B.Tech II Year 4rth Semester

Year(2022)

Branch ECE

Subject : Communication System **Final Semester**

Time : 3 Hour **M.M : 120**

Note : Attempt All question

1. Answer the following questions.(Very short answers) (5x2=10)
   a) Why is FM superior to AM in performance?
   b) Define the term signal to noise ratio.
   c) What is the effect of aliasing?
   d) What do you mean by Nyquist rate?
   e) Why carrier recovery is required for signal demodulation?
2. Answer the following questions.(Short answers)
   a) With the help of suitable block diagram , explain the relationship between phase modulation and frequency modulation.
   b) Why we use pre-emphasis and de-emphasis in case of FM broadcasting?
   c) Differentiate between PAM, PWM and PPM.
   d) What do you mean by inter symbol interference?
   e) Briefly explain quantization process.
3. Part(a) is compulsory and attempt any one part from part (b) or part (c).
   a) : Describe Vestigial Sideband (VSB) with the help of appropriate waveform and block diagram. (6) Also drive the relationship between equalizer filter at the receiver output Ho(f) and vestigial shaping filter that produces VSB from DSB output Hi(f).
   b) A modulating signal $10\sin(2\pi \times 10^3 t)$ is used to modulate a carrier signal $20\sin(2\pi \times 10^4 t)$. Determine the modulation index, percentage modulation, frequencies of the sideband components and their amplitudes. What will be the bandwidth of the modulated signal? What are the different techniques for DSB Amplitude Modulation? Explain Ring Modulator with digram. (12)

   OR

   c) Determine the carrier frequency, and the maximum deviation for an FM wave $f(t) = 15\sin(8 \times 10^8 t + 6\sin 1300t)$. What is the power dissipated by this FM wave in a 12Ω resistor? Assume the modulation index β to be 3. Draw the block diagram for Quadrature Amplitude Modulation (QAM) and with appropriate derivation show how two message signals are recovered at receiver end. (12)
4. Part(a) is compulsory and attempt any one part from part (b) or part (c).

a) Derive the pre-detection signal to noise ratio of the DSB-SC system with the help of suitable block diagram. (6)

b) A bin contains three oscillator microchips, marked O_1 , O_2, O_3, and two PLL microchips, marked P_1, P_2, .Two chips are picked randomly in succession without replacement.

   (a) How many outcomes are possible (i.e., how many points are in the sample space?) List all the outcomes and assign probabilities to each of them.

   (b)Express the following event as unions of the outcomes in part (a): (i) one chip drawn

   Is marked oscillator and the other PLL (ii) both chips are PLL; (iii) both chips are oscillators; and

   (iv) both chips are of the same kind. Assign probabilities to each of these events.

Define Gaussian random variable, its different properties along with mathematical expression for density function. (12)

OR

c) A binary source generates digits 1 and 0 randomly with probabilities P(1) = 0.8 and P(0) = 0.2.
   (1) What is the probability that two 1′s and three 0′ s will occur in five-digit sequence?
   (2) What is the probability that at least three 1′s will occur in five-digit sequence?
   Derive the expression for figure of merit as well as post-detection signal-to-noise ratio of the DSB-SC system. (12)

5. Part(a) is compulsory and attempt any one part from part (b) or part (c).
   a) Prove sampling theorem with the help of a figure of a sampled signal and its Fourier spectra. (6)
   b) Find the Nyquist rate and the Nyquist interval for the signal given mathematically as $x(t) = \frac{1}{2\pi}\cos(4000\,\pi t)\cos(1000\pi t)$. With a neat diagram explain the basic elements of a PCM system. (12)

OR

   c) For an amplifier input signal power is 1.5×10^{-9}W , input noise power 1.5×10^{-18}W power gain is 10^6 while the value of internal noise is 4×10^{-12} W. Find(i) input signal-to-noise-ratio (SNR) in dB (ii) noise factor (iv) noise-figure. With a neat block diagram outline the concept of time division multiplexing. (12)

6. Part(a) is compulsory and attempt any one part from part (b) or part (c).
   a) What are the different advantages offered by the digital pulse-modulation techniques? (6)
   b) For a continuous-time signal x(t) = cos(200πt) determine (i) minimum sampling rate i.e. Nyquist rate required to avoid aliasing (ii) If sampling frequency 400 Hz. What is the discrete-time signal x(n) or $x(nT_s)$ obtained after sampling? (iii) If sampling frequency 150 Hz. What is the discrete-time signal x(n) or $x(nT_s)$ obtained after sampling? Differentiate between ASK, FSK, and PSK. (12)

OR

   c) An amplifier is operating at 17° C with a bandwidth of 15KHz. Find (i) thermal noise power in watts and dBm and (ii) rms noise voltage for a 60Ω internal resistance and a 60 Ω load resistance. Briefly explain MSK transmission and detection along with its block diagram. (12)

7. Part(a) is compulsory and attempt any one part from part (b) or part (c).
   a) Explain Delta modulation with the help of neat block diagrams. (6)
   b) Consider a binary sequence 01101001. Draw the waveforms for this sequence, using the following line code formats: (i) Non-return-to-zero (NRZ) signaling (ii) RZ signaling (iii) Bipolar RZ (iv) Split-phase (Manchester) signaling (v) Differential encoding. Write short notes on maximum likelihood sequence detection. (12)

OR

   c) A television signal having a bandwidth of 4.2 MHz is transmitted using binary PCM system. Given that the number of quantization level is 512. Determine (i) code word length (ii) transmission bandwidth (iii) Final bit rate. Briefly describe the role of Equalizer and different equalization techniques. (12)

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