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17EC44

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Principles of Communication Systems

Time: 3 hrs.

Max. Marks: 100

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

Module-1

1. a. Explain the operation of the switching modulator with suitable circuit diagram and waveforms. **(08 Marks)**
   b. With suitable block diagram approach explain the operation of the Costas receiver. Write the relevant expressions. **(06 Marks)**
   c. What is the significance of VSB modulation? With spectrum of message signal and spectrum of VSB modulated wave explain briefly. **(06 Marks)**

OR

2. a. Explain the operation of the envelope detector with circuit diagram and waveforms. **(08 Marks)**
   b. With suitable block diagram approach explain the operation of the quadrature carries multiplexing process. **(06 Marks)**
   c. With relevant block diagram, explain the operation of the frequency division multiplexing method. **(06 Marks)**

Module-2

3. a. A 93.2MHz carrier is frequency modulated by a 5KHz sine wave. The resultant FM signal has a frequency deviation of 40KHz.
   i) Find the carrier frequency swing of the FM signal
   ii) What are the highest and lowest frequencies obtained by the frequency modulated waves
   iii) Calculate the modulation index of the same? **(04 Marks)**
   b. Explain the operation of the FM stereo multiplexing system (transmitter) using block diagram and spectrum. **(08 Marks)**
   c. Explain the operation of the super heterodyne receiver with block diagram. Mention the function of each block. **(08 Marks)**

OR

4. a. A modulating signal $5 \cos 2\pi \ 15 \times 10^3 t$, angle modulates a carrier $A \cos \omega_c t$. Find the modulation index and the bandwidth for the FM system. Determine the change in the bandwidth and modulation index if FM is reduced to 5KHz. What is the conclusion of the two results? **(05 Marks)**
   b. With relevant block diagram approach explain the operation of the linear model of phase locked loop. Derive an expression. **(07 Marks)**
   c. Explain the process of demodulation of FM waves. Write suitable circuit and relevant graphs. **(08 Marks)**

Module-3

5. a. Explain the properties of the auto correlation functions. Mention the three properties. **(06 Marks)**
   b. Explain the noise equivalent bandwidth in noise system, with circuit and derivation. **(08 Marks)**
   c. Three $5k\Omega$ resistors are connected in series. For room temperature ($KT = 4 \times 10^{-21}$) and an effective noise bandwidth of 1MHz. Determine :
   i) The noise voltage appearing across each resistor
   ii) The noise voltage appearing across the series combination
   iii) What is the rms noise voltage which appears across same three resistors connected in parallel under the same conditions? **(06 Marks)**

OR

6 a. Mathematically write the expression and define briefly for :
       i) Conditional probability   ii) Mean.   **(06 Marks)**
   b. Explain the shot noise with relevant expression. And also explain the white noise with power spectral density and auto correlation function.   **(08 Marks)**
   c. An amplifier is fed from a 100Ω, $15\mu V$ rms sinusoidal signal source. Its equivalent input noise resistance and equivalent input short current are 250Ω and $6\mu A$, respectively. Calculate the individual noise voltages at the input and the input signal to noise ratio. Assume noise bandwidth is 10MHz and temperature is 30°C.   **(06 Marks)**

Module-4

7 a. Explain the noise in DSBSC receivers using model of DSBSC receiver using coherent detection.   **(08 Marks)**
   b. Explain the significance of pre-emphasis and de-emphasis in FM system with circuit, relevant graph and derivation.   **(08 Marks)**
   c. Find the figure of merit when the depth of modulation is :
       i) 100%   ii) 150%   iii) 30%.   **(04 Marks)**

OR

8 a. Explain the noise in FM receivers. Derive an expression for "Figure of Merit' for FM receiver.   **(08 Marks)**
   b. Explain the FM threshold effect with nature of graph representing the relationship between P and $(SNR)_0$. And also explain the FM threshold reduction with block diagram and relevant graph.   **(08 Marks)**
   c. An AM receiver operating with a sinusoidal wave and 80% modulation has an output signal to noise ratio of 30dB. Calculate the corresponding carrier to noise ratio.   **(04 Marks)**

Module-5

9 a. Why digitize analog signals? Explain the sampling process with CT and DT signals.
                                                                                 (08 Marks)
   b. With block diagram approach. Explain pulse amplitude modulation. Draw the suitable (relevant) waveforms.   **(08 Marks)**
   c. For a PAM transmission of voice signal with W = 3KHz, calculate B_T. if f_s = 8KHz and $\tau = 0.1Ts$.   **(04 Marks)**

OR

10 a. With suitable PPM generator circuit and relevant waveforms explain the operation of pulse position modulation.   **(08 Marks)**
    b. Write on applications to vocoders, considering speech model used in voice coders and block diagram of vocoder.   **(08 Marks)**
    c. An analog waveform with bandwidth 15Hz is to be quantized with 200 levels and transmitted via binary PCM signal. Find the rate of transmission and bandwidth required. If 10 such signals are to be multiplexed find the bandwidth requirement.   **(04 Marks)**

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