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Question Paper Code: R4405

B.E. / B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Fourth Semester

Electronics and Communication Engineering

R21UEC405- ANALOG AND DIGITAL COMMUNICATION

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5Marks)

1. The advantages of the modulation are _____ CO1-U
(a) High energy of carrier (b) Noise can be reduced
(c) Multiplexing is possible (d) All of the above
2. A 12 MHz carrier gets modulated by a sine signal with a frequency of 500 Hz bearing the frequency deviation of about 50 kHz. Find the bandwidth? CO1-U
(a) 100 (b) 101 (c) 102 (d) 103
3. Quantization noise can be reduced by _____ the number of levels. CO1-U
(a) Decreasing (b) Increasing (c) Doubling (d) Squaring
4. QPSK system uses a phase shift of _____ CO1-U
(a) Π (b) 2Π (c) $\Pi/2$ (d) $\Pi/4$
5. The main objective of Trellis coding is _____ CO1-U
(a) To narrow the Bandwidth (b) To simplify the modulation
(c) To increase the data rate (d) To reduce the error rate

PART – B (5 x 3= 15 Marks)

6. A transmitter supplies 8 KW to the antenna when modulated. Determine the total power radiated when modulated to 30%. CO2- App
7. List the properties of the Bessel function. CO1- U
8. What are the advantages of DM over PCM CO1- U
9. Differentiate between coherent and non coherent detection techniques. CO1- U

10. Determine code vector for the message 001 given check bits as

CO3- App

$$C1=m1\oplus m3$$

$$C2=m2\oplus m3$$

$$C3=m1\oplus m2$$

PART – C (5 x 16= 80 Marks)

11. (a) Derive the expression of DSB-SC AM wave with time domain representation, Frequency spectrum and calculate its Power Savings. CO1-U (16)

Or

(b) Derive the expression of an AM wave, modulation index, total power and Transmission efficiency CO1-U (16)

12. (a) A 107.6 MHz carrier signal is frequency modulated by a 7 kHz sine wave. The resultant FM signal has a frequency deviation of 50 kHz. Determine CO2 App (16)

- a) Carrier swing of the FM signal
- b) Highest and lowest frequencies attained by the modulated signal
- c) Modulation index of the FM wave.
- d) Bandwidth of FM

Or

(b) A 200 MHz carrier signal is frequency modulated by a 7 kHz sine wave. The resultant FM signal has a frequency deviation of 50kHz. Determine CO2 App (16)

- a) Carrier swing of the FM signal
- b) Highest and lowest frequencies attained by the modulated signal
- c) Modulation index of the FM wave.
- d) Bandwidth of FM

13. (a) The television signal with a bandwidth of $W=f_m=4.2$ MHz is transmitted using PCM. The number of quantization level is 512. The amplitude of signal is varied from 7V to -7V. Calculate (i) Nyquist rate (ii) code word length or number of bits (iii) transmission bandwidth (iv) final bit rate (v) step size CO3 App (16)

Or

- (b) Consider the input data sequence of alternate 1's and 0's. Sketch the waveforms for each of these sequences using following methods. (i) Unipolar NRZ (ii) Unipolar RZ (iii) Polar NRZ, (iv) Polar RZ (v) Bipolar NRZ (vi) Bipolar RZ (vii) Manchester (viii) Differential Manchester. CO3 App (16)
14. (a) Explain the digital modulation techniques in which the frequency of the modulated signal is shifted relative to the previous signal element. CO1-U (16)
- Or
- (b) Explain the digital modulation techniques in which the phase of the modulated signal is shifted relative to the previous signal element. CO1-U (16)
15. (a) A message source generates one of four messages randomly every microsecond. The probabilities of these messages are 0.4, 0.3, 0.2, and 0.1. Each emitted message is independent of the other messages in the sequence. CO5- Ana (16)
- a) What is the source entropy?
- b) What is the rate of information generated by this source (in bits per second)?
- Or
- (b) For a discrete memory less source 'S' with 5 symbols S_1, S_2, S_3, S_4, S_5 . The probability of occurrence of these symbols are given as $P(S_1) = 0.4$, $P(S_2) = 0.2$, $P(S_3) = 0.2$, $P(S_4) = 0.1$, $P(S_5) = 0.1$. Construct a Huffman code and also calculate its efficiency. CO5- Ana (16)

