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06EC53

Fifth Semester B.E. Degree Examination, December 2012

Analog Communication

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define: i) Random variable ii) Mean iii) Correlation iv) Covariance functions. **(08 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], iii) E [X^2] **(06 Marks)**

c. What is Gaussian process? List the properties of Gaussian process. **(06 Marks)**

2 a. Explain the generation of an AM wave using square-law modulator, and show that overall output $V_0(t) = a_1 A_C \left[1 + \frac{2a_2}{a_1} m(t)\right] \cos(2\pi f_C t)$. **(08 Marks)**

b. Consider a message signal m(t) = 20 cos (2πt)V and the carrier wave c(t) = 50 cos (100πt)V.
i) Write an expression for the resulting AM wave for 75% modulation in time domain.
ii) Draw the spectrum of AM wave
iii) Sketch the resulting wave for 75% modulation. **(06 Marks)**

c. Explain the operation of coherent detection of DSB SC modulating wave and show that the overall output $V_0(t) = \frac{1}{2} A_C \cos\phi m(t)$. **(06 Marks)**

3 a. With a neat block diagram, explain the generation of SSB wave using phase discrimination method. **(08 Marks)**

b. Consider a two stage modulator shown in Fig.Q3(b). The input signal consists of a voice signal occupying the frequency band 0.3 to 3.4 kHz. The two oscillator frequencies have the values f_1 = 100 kHz and f_2 = 10 MHz. Specify the following:
i) Sidebands of DSB-SC modulated wave appearing at the two product modulator output.
ii) The sidebands of SSB modulated wave appearing at the two BPF outputs.
iii) The pass band and guard bands of the two band pass filters.
iv) Sketch he spectrum of the signal at each stage. [Assume suitable m(f)]

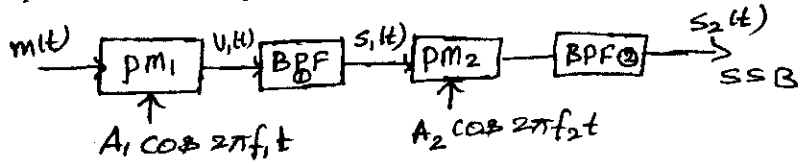

Fig.Q3(b) **(08 Marks)**

c. What is Hilbert transform? Obtain the Hilbert transform of the signal g(t) = sin $2\pi f_C t$. **(04 Marks)**

4 a. What is meant by VSB? Explain how VSB signal can be obtained from a modulating signal m(t) using a carrier $A_C \cos(2\pi f_C t)$ and later demodulated. **(08 Marks)**

b. With a block diagram, explain the operation of FDM transmitter receiver. **(08 Marks)**

c. Compare DSB-FC, DSB-SC, SSB and VSB. **(04 Marks)**

PART – B

5 a. Define angle modulation. Explain how FM wave can be generated using Armstrong (indirect) method. **(08 Marks)**

b. Sketch FM and PM waves for the modulating signal m(t) a shown in Fig.Q5(a). Assume frequency of 100 MHz and constants K_f and K_p as $2\pi \times 10^5$ and $\frac{\pi}{4}$ respectively.

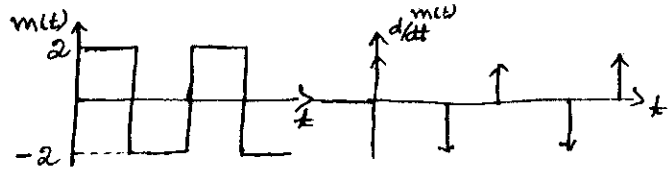

Fig.Q5(a) **(08 Marks)**

c. Compare FM with AM. **(04 Marks)**

6 a. Explain the detection process of FM signal using Foster-Seelay discriminator. **(08 Marks)**

b. What is PLL? Explain the non-linear and linear model of PLL can be used to demodulate an FM wave, with relevant block diagram and expressions. **(12 Marks)**

7 a. Write short notes on:
i) Shot noise
ii) Therma noise **(06 Marks)**

b. Determine the noise equivalent bandwidth for RC low pass filter shown in Fig.Q7(b).

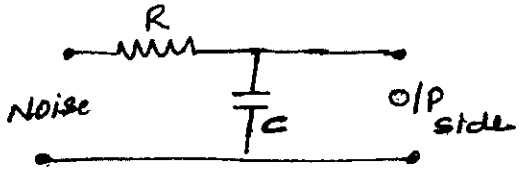

Fig.Q7(b) **(06 Marks)**

c. A TV receiving system is as shown in the Fig.Q7(c). A preamplifier is used to overcome the effect of the lossy cable. Typical values of the parameters are as shown in figure.
i) Find the overall noise figure of the system.
ii) Find the overall noise figure if the preamplifier is omitted.

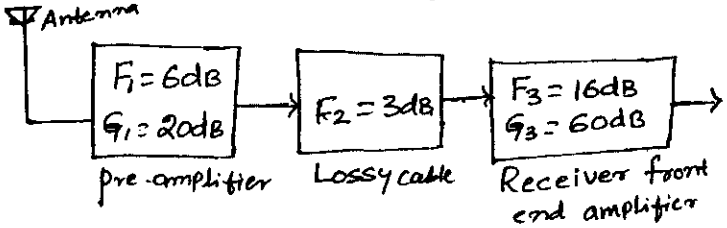

Fig.Q7(c) **(08 Marks)**

8 a. Derive the expression for output signal-to-noise ratio of an AM receiver using an envelop detector. **(10 Marks)**

b. Find the figure of merit when the depth of modulation is (i) 100%, (ii) 50%, (iii) 30%. **(03 Marks)**

c. What is pre-emphasis and de-emphasis? Explain briefly how is it useful in FM. **(07 Marks)**

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