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06EC53

Fifth Semester B.E. Degree Examination, June/July 2016
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. Define the power spectral density and explain its properties. **(08 Marks)**

b. Define Mean, Correlation and Covariance function. **(06 Marks)**

c. A random variable has a probability density function :

$$f_x(x) = \begin{cases} \frac{5}{4}(1-x^4), & 0 \le x \le 1 \\ 0, & \text{otherwise} \end{cases}$$

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

2 a. Explain with the help of neat diagram, how square law modulator is used to generate A.M. **(06 Marks)**

b. Suppose non linear devices are available for which the output current i_o and input voltage v_i are related by $i_o = a_1 v_i + a_3 v_i^3$, where a_1 and a_3 are constants. Explain how these devices could be used to produce DSB-SC waves. **(06 Marks)**

c. Explain with relevant sketches and expression, the generation of DSB – SC using Ring modulator. **(08 Marks)**

3 a. Explain the operation of Quadrative carrier multiplexing. **(06 Marks)**

b. i) Define Hilbert transform ii) State the properties of Hilbert transform.
iii) Prove any one of the properties of Hilbert transform. **(07 Marks)**

c. With a neat block diagram, explain how SSB wave is generated using phase shift method. **(07 Marks)**

4 a. Show that a VSB modulated wave S(t) containing a vestige of LSB which is defined by

$$S(t) = \frac{A_C}{2} m(t) \cos 2\pi f_c t - \frac{A_C}{2} M_Q(t) \sin 2\pi f_c t.$$ **(08 Marks)**

b. Explain AM radio, with a neat block diagram. **(07 Marks)**

c. Compare the different AM techniques. **(05 Marks)**

PART – B

5 a. Derive time domain expression for wideband FM wave. **(07 Marks)**

b. With relevant expressions and block diagram, explain Armstrong method of FM generation. **(07 Marks)**

c. Consider an angle modulated signal $x_c(t) = 10 \cos (w_c t + 3 \sin w_m t)$. Assume FM and fm = 1KHz. Calculate the modulation index and find the bandwidth when
i) fm is doubled ii) fm is decreased by one – half. **(06 Marks)**

6 a. How Demodulation and FM can be done using PLL, explain with mathematical expression? **(10 Marks)**

b. Write a note on FM stereo multiplexing. **(05 Marks)**

c. A block diagram of indirect FM transmitter is shown in fig. Q6(c). Compute the maximum frequency deviation Δf of the output of the FM transmitter and the carrier frequency fc if $f_1 = 200$ KHz , $F_{LO} = 10.8$MHz , $\Delta f_1 = 25$Hz , $n_1 = 64$ and $n_2 = 48$. **(05 Marks)**

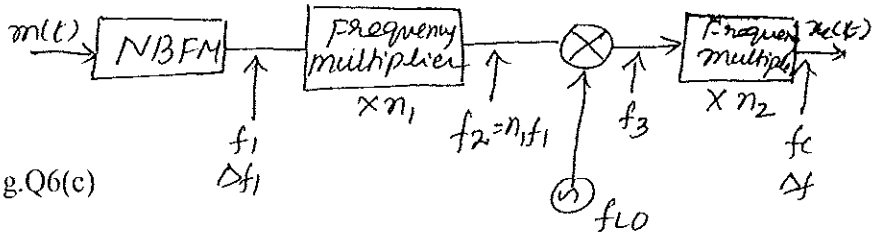

Fig.Q6(c)

7 a. Derive an expression for overall equivalent noise temperature of the cascade connection of any number of noises for two port network. **(08 Marks)**

b. Explain Noise figure, Thermal noise and Shot noise. **(06 Marks)**

c. The two port devices are connected in cascade. For the first stage, the noise figure and available power gain are 5dB and 12dB respectively. For the second stage the noise figure and available power gain are 15dB and 10dB respectively. Determine the overall noise figure on dB. **(06 Marks)**

8 a. Explain pre-emphasis and De – emphasis process in FM. **(06 Marks)**

b. Derive the SNR of SSB system and show that it has figure of merit equal to 1. **(08 Marks)**

c. An unmodulated carrier is defined by $C(t) = Ac \cos 2\pi f_c t$. This unmodulated carrier and narrow band noise centered about f_c are summed and then passed through an ideal envelop detector. Assume the noise PSD to be of height $\frac{N_o}{2}$ and bandwidth 2w, centered about f_c.

Find the output SNR for the carrier to noise ratio is high. **(06 Marks)**

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