Processes and Gaussian Process Through LTI System

Assignment-6

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

Due on 2020-03-11, 23:59 IST.

1) Consider an FM signal with modulation index β and frequency of the sinusoidal message signal denoted by f_m . Using Carsons rule, **1 point** the bandwidth of the FM signal can be approximated as

- $2(\beta + 1)f_m$
- $(2\beta + 1)f_m$
- $(1 + \frac{1}{\beta})f_m$
- $(1 + \frac{2}{\beta})f_m$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $2(\beta + 1)f_m$

2) Consider a parallel resonant LC circuit with $L=2.5$ mH and the capacitance of the variable capacitor given as $C(t) = 10\mu F - 5 \times 10^{-7} m(t)$, where $m(t)$ is the message signal which varies slowly with $\max|m(t)| \ll 1$. What is the approximate carrier frequency of the resulting frequency modulated signal $x_c(t)$ **1 point**

- 0.25 kHz
- 2 MHz
- 2.5 kHz
- 1.0 kHz

No, the answer is incorrect.
Score: 0

Accepted Answers:
1.0 kHz

3) Consider a FM signal with the message signal $A_m \cos(2\pi f_m t)$ and maximum frequency deviation be Δf . The modulation index β equals **1 point**

- $\Delta f f_m$
- $\frac{\Delta f}{f_m}$
- $\frac{f_m}{\Delta f}$
- $1 - \left(\frac{\Delta f}{f_m}\right)^2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $\frac{\Delta f}{f_m}$

4) A frequency modulated (FM) signal is described as **1 point**

$$x_c(t) = 10 \cos \left(6\pi \times 10^6 t + \frac{1}{4} \sin(8 \times 10^2 \pi t) \right)$$

The approximate bandwidth of $x_c(t)$ calculated using Carsons rule is

- 400 kHz
- 0.75 MHz
- 1 kHz
- 3 MHz

No, the answer is incorrect.
Score: 0

Accepted Answers:
1 kHz

5) Consider the frequency modulated (FM) signal **1 point**

$$A_c \cos \left(2\pi f_c t + \frac{K_f A_m}{f_m} \sin(2\pi f_m t) \right)$$

The modulation index β for this FM signal is

- K_f
- $\frac{K_f A_m}{f_m}$
- $K_f A_m$
- $\frac{A_m}{f_m}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $\frac{K_f A_m}{f_m}$

6) A frequency modulated (FM) signal with carrier frequency $f_c = 5 \times 10^7$ is described by the equation **1 point**

$$\varphi(t) = 5 \times \cos \left(2\pi f_c t + 2 \times \sin(5000\pi t) \right).$$
 Find the maximum frequency deviation Δf .

- 2.5 kHz
- 2 kHz
- 15 kHz
- 5 kHz

No, the answer is incorrect.
Score: 0

Accepted Answers:
5 kHz

7) Consider an FM signal with carrier frequency f_c , modulation index β and message signal $A_m \cos(2\pi f_m t)$. The instantaneous frequency of the signal is **1 point**

- $f_c + \beta A_m \cos(2\pi f_m t)$
- $f_c + \beta \cos(2\pi f_m t)$
- $f_c + \beta f_m \cos(2\pi f_m t)$
- $f_c + \frac{\beta}{f_m} \sin(2\pi f_m t)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $f_c + \beta f_m \cos(2\pi f_m t)$

8) A frequency modulated (FM) signal is described as **1 point**

$$x_c(t) = 200 \cos \left(\pi \times 10^7 t + 3 \sin(5 \times 10^3 \pi t) \right)$$

The approximate bandwidth of $x_c(t)$ calculated using carsons rule is

- 200 MHz
- 5 MHz
- 5 kHz
- 20 kHz

No, the answer is incorrect.
Score: 0

Accepted Answers:
20 kHz

9) Consider a FM signal with the message signal $A_m \cos(2\pi f_m t)$ and modulation index β . The maximum frequency deviation of the signal is **1 point**

- $\frac{\beta}{f_m}$
- $\beta f_m f_c$
- βf_m
- $\frac{f_m}{\beta^2}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 βf_m

10) Consider a narrowband frequency modulated (FM) signal with modulation index β given as input to a frequency multiplier by a factor of n . The modulation index of the output wideband FM signal is **1 point**

- $n\beta$
- β
- $\frac{\beta}{n}$
- $n^2 \beta^2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $n\beta$