CBCS SCHEME

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15EC45

Fourth Semester B.E. Degree Examination, June/July 2018
Principles of Communication Systems

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define Amplitude modulation. Explain the generation of AM wave using switching modulator. **(06 Marks)**

b. What is coherent detection? With a neat block diagram, explain the demodulation of DSB-SC signals using Costas receiver. **(05 Marks)**

c. Obtain the expression for a spectrum of single tone AM signal. Show that the total power in the sidebands is one third of the total power in the modulated wave with 100% modulation. **(05 Marks)**

OR

2 a. What are the modified forms of amplitude modulation? With a neat circuit diagram and waveform, explain the operation of ring modulator. **(06 Marks)**

b. With the help of an amplitude response of VSB filter. Explain the VSB modulation and demodulation process. **(06 Marks)**

c. Consider a square law detector using a nonlinear device whose output defined by $v_2(t) = a_1 v_1(t) + a_2 v_1^2(t)$, where a_1, a_2 are constants and $v_1(t) = A_c [1 + k_a u(t)] \cos 2\pi f_c t$.

i) Evaluate the output $v_2(t)$

ii) How the message signal can be recovered from $v_2(t)$? **(04 Marks)**

Module-2

3 a. Derive the expression for narrow band FM and compare it with the AM signal using phasor diagrams. **(06 Marks)**

b. Describe the frequency response of an ideal slope circuit used for the demodulation of FM signals and explain the balanced frequency discriminator. **(08 Marks)**

c. A commercial FM radio broadcasting uses modulation frequency w = 15KHz with the maximum value of frequency deviation 75KHz. Find the deviation ratio and transmission bandwidth. **(02 Marks)**

OR

4 a. With a neat block diagram, explain the generation of wideband FM signals. How the frequency stability is achieved. **(06 Marks)**

b. With the help of linear model of phase locked loop, obtain the output expression for demodulation of FM signals. **(07 Marks)**

c. An FM signal with a frequency deviation of 10KHz at a modulation frequency of 5KHz is applied to two frequency multipliers connected in cascade. The first multiplier doubles the frequency and the second multiplier triples it. Determine the frequency deviation and modulation index at the output. What is the frequency separation of adjacent side frequencies of this FM signal? **(03 Marks)**

Module-3

5 a. Define a random variable. Illustrate the relationship between sample space, random variable and probability. **(04 Marks)**

b. Define the autocorrelation and cross correlation functions. State the properties of auto correlation function. **(05 Marks)**

c. Explain the shot noise and thermal noise with the relevant expressions. **(07 Marks)**

OR

6 a. What is binary symmetric channel? Obtain a posteriori probabilities for the binary symmetric channel using transition probability diagram. **(06 Marks)**

b. Define mean, correlation and covariance function of a random process. compute the cross correlation for a pair of quadrature modulated stationary processes $x_1(t) = \text{Cos } 2\pi f_c t$ and $x_2(t) = \text{Sin } 2\pi f_c t$ **(05 Marks)**

c. What is white noise? Explain the power spectral density and autocorrelation function. **(05 Marks)**

Module-4

7 a. Explain the noise analysis of coherent detection of DSB – SC receiver. **(06 Marks)**

b. Explain the need of pre emphasis and de-emphasis in FM. Describe the transfer functions and circuit diagram of these filters. **(06 Marks)**

c. Compare the noise performance of AM and FM signals with reference to sinusoidal modulating signal and figure of merit. **(04 Marks)**

OR

8 a. Obtain the figure of merit of an AM receiver using envelope detector. **(08 Marks)**

b. With a neat block diagram, explain FMFB demodulator. **(04 Marks)**

c. Explain the following term with respect to FM i) Threshold effect ii) Capture effect. **(04 Marks)**

Module-5

9 a. State the sampling theorem. Obtain the expression for the spectrum of an ideally sampled signal and plot the spectrum for an arbitrary signal. **(06 Marks)**

b. What is multiplexing? What are the different types of multiplexing? Explain TDM with a neat block diagram. **(06 Marks)**

c. For a sinusoidal modulating signal, show that the signal to quantization noise ratio is 1.8 + 6R dB, where R is the number of bits per sample. **(04 Marks)**

OR

10 a. Define pulse amplitude modulation. Obtain the expression for the Fourier transform of PAM signal. **(07 Marks)**

b. What is quantization process? Explain the different types of Quantization with their input output characteristics. **(05 Marks)**

c. Represent the binary data: 10011101 in polar NRZ and bipolar RZ formatting. **(04 Marks)**

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