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Question Paper Code : 30144

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Computer and Communication Engineering

EC 3491 — COMMUNICATION SYSTEMS

(Common to Electronics and Communication Engineering/Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is modulation?

2. What is the Hilbert Transform of an impulse function, $\delta(t)$?

3. Define sampling theorem.

4. What is use of a compander?

5. Write the properties of Line coding.

6. Write the advantages of delta modulation over PCM.

7. What are the bandpass digital modulation techniques?

8. Draw constellation diagram of 8-QAM.

9. Define correlation receiver.

10. What is the meaning of the term "likelihood" in maximum likelihood decoding.

PART B — (5 × 13 = 65 marks)

11. (a) A DSB-SC signal is to be generated with a carrier frequency fc=1 MHz using a non-linear device with input-output relation given by $V_o = a V_i + b V_i^3$, where a and b are constants. The output of the non-linear device is filtered by a band pass filter. Let the $V_i = A_C{}^i \cos\left(2\pi f_c^i t\right) + m(t)$, where $m(t)$ is the message signal. Then, calculate the value of $f_c{}^i$.

Or

(b) Calculate the Hilbert Transform of the function, $f(t) = \cos(\omega_1 t) + \sin(\omega_2 t)$.

12. (a) A message signal of 10 $\cos\left[\left(4\pi * 10^3\right)t\right]$ is transmitted through PCM system. If sampling frequency equal to twice the Nyquist rate, and signal to quantization noise ratio (SQNR) should be minimum of 22 dB, then find the transmission bandwidth and SQNR in dB. (13)

Or

(b) Calculate the Nyquist sampling rate for the signal given below :

$$x(t) = \frac{\sin(100\pi t) \cdot \sin c(200t)}{\pi t}.$$

13. (a) Explain in detail viterbi decoders.

Or

(b) Explain DPCM transmitter and receiver in detail.

14. (a) What is difference between M-ary QAM and M-ary PSK? Explain it using constellation diagram for different values of M = 2, 4 and 16.

Or

(b) A message signal of $10\cos\left[\left(2\pi * 10^4\right)t\right]$ is given to 1024 level PCM system. The resulting signal is transmitted through free space by using binary signaling technique. Find the transmission bandwidth if modulation technique is (i) ASK and (ii) BPSK. (6+7)

15. (a) What is matched filter receiver? Derive the expression for impulse response of a matched filter receiver. (3+10=13)

Or

(b) What is Intersymbol Interference (ISI)? What are the ways to reduce ISI? Discuss in detail. (5+8=13)

PART C — (1 × 15 = 15 marks)

16. (a) Let m(t) = $\cos\left[\left(4\pi * 10^3\right)t\right]$ be the message signal and $c(t) = 5\cos\left[\left(2\pi * 10^6\right)t\right]$ be the carrier signal. $c(t)$ and $m(t)$ are used to generate an FM signal. If the peak frequency deviation of the generated FM signal is three times the transmission bandwidth of the AM signal. Then, calculate the coefficient of the term $\cos\left[4\pi\left(1006 * 10^3\right)t\right]$ in the FM signal in terms of the Bessel coefficients.

Or

(b) An analog voltage signal with maximum significant frequency of 1kHz and voltage range of 0 to 5 V, is to be digitally encoded with a resolution of 0.005%. To avoid the loss of information, calculate the following :

(i) Minimum sampling rate required (2)

(ii) Minimum number of bits in the digital code (4)

(iii) R.M. S value of the quantization noise (5)

(iv) Signal to quantization noise ratio (SQNR) in DB. (4)

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