Data Communication Class Test 1 Set No 100 Marks: 2X15=30 Time 45mins

Name:

Roll No.:

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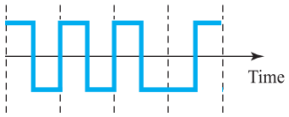
1. **Let us consider two cases: Case-1: A long sequence of 0s, Case-2: A long sequence of 1s. Identify the correct option(s) regarding baseline (running average of the received signal power).**

   (a) Case-1 will cause the problem of baseline wandering (a drift in the baseline) for NRZ-L
   (b) Case-1 will cause the problem of baseline wandering for NRZ-I
   (c) Case-2 will cause the problem of baseline wandering for NRZ-L
   (d) Case-2 will cause the problem of baseline wandering for NRZ-I
   (e) For both the cases, there will be the problem of baseline wandering for NRZ-I and NRZ-L

2. **Let us consider in differential Manchester scheme, a 4-bit data stream is represented in the figure below. However, if the receiver erroneously decodes it using the Manchester scheme, how many bits will be incorrectly decoded?**



   (a) 1 (b) 2 (c) 3 (d) 4 (e) 0

3. **A signal has travelled from point 1 to point 2. Suppose, its power is increased 100 times. There can be N cascaded amplifiers between point 1 and point 2, each with M dB gain. Find the maximum value of N, if the condition N<=M needs to be satisfied.**

   (a) 1 (b) 2 (c) 3 (d) 20 (e) None of the above

4. **An analog signal has amplitudes between -40 V and +40 V. Let each quantization zones (uniform) has a height of 10 V. What will be the SNR of the signal?**
   Ans: _____

5. **The bandwidth of a low-pass analog signal is 5 kHz. If SNR_{dB} of the signal is 34, then find the bit rate in kbps**.

   Ans: _____

6. **State Correct statement(s)**
   S1: In asynchronous transmission, at the byte level the sender and the receiver are synchronized, but within each byte the receiver does not have to be synchronized with the incoming bit stream.
   S2: If an analog signal contains frequencies from 0 to 6000 Hz and we digitize the signal (assume 256 quantization levels), the new minimum bandwidth of the channel that can pass the digitize signal is 48 kHz
   S3: A block coding scheme can be used to solve the NRZ-I encoding problem of synchronization as well as the DC component problem.
   S4: According to Fourier analysis, any composite signal is a combination of simple sine waves with different frequencies, amplitudes, and phase.

   Ans: _____

7. **Let us consider, we have a bandpass channel. The available bandwidth span from 75 kHz to M kHz and 75 < M. Suppose the data is modulated using BFSK and we have selected two carrier frequencies f_1 and f_2. It is given that f_2 is 25 kHz apart from $\frac{M-75}{2}$. Which one of the following is correct? (Assume d=1 and N is the data rate).**

   (a) $N + 25 = (M - 50)/2$
   (b) $2N + 75 = M - 25$
   (c) $2N + M = -125$
   (d) None of the above.

8. **Suppose, we need to modulate a 6-KHz audio signal, find the bandwidth for the following cases. (i) Amplitude modulation (ii) Frequency modulation (set $\beta = 4$) (iii) Phase modulation (set $\beta = 2$).**
   (a) (i)-->10 kHz (ii)-->60 kHz (iii)-->20 kHz
   (b) (i)-->12 kHz (ii)-->48 kHz (iii)-->36 kHz

(c) (i)-->10 kHz (ii)-->48 kHz (iii)-->24 kHz
(d) (i)-->12 kHz (ii)-->60 kHz (iii)-->24 kHz
(e) None of the above

9. If we need to send 6000 bits per second, what is the required bandwidth for the following cases? assume d=1. (i) ASK (ii) QPSK (iii) 16-QAM (iv) 64-QAM

(a) Case (i) --> 12000 Hz; Case (ii) --> 8000 Hz; Case (iii) --> 6000 Hz; Case (iv) --> 2000 Hz
(b) Case (i) --> 12000 Hz; Case (ii) --> 6000 Hz; Case (iii) --> 1000 Hz; Case (iv) --> 2000 Hz
(c) Case (i) --> 12000 Hz; Case (ii) --> 6000 Hz; Case (iii) --> 3000 Hz; Case (iv) --> 2000 Hz
(d) Case (i) --> 12000 Hz; Case (ii) --> 8000 Hz; Case (iii) --> 2000 Hz; Case (iv) --> 3000 Hz
(e) None of the above

10. Let us consider, Vs and Vn denote the peak voltage value of the signal and noise respectively. If Vs is 20 times the value of Vn, then calculate theoretical channel capacity (assume bandwidth is 2 MHz).

Ans: _____

11. We'll have to aggregate 30 digital sources, each with a bit rate of 100 kbps, using synchronous TDM. Each digital source sends four bits to each output slot, but every frame needs an additional bit for synchronization. In the above-mentioned context, 5 statements (S1 to S5) are given below. Identify the correct statement(s)?

S1: The size of an output frame is 150 bits
S2: The frame rate will be 20000 frames/s
S3: Duration of each frame will be 40 µs
S4: The output data rate will be 2.025 Mbps
S5: System efficiency will be 99.17%

Ans: _____

12. Suppose that a voice channel has a 5500 Hz bandwidth. Using frequency-division multiplexing, we have to multiplex 12 voice channels with 0.6 kHz guard bands. Determine how much bandwidth we need (in kHz).

(a) 73.2 (b) 71.2 (c) 72.6 (d) None of the above

13. Find the most accurate matching between List A and List B

List A	**List B**
(i) FDM	(P) Analog multiplexing technique
(ii) WDM	(Q) Combine optical signals
(iii) TDM	(R) Digital multiplexing technique
(iv) FHSS	(S) Wireless applications
	(T) Guard bands
	(U) Privacy and antijamming

(a) i--> P; ii-->P; iii--> R; iv--> S
(b) i--> P, T; ii-->Q; iii--> R; iv--> S, U
(c) i--> P, T; ii-->P, Q ; iii--> R; iv--> S, U
(d) None of the above

14. Identify the correct statement(s).
S1: In asynchronous transmission, we send 1 start bit (0) at the beginning and 1 or more stop bits (1s) at the end of each byte. There should not be a gap between each byte.
S2: In asynchronous transmission, we send 1 start bit (1) at the beginning and 1 or more stop bits (0s) at the end of each byte. There should not be a gap between each byte.
S3: In asynchronous transmission, we send 1 start bit (1) at the beginning and 1 or more stop bits (0s) at the end of each byte. There may be a gap between each byte.
S4: In asynchronous transmission, we send 1 start bit (0) at the beginning and 1 or more stop bits (1s) at the end of each byte. There may be a gap between each byte.

Ans: _____

15. Identify the correct statement(s).
S1: If the analog signal is low-pass, sampling rate in PCM must be at least 2 times the bandwidth.
S1: In data communication, $\text{Latency} = \text{processing time} + \text{queuing time} + \text{propagation time}$
S3: Number of invalid (unused) code sequences in 8B/10B encoding is 768
S4: Average signal rate in Manchester scheme is greater than that of NRZ-I.

Ans: _____