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10EC53

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Analog Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO full questions from each part.***

PART – A

1 a. Define Probability Density Function and discuss the properties of PDF. **(06 Marks)**

b. The random variable 'Y' is the function of another random variable 'X' in such a way that X = cos(x) and 'X' is uniformly distributed in the interval (-π, π) ie

$$f_x(x) = \begin{cases} \frac{1}{2\pi} & \text{for} - \pi < x < \pi \\ 0 & \text{otherwise} \end{cases}$$

Determine the expected value of 'Z'. **(06 Marks)**

c. A random variable X is Gaussian distributed with mean $m_x = 5$ and variance $\sigma_x^2 = 64$. What is the probability of obtaining 'X' between -3 and 13? **(08 Marks)**

2 a. Explain the detection of square-law detector using relevant diagram, mathematical analysis and waveform. **(07 Marks)**

b. Discuss the ring modulator with necessary equations and waveform to generate DSBSC wave. **(07 Marks)**

c. An amplitude modulated waveform has the form $X_C(t) = 10[1 + 0.5 \cos 2000 \pi t + 0.5 \cos 4000 \pi t] \times \cos (20{,}000\pi t)$.

i) Sketch the spectrum of $X_c(f)$.
ii) Find the average power content in each spectral component including the carrier.
iii) Modulation index. **(06 Marks)**

3 a. Define Hilbert transform and explain its properties. **(06 Marks)**

b. Let $S_u(t)$ denote the SSB signal obtained by transmitting only upper sideband and let $\hat{S}_u(t)$ denotes its Hilbert transform. Show that:

i) $$m(t) = \frac{2}{A_c}\left[S_u(t)\cos(2\pi f_c t) + \hat{S}_u(t)\sin(2\pi f_c t)\right]$$

ii) $$\hat{m}(t) = \frac{2}{A_c}\left[\hat{S}_u(t)\cos(2\pi f_c t) - S_u(t)\sin(2\pi f_c t)\right]$$ **(08 Marks)**

c. With neat block diagram, explain for SSB modulated wave using phase discrimination with relevant expressions method. **(06 Marks)**

4 a. Describe the filtering technique method used for generating VSB modulated wave. **(10 Marks)**

b. Discuss the transmission and reception of a number of independent signal over a single communication channel by modulating different carrier signals. **(10 Marks)**

PART – B

5 a. Distinguish between amplitude modulation and frequency modulation. **(06 Marks)**

b. Discuss the indirect method of generating frequency modulation using relevant block diagram. **(08 Marks)**

c. In a FM system, the modulating fly f_m = 1kHz, the modulating voltage A_m = 2 volt and the deviation is 6kHz. If the modulating v_g is raised to 4 volt, then what is the new deviation? If the modulating voltage is further increased to 8 volts and modulating fly is reduced to 500Hz what will be deviation? **(06 Marks)**

6 a. Mention the comparison between NBFM and WBFM. **(06 Marks)**

b. Discuss the characteristics of balanced slope detector model. **(06 Marks)**

c. With the block diagram approach, explain the operation of FM stereo system. **(08 Marks)**

7 a. Discuss about the different sources of noise and explain the classification of Internal Noise. **(06 Marks)**

b. Derive the equation of equivalent noise temperature of amplifier connected in cascade. **(06 Marks)**

c. An amplifier has a noise figure of 19dB and power gain of 15dB. It is connected in cascade to an amplifier. Whose noise figure is 20dB? Calculate the overall noise figure for this connection. **(08 Marks)**

8 a. Derive the figure of merit of noise in DSBSC systems using coherent detection. **(10 Marks)**

b. Calculate the figure of merit of an AM receiver operating on single tone AM. **(10 Marks)**

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