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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
- $$F_X(x) = \begin{cases} \frac{5}{4}(1-x^4) & 0 \leq x \leq 1 \\ 0 & \text{Elsewhere} \end{cases}$$
- 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 $m(t) \ll \frac{A_c}{2}$. (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 :
- $$g(t) = \begin{cases} 1 & \text{for } |t| \leq \frac{T}{2} \\ 0 & \text{Elsewhere} \end{cases}$$
- 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)

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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 | $F_1 = 8 \text{ dB}$ | $G_1 = 42 \text{ dB}$ |
| Amplifier 2 | $F_2 = 9 \text{ dB}$ | $G_2 = 38 \text{ dB}$ |
| Amplifier 3 | $F_3 = 5 \text{ dB}$ | $G_3 = 22 \text{ dB}$ |
- 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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