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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  $(-\pi, \pi)$  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)  $m(t) = \frac{2}{A_c} [S_u(t) \cos(2\pi f_c t) + \hat{S}_u(t) \sin(2\pi f_c t)]$
  - ii)  $\hat{m}(t) = \frac{2}{A_c} [\hat{S}_u(t) \cos(2\pi f_c t) - S_u(t) \sin(2\pi f_c t)]$  (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 frequency  $f_m = 1\text{kHz}$ , the modulating voltage  $A_m = 2$  volt and the deviation is 6kHz. If the modulating voltage  $v_g$  is raised to 4 volt, then what is the new deviation? If the modulating voltage is further increased to 8 volts and modulating frequency 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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24 JAN 2020