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10EC53

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Analog Communication

Time: 3 hrs. Max. Marks:100

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

PART - A

1 a. List the properties of Autocorrelation function. **(04 Marks)**

b. A random variable has a probability density function

$$F_X(x) = \begin{cases} \frac{5}{4}(1-x^4) & 0 \le x \le 1 \\ 0 & \text{Elsewhere} \end{cases}.$$

Find i) $E[X]$ ii) $E[4X+2]$ and iii) $E[X^2]$. **(06 Marks)**

c. The random process $X(t) = A\cos(2\pi f_c t + \theta)$, where θ is the random variable, that is uniformly distributed over the interval $(-\pi, \pi)$. Determine
i) The auto correlation function X(t) ii) Power spectral density
iii) Average power of X(t). **(10 Marks)**

2 a. Determine the optimal efficiency of amplitude modulation. **(06 Marks)**

b. What is the importance of COSTAS receiver? Explain its working principles with a suitable block diagram. **(08 Marks)**

c. Consider the wave obtained by adding a non – coherent carrier $A_C \cos(2\pi f_c t + \phi)$ to the DSBSC waver $m(t)\cos 2\pi f_c t$, where m(t) is the message waveform. This waveform is applied to as ideal envelope detector. Find the resulting detector output. Evaluate the output for
i) $\phi = 0$ ii) $\phi \neq 0$ and $m(t) << \frac{A_c}{2}$. **(06 Marks)**

3 a. Highlight the advantages of Quadrature amplitude multiplexer and explain its QAM system with a suitable block diagram. **(06 Marks)**

b. Determine the Hilbert Transform of the function given below :

$$g(t) = \begin{cases} 1 & \text{for} \quad |t| \le \frac{T}{2} \\ 0 & \text{Elsewhere} \end{cases}$$ **(04 Marks)**

c. Generate SSBSC wave using frequency discrimination method with a suitable block diagram. **(10 Marks)**

4 a. Describe the generation and detection of VSB with a necessary block diagram. **(09 Marks)**

b. Let the incoming narrow – band signal of bandwidth 10KHz and mid – band frequency which may lie in the range 0.535 – 1.605 MHz. It is required to translate this signal to a fixed frequency band centered at 0.455 MHz. Determine the range of tuning that must be provided in the local oscillator. **(05 Marks)**

c. Describe the working principle of frequency division multiplexing. **(06 Marks)**

PART - B

5 a. With a neat circuit diagram, describe the direct method of generating FM. Also explain feedback scheme for frequency stabilization of a frequency modulator in direct method. **(10 Marks)**

b. The equation for an FM wave is given by $s(t) = 10 \sin [5.7 \times 10^8 t + 5 \sin 12 \times 10^3 t]$. Calculate i) Carrier frequency ii) Modulating frequency iii) Modulation index iv) Frequency deviation and v) Power dissipated in 100Ω resistor. **(06 Marks)**

c. Explain Carson's rule. **(04 Marks)**

6 a. Explain the working principle of balanced slope detector with a suitable circuit. **(08 Marks)**

b. Explain with relevant block diagram FM stereo multiplexing system. **(08 Marks)**

c. Explain Threshold in FM. **(04 Marks)**

7 a. Define and explain the following :
i) Noise equivalent bandwidth ii) Equivalent Noise bandwidth. **(08 Marks)**

b. Three amplifiers have the following specifications :

Amplifier 1	$F_1 = 8$ dB	$G_1 = 42$dB
Amplifier 2	$F_2 = 9$ dB	$G_2 = 38$dB
Amplifier 3	$F_3 = 5$ dB	$G_3 = 22$dB

The amplifiers are connected in cascade. Find the overall Noise figure. **(06 Marks)**

c. Deduce FRII's formula. **(06 Marks)**

8 a. Derive an expression for figure of merit of an AM receiver, with envelope detector. **(10 Marks)**

b. Explain the working principle of pre – emphasis and de – emphasis in FM system and high – light their applications. **(10 Marks)**

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