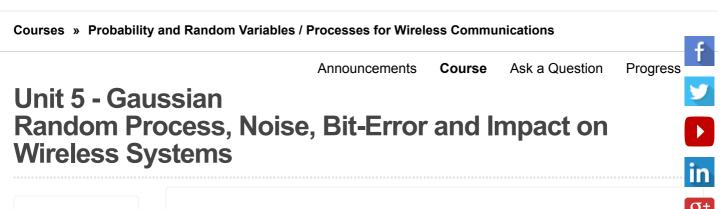
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Course outline

How to access the portal

Basics of Probability, Conditional Probability, MAP Principle

Random Variables, Probability Density Functions, Applications in Wireless Channels

Basics of Random Processes, Wireless Fading Channel Modeling

Gaussian Random Process, Noise, Bit-Error and Impact on Wireless Systems

- Power Spectral Density (PSD) for WSS Random Process
- PSD Application in Wireless – Bandwidth Required for Signal Transmission
- Transmission of WSS Random Process

Assignment 4

The due date for submitting this assignment has passed. Due on 2017-02-21, 23:59 IST. As per our records you have not submitted this assignment.

1) Consider the random process $X(t) = \alpha \cos(2\pi f_c t)$, with f_c constant and **1** point α distributed uniformly in $\left[0, \frac{1}{2}\right]$. What is the autocorrelation corresponding to time instants t_1, t_2 ?

 $(1/6) \times (\cos(2\pi f_c t_1) + \cos(2\pi f_c t_2))$ (1/3) $\times \cos(2\pi f_c t_1) \cos(2\pi f_c t_2)$ (1/12) $\times \cos(2\pi f_c (t_2 - t_1))$ (1/12) $\times \cos(2\pi f_c t_1) \cos(2\pi f_c t_2)$

No, the answer is incorrect.

Accepted Answers: (1/12) × $\cos(2\pi f_c t_1) \cos(2\pi f_c t_2)$

2) Consider $X(t) = \alpha_0 + \sum_{k=1}^{\infty} \alpha_k \cos(2\pi k f_c t) + \beta_k \sin(2\pi k f_c t)$, where all α_k , β_k are **1** point independent zero-mean Gaussian random variables with variance of α_k , β_k equal to $\frac{1}{2^k}$. What is the nature of this random process?

White

Score: 0

- Gaussian
- Both of the above
- None of the above

No, the answer is incorrect. Score: 0

Accepted Answers: Gaussian

3) Consider $X(t) = \alpha_0 + \sum_{k=1}^{\infty} \alpha_k \cos(2\pi k f_c t) + \beta_k \sin(2\pi k f_c t)$, where all α_k , β_k are **1 point** independent zero-mean Gaussian random variables with variance of α_k , β_k equal to $\frac{1}{2^k}$. What is the autocorrelation $R_{XX}(\tau)$ of this random process?

 $0.5\cos(2\pi f_c\tau)$

22/07/2020

Through LTI System

Special Random Processes – Gaussian Process and White Noise – AWGN Communication Channel

Gaussian
 Process
 Through LTI
 System –
 Example: WGN
 Through RC
 Low Pass Fillter

 Quiz : Assignment 4

 Assignment-4 Solutions $0.5\sin(2\pi f_c\tau)$

$$1 + \sum_{k=1}^{\infty} \frac{1}{2^k} \cos(2\pi k f_c \tau)$$

$$1 + \sum_{k=1}^{\infty} \frac{1}{2^k} \sin(2\pi k f_c \tau)$$

No, the answer is incorrect. Score: 0

Accepted Answers:

$$1 + \sum_{k=1}^{\infty} \frac{1}{2^k} \cos(2\pi k f_c \tau)$$

f > in 8⁺

4) Consider $X(t) = \alpha_0 + \sum_{k=1}^{\infty} \alpha_k \cos(2\pi k f_c t) + \beta_k \sin(2\pi k f_c t)$, where all α_k , β_k are **1** point independent zero-mean Gaussian random variables with variance of α_k , β_k equal to $\frac{1}{2^k}$. What is the power spectral density of this random process?

$$\begin{split} & \frac{1}{4}\delta(f - f_c) + \frac{1}{4}\delta(f + f_c) \\ & \frac{1}{4}\delta(f - f_c) - \frac{1}{4}\delta(f + f_c) \\ & \bullet \\ & \delta(f) + \sum_{k=1}^{\infty} \frac{1}{2^{k+1}}(\delta(f - kf_c) - \delta(f + kf_c)) \\ & \bullet \\ & \delta(f) + \sum_{k=1}^{\infty} \frac{1}{2^{k+1}}(\delta(f - kf_c) + \delta(f + kf_c)) \end{split}$$

No, the answer is incorrect. Score: 0

Accepted Answers:

$$\delta(f) + \sum_{k=1}^{\infty} \frac{1}{2^{k+1}} (\delta(f - kf_c) + \delta(f + kf_c))$$

5) Consider $X(t) = \alpha_0 + \sum_{k=1}^{\infty} \alpha_k \cos(2\pi k f_c t) + \beta_k \sin(2\pi k f_c t)$, where all α_k , β_k are **1** point independent zero-mean Gaussian random variables with variance of α_k , β_k equal to $\frac{1}{2^k}$. What is the minimum bandwidth 2W such that the band [-W, W] contains 90% of the signal power?

 $6f_c$ $4f_c$ $2f_c$ 0No, the answer is incorrect.
Score: 0
Accepted Answers: $6f_c$ 6)

1 point

22/07/2020

Probability and Random Variables / Processes for Wireless Communications - - Unit 5 - Gaussian Random Process, ...

Consider $X(t) = \alpha_0 + \sum_{k=1}^{\infty} \alpha_k \cos(2\pi k f_c t) + \beta_k \sin(2\pi k f_c t)$, where all α_k, β_k are independent zero-mean Gaussian random variables with variance of α_k , β_k equal to $\frac{1}{2^k}$. It is passed through an LTI system whose impulse response is $h(t) = 3f_c sinc(3f_c t)$. What is the power of the output random process Y(t)?

1.76 dB 3 dB 4.77 dB 6 dB

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

1.76 dB

7) Consider $X(t) = \alpha_0 + \sum_{k=1}^{\infty} \alpha_k \cos(2\pi k f_c t) + \beta_k \sin(2\pi k f_c t)$, where all α_k , β_k are **1** pc independent zero-mean Gaussian random variables with variance of α_k , β_k equal to $\frac{1}{2^k}$ is passed through an LTI system whose impulse response is $h(t) = 3f_c sinc(3f_c t)$. Whe g is distribution $f_{Y(t)}(y)$ of the output random process Y(t)?

$$\frac{1}{\sqrt{4\pi}}e^{-y^2/4}$$

$$\frac{1}{\sqrt{3\pi}}e^{-y^2/3}$$

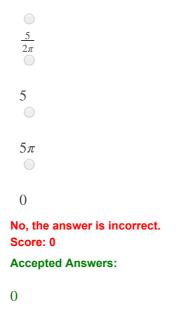
$$\sum_{k=1}^{\infty} \cos(2\pi k f_c y)$$

No, the answer is incorrect. Score: 0

Accepted Answers:

$$\frac{1}{\sqrt{3\pi}}e^{-y^2/3}$$

8) Consider X(t) to be white Gaussian noise with zero mean and autocorrelation function **1** point $\frac{\eta}{2}\delta(\tau)$. It is passed through an LTI system whose impulse response is h(t) = 2Bsinc(2Bt). what is the mean of the output random processY(t)?



22/07/2020

Probability and Random Variables / Processes for Wireless Communications - - Unit 5 - Gaussian Random Process, ... 9) Consider X(t) to be white Gaussian noise with zero mean and autocorrelation function **1** point $\frac{\eta}{2}\delta(\tau)$. It is passed through an LTI system whose impulse response is h(t) = 2Bsinc(2Bt). what is the autocorrelation function of the output random process Y(t)?

> $\eta B sinc(2B\tau)$ $\eta B^{2} sinc^{2}(2B\tau)$ $2\eta B^{2} sinc(2B\tau)$

No, the answer is incorrect. Score: 0

Accepted Answers: $\eta Bsinc(2B\tau)$

10Consider X(t) to be white Gaussian noise with zero mean and autocorrelation function $1 p g^+ \frac{\eta}{2} \delta(\tau)$. It is passed through an LTI system whose impulse response is h(t) = 2Bsinc(2Bt). Consider two time instants t_1 and $t_2 = t_1 + 1/B$. What is the joint distribution $f_{Y(t_1)Y(t_2)}(y_1, y_2)$ of the output random process Y(t)?

$$\frac{1}{2\pi\eta B}e^{-\frac{y_1^2+y_2^2}{2\eta B}}$$
$$\frac{1}{\sqrt{2\pi\eta B}}e^{-\frac{y_1^2+y_2^2}{\eta B}}$$
$$\frac{\eta}{2}, -\infty \le f \le \infty$$
$$2B^2 sinc(2Bt)$$

No, the answer is incorrect. Score: 0 Accepted Answers: $v_1^2+v_2^2$

 $\frac{1}{2\pi\eta B}e^{-\frac{1}{2}}$

Previous Page

End

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