Code No: NR210402 **NR** **Set No. 2**

II B.Tech I Semester Examinations,November 2010
PROBABILITY AND RANDOM VARIABLES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain what do you mean by the term "Random variable"? Give the classification of random variables and explain with examples.
   (b) If the probability density of a random variable is given by:
   f(x) = xfor0 < x < 1
   = (2 − x)for1 < x < 2
   Find the probabilities that a random variable having this probability density will take on a value
      i. between 0.2 and 0.8.
      ii. between 0.6 and 1.2. [8+8]

2. (a) An antenna is connected to a receiver having an equivalent noise temperature $T_e = 100^0 k$. The available gain of receiver is 10^8 and the noise band width is B_N=10 MHz. If the available noise output noise power is 10μw, find the antenna temperature.
   (b) Calculate the noise bandwidth of a RC low pass filter having 3db bandwidth fc. [8+8]

3. (a) Given the following table

X	1	2	3	4	5	6	7
P(x)	0.05	0.1	0.3	0	0.3	0.15	0.1

   Find
      i. E[X]
      ii. $E[X^2]$
      iii. V[X]
      iv. V[2x $\pm$ 3]
   (b) Prove that cov(ax,by) = ab cov(x,y) [8+8]

4. (a) Derive the relation between PSDs of input and output random process of an LTI system.
   (b) X(t) is a stationary random process with zero mean and auto correlation $R_{XX}(\tau)\, e^{-2|\tau|}$is applied to a system of function $H(w) = \frac{1}{jw+2}$ Find mean and PSD of its output. [8+8]

5. (a) Derive an expression for, the error function of the standard normal Random variable

   (b) Lifetime of IC chips manufactured by a semiconductor manufacturer is approximately normally distributed with mean = 5x 10^6 hours and standard deviation of 5x 10^5 hours. A mainframe manufacturer requires that at least 95% of a batch should have a lifetime greater than 4x10^6 hours. Will the deal be made? [8+8]

6. Let the Random process be given as = Z(t) = x(t) cos $[\varpi_0 t + \theta]$ where x(t) in stationary Random process with E[x(t)]=0 and E$[x^2(t)] = \sigma_x^2$

   (a) If $\theta = 0 \ \ find \ \ E[Z(t)] \ \ and \ \ E[Z^2]$ if Z(t) stationary.

   (b) If θ is a random variable independent of x(t) and uniformly distributed over the interval $(-\Pi, \Pi)$ show that E[Z(t)] = 0 and E$[Z^2(t)] = \frac{\sigma_x^2}{2}$ [8+8]

7. (a) Explain how the available noise power in an electronic circuit can be estimated.

   (b) What are the different noise sources that may be present in an electron devices? [8+8]

8. Explain the following:

   (a) Code efficiency

   (b) Noiseless-coding theorem

   (c) Ideal channel

   (d) Hamming codes [4+4+4+4]

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Code No: NR210402 **NR** **Set No. 4**

II B.Tech I Semester Examinations,November 2010
PROBABILITY AND RANDOM VARIABLES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Given the following table

X	1	2	3	4	5	6	7
P(x)	0.05	0.1	0.3	0	0.3	0.15	0.1

Find

i. E[X]
ii. $E[X^2]$
iii. V[X]
iv. V[2x ± 3]

(b) Prove that cov(ax,by) = ab cov(x,y) [8+8]

2. (a) Derive an expression for, the error function of the standard normal Random variable

(b) Lifetime of IC chips manufactured by a semiconductor manufacturer is approximately normally distributed with mean = 5x 10^6 hours and standard deviation of 5x 10^5 hours. A mainframe manufacturer requires that at least 95% of a batch should have a lifetime greater than 4x10^6 hours. Will the deal be made? [8+8]

3. (a) Explain how the available noise power in an electronic circuit can be estimated.

(b) What are the different noise sources that may be present in an electron devices? [8+8]

4. (a) Derive the relation between PSDs of input and output random process of an LTI system.

(b) X(t) is a stationary random process with zero mean and auto correlation $R_{XX}(\tau) e^{-2|\tau|}$is applied to a system of function $H(w) = \frac{1}{jw+2}$ Find mean and PSD of its output. [8+8]

5. (a) An antenna is connected to a receiver having an equivalent noise temperature $T_e = 100^0 k$. The available gain of receiver is 10^8 and the noise band width is B_N=10 MHz. If the available noise output noise power is 10μw, find the antenna temperature.

(b) Calculate the noise bandwidth of a RC low pass filter having 3db bandwidth fc. [8+8]

6. (a) Explain what do you mean by the term "Random variable"? Give the classification of random variables and explain with examples.

   (b) If the probability density of a random variable is given by:
   f(x) = xfor0 < x < 1
   = (2 − x)for1 < x < 2
   Find the probabilities that a random variable having this probability density will take on a value

      i. between 0.2 and 0.8.
      ii. between 0.6 and 1.2. [8+8]

7. Let the Random process be given as = Z(t) = x(t) cos $[\varpi_0 t + \theta]$ where x(t) in stationary Random process with E[x(t)]=0 and E$[x^2(t)] = \sigma_x^2$

   (a) If $\theta = 0$ $find$ $E[Z(t)]$ and $E[Z^2]$ if Z(t) stationary.

   (b) If θ is a random variable independent of x(t) and uniformly distributed over the interval $(-\Pi, \Pi)$ show that E[Z(t)] = 0 and E$[Z^2(t)] = \frac{\sigma_x^2}{2}$ [8+8]

8. Explain the following:

   (a) Code efficiency
   (b) Noiseless-coding theorem
   (c) Ideal channel
   (d) Hamming codes [4+4+4+4]

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Code No: NR210402 **NR** **Set No. 1**

II B.Tech I Semester Examinations,November 2010
PROBABILITY AND RANDOM VARIABLES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Given the following table

X	1	2	3	4	5	6	7
P(x)	0.05	0.1	0.3	0	0.3	0.15	0.1

Find

i. E[X]
ii. $E[X^2]$
iii. V[X]
iv. V[2x $\pm$ 3]

(b) Prove that cov(ax,by) = ab cov(x,y) [8+8]

2. (a) Derive the relation between PSDs of input and output random process of an LTI system.

(b) X(t) is a stationary random process with zero mean and auto correlation $R_{XX}(\tau)\, e^{-2|\tau|}$ is applied to a system of function $H\,(w) = \frac{1}{jw+2}$ Find mean and PSD of its output. [8+8]

3. (a) An antenna is connected to a receiver having an equivalent noise temperature $T_e = 100^0 k$. The available gain of receiver is 10^8 and the noise band width is B_N=10 MHz. If the available noise output noise power is 10μw, find the antenna temperature.

(b) Calculate the noise bandwidth of a RC low pass filter having 3db bandwidth fc. [8+8]

4. (a) Explain how the available noise power in an electronic circuit can be estimated.

(b) What are the different noise sources that may be present in an electron devices? [8+8]

5. Let the Random process be given as = Z(t) = x(t) cos $[\varpi_0 t + \theta]$ where x(t) in stationary Random process with E[x(t)]=0 and E$[x^2(t)] = \sigma_x^2$

(a) If $\theta = 0$ $\;find\;$ $E[Z(t)]$ $\;and\;$ $E[Z^2]$ if Z(t) stationary.

(b) If θ is a random variable independent of x(t) and uniformly distributed over the interval $(-\Pi, \Pi)$ show that E[Z(t)] = 0 and E$[Z^2(t)] = \frac{\sigma_x^2}{2}$ [8+8]

6. (a) Derive an expression for, the error function of the standard normal Random variable

   (b) Lifetime of IC chips manufactured by a semiconductor manufacturer is approximately normally distributed with mean = 5x 10^6 hours and standard deviation of 5x 10^5 hours. A mainframe manufacturer requires that at least 95% of a batch should have a lifetime greater than 4x10^6 hours. Will the deal be made? [8+8]

7. Explain the following:

   (a) Code efficiency

   (b) Noiseless-coding theorem

   (c) Ideal channel

   (d) Hamming codes [4+4+4+4]

8. (a) Explain what do you mean by the term "Random variable"? Give the classification of random variables and explain with examples.

   (b) If the probability density of a random variable is given by:
   $f(x) = x \text{for} 0 < x < 1$
   $= (2 - x) \text{for} 1 < x < 2$
   Find the probabilities that a random variable having this probability density will take on a value

   i. between 0.2 and 0.8.

   ii. between 0.6 and 1.2. [8+8]

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Code No: NR210402 **NR** **Set No. 3**

II B.Tech I Semester Examinations,November 2010
PROBABILITY AND RANDOM VARIABLES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Let the Random process be given as = Z(t) = x(t) cos $[\varpi_0 t + \theta]$ where x(t) in stationary Random process with E[x(t)]=0 and $E[x^2(t)] = \sigma_x^2$
   (a) If $\theta = 0$ $find$ $E[Z(t)]$ and $E[Z^2]$ if Z(t) stationary.
   (b) If θ is a random variable independent of x(t) and uniformly distributed over the interval $(-\Pi, \Pi)$ show that E[Z(t)] = 0 and $E[Z^2(t)] = \frac{\sigma_x^2}{2}$ [8+8]

2. (a) Derive the relation between PSDs of input and output random process of an LTI system.
   (b) X(t) is a stationary random process with zero mean and auto correlation $R_{XX}(\tau)\, e^{-2|\tau|}$is applied to a system of function $H(w) = \frac{1}{jw+2}$ Find mean and PSD of its output. [8+8]

3. (a) Explain what do you mean by the term "Random variable"? Give the classification of random variables and explain with examples.
   (b) If the probability density of a random variable is given by:
   f(x) = xfor0 < x < 1
   = (2 − x)for1 < x < 2
   Find the probabilities that a random variable having this probability density will take on a value
      i. between 0.2 and 0.8.
      ii. between 0.6 and 1.2. [8+8]

4. (a) Given the following table

X	1	2	3	4	5	6	7
P(x)	0.05	0.1	0.3	0	0.3	0.15	0.1

   Find
      i. E[X]
      ii. $E[X^2]$
      iii. V[X]
      iv. V[2x ± 3]
   (b) Prove that cov(ax,by) = ab cov(x,y) [8+8]

5. (a) Explain how the available noise power in an electronic circuit can be estimated.

(b) What are the different noise sources that may be present in an electron devices? [8+8]

6. (a) Derive an expression for, the error function of the standard normal Random variable

   (b) Lifetime of IC chips manufactured by a semiconductor manufacturer is approximately normally distributed with mean = 5x 10^6 hours and standard deviation of 5x 10^5 hours. A mainframe manufacturer requires that at least 95% of a batch should have a lifetime greater than 4x10^6 hours. Will the deal be made? [8+8]

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   (b) Calculate the noise bandwidth of a RC low pass filter having 3db bandwidth fc. [8+8]

8. Explain the following:

   (a) Code efficiency
   (b) Noiseless-coding theorem
   (c) Ideal channel
   (d) Hamming codes [4+4+4+4]

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