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06EC53

Fifth Semester B.E. Degree Examination, December 2010

Analog Communication

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. State and explain three properties of autocorrelation function. **(10 Marks)**

b. Define mean and covariance functions. **(06 Marks)**

c. Le x(t) and y(t) be two jointly wide sense stationary processes. Show that cross correlation $R_{xy}(\tau) = R_{xy}(-\tau)$. **(04 Marks)**

2 a. What are DSBSC generation methods? Explain the generation of DSBSC using ring modulator in detail, with relevant diagrams. **(10 Marks)**

b. A modulating signal m(t) is given by $m(t) = \cos 100t + 2\cos 300t$:

i) Sketch the spectrum of m(t)

ii) Find and sketch the spectrum of DSBSC signal $2m(t)\cos 1000t$. **(10 Marks)**

3 a. Derive the expression for representing SSB containing upper side band in time domain. **(10 Marks)**

b. Let $S_{u(t)}$ denote SSB wave obtained by transmitting only upper side band and $\hat{S}_{u(t)}$ denote its Hilbert transform. Show that :

$$\hat{M}(t) = \frac{2}{A_c}\left[\hat{S}_{u(t)}\cos 2\pi fct - S_{u(t)}\sin 2\pi fct\right]$$ **(05 Marks)**

c. Explain phase discrimination method for generating SSB. **(05 Marks)**

4 a. What is frequency translation? With spectrum diagram, explain the operation of frequency translation. **(10 Marks)**

b. What is FDM? Discuss the detailed scheme of FDM. **(10 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. Given a single tone FM signal : $S(t) = 20\cos\left[2\pi 10^6 t + 2\sin 2\pi 10^4 t\right]$. Sketch FM spectrum for the carrier and first three sidebands and find B.W using Carsons' rule. The required Bessel function values are : $J_0(2) = 0.224$, $J_1(2) = 0.577$, $J_2(2) = 0.353$ and $J_3(2) = 0.129$. **(10 Marks)**

6 a. Explain demodulation of FM using balanced slope detector. **(10 Marks)**

b. An angle modulated signal is given by $S(t) = 5\cos(12000t)$ for $0 \le t \le 1$. Let the carrier frequency be 10000 rad/s.

i) If S(t) is an FM signal with k.f. = 500 radians/sec-volt, determine modulating signal m(t) over the interval $0 \le t \le 1$.

ii) Instead if S(t) is a PM signal with kp = 500 radians/volt, determine m(t) over $0 \le t \le 1$. **(05 Marks)**

c. For a WBEM if narrow band carrier $f_1 = 0.1$ MHz, second carrier $f_2 = 9.5$ MHz, O/P carrier frequency = 100 MHz and $\Delta f = 75$ KHz. Calculate multiplying factors n_1 and n_2 if NBFM deviation is 20 Hz. Draw the block diagram of the modulator. **(05 Marks)**

7 a. Define noise figure and explain its significance, with derivation. **(05 Marks)**

b. Obtain the expression for auto correlation function of filtered noise n(t) in case of :

i) Ideal low pass filtered white noise

ii) RC low pass filtered white noise. **(10 Marks)**

c. Two port devices are connected in cascade. For the first stage the noise figure and available power gain are 5 dB and 12 dB respectively. For the second stage the noise figure and power gain are 15 dB and 10 dB. Determine overall noise figure in dB. Also find equivalent noise temperature. **(05 Marks)**

8 a. Derive the expression for figure of merit for SSB receiver. **(10 Marks)**

b. Explain functioning of preemphasis and de-emphasis in FM system. **(10 Marks)**

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