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**Presidency University**

**Bengaluru**

 **SCHOOL OF MANAGEMENT**

**MAKE-UP EXAMINATION – SEP 2023**

**Course Code**: ECE 212

**Course Name**: DIGITAL COMMUNICATION

**Program**: B.Tech

**Date**: 30-SEP-2023

**Time**: 1.00PM to 4.00 PM

**Max Marks**: 100

**Weightage**: 50%

 **Instructions:**

1. *Read the all questions carefully and answer accordingly.*
2. *Scientific calculators are allowed; programmable calculators are not allowed.*

**Part A [Memory Recall Questions]**

**Answer all the Questions. Each question carries TWO marks. (20Qx 2M= 40M)**

1. To convert a signal from continuous time to discrete time, a process called sampling is used. If the top of the samples remains constant and equal to the instantaneous value of the modulating signal at the start of the sampling is called \_\_\_\_\_\_ sampling and the sampling in which the top of sampled pulses retains their natural shape during the sampling interval is called \_\_\_\_\_\_\_ sampling. (C.O.No.1) [Knowledge Level]
2. Sampling is the process of measuring the instantaneous values of continuous-time signal in a discrete form. The sampling rate of 2W samples per second for a signal bandwidth WHz is called the \_\_\_\_\_ and 1/2Wsec is called the \_\_\_\_\_\_. (C.O.No.1) [Knowledge Level]
3. Nyquist Rate is the minimum sampling frequency needed to detect the original signal without distortion. So determine the Nyquist Rate for signal $g^{3}(t)$, if g(t)=cos200πt.

 (C.O.No.1) [Knowledge Level]

1. A bandpass signal is a signal containing a band of frequencies not adjacent to zero frequency. If the bandwidth of a bandpass signal is given by 1600hz. The bandwidth of the inphase component of the signal is \_\_\_\_\_\_\_\_\_\_. (C.O.No.1) [Knowledge Level]
2. Nyquist Interval is the maximum time interval between equally spaced samples of a signal that will enable the signal waveform to be completely determined. So determine the Nyquist Interval for signal, g(t)=sinc(100t). (C.O.No.1) [Knowledge Level]
3. In Delta Modulation the present sample value is compared with the previous sample value and the difference is quantized. There fore \_\_\_\_\_number of quantization levels and \_\_\_\_\_\_number of bits/sample are required in DM. (C.O.No.2) [Knowledge Level]
4. The error observed when the slope of analog signal is much higher than the slope of the approximated staircase signal is\_\_\_\_\_\_ and the error observed when the step size is too large compared to small variations in the input signal is\_\_\_\_\_. (C.O.No.2) [Knowledge Level]
5. Bit rate represents the number of bits transmitted per second. In PCM the bit rate is \_\_\_\_\_\_\_\_\_\_ and in delta modulation the bit rate is \_\_\_\_\_\_\_\_\_\_\_. (C.O.No.2) [Knowledge Level]
6. The digital modulation technique that requires minimum bandwidth is\_\_\_\_\_\_\_\_\_\_\_\_. One-bit quantizer is used in \_\_\_\_\_\_\_\_\_\_ modulation. (C.O.No.2) [Knowledge Level]
7. Quantization noise is the effect of representing an analog continuous signal with a discrete number. Quantization noise can be reduced by \_\_\_\_\_\_ the number of levels. In PCM encoding, quantization level varies as a function of \_\_\_\_\_\_\_. (C.O.No.2) [Knowledge Level]
8. For the given binary sequence 100111010 draw the M-ary line code format; Assume M=4.

 (C.O.No.3)[Knowledge Level]

1. Draw the signal space diagram of QPSK. (C.O.No.3) [Knowledge Level]
2. The difference between coherent and non coherent modulation techniques lies in \_\_\_\_\_\_\_\_\_\_.

 (C.O.No.3) [Knowledge Level]

1. In BPSK \_\_\_\_\_\_\_ line code format is used to represent binary data stream; Justify your answer.

 (C.O.No.3) [Knowledge Level]

1. Digital data i.e binary digits are represented by different waveforms for the purpose of transmission over the channel. This process is called as\_\_\_\_\_\_ and also list any two of such techniques. (C.O.No.3) [Knowledge Level]
2. Spread Spectrum refers to a system originally developed for military applications, to provide secure communications by spreading the signal over a large frequency band. \_\_\_\_\_is called as the bit duration of PN sequence and \_\_\_\_\_is called as the rate of PN sequence.

 (C.O.No.4) [Knowledge Level]

1. Pseudo-Noise (PN) sequences are commonly used to generate noise that is approximately "white". It has applications in cryptography, and spread-spectrum communications. PN sequences are generated by\_\_\_\_\_and the length of PN sequence is\_\_\_\_\_\_.

 (C.O.No.4) [Knowledge Level]

1. PN sequence is normally a sequence of bits. Multiplication of two same PN sequence is \_\_\_\_\_ and multiplication of two different PN sequence is \_\_\_\_. (C.O.No.4) [Knowledge Level]
2. Shift register is a series combination of flip-flops. \_\_\_\_\_\_\_flip-flop is used to generate a PN sequence. How many flip-flops require to generate a PN sequence of length 7 bit.

 (C.O.No.4) [Knowledge Level]

1. A PN sequence is generated using a linear feedback shift register with number of stages equal to 10. The chip rate is 107 bits per second; then the length of PN sequence is \_\_\_\_\_\_ and Chip duration is \_\_\_\_\_. (C.O.No.4) [Knowledge Level]

**Part B [Thought Provoking Questions]**

**Answer all the Questions. Each question carries TEN marks. (3Qx10M=30M)**

1. The over sampling of baseband signal is done to increase the correlation between adjacent samples of the signals. These highly correlated adjacent samples are then approximated by a quantizer which has only 2 quantization levels(1-bit quantizer). Identify the modulation scheme and explain it with neat diagrams, waveforms and relevant equations.

 (C.O.No.2) [Comprehension Level]

1. In a digital modulation, the bit rate can be increased by using multilevel modulation techniques. In 4-level modulation the data stream is divided into groups of 2bits and each group phase modulates the carrier by either π/4, 3π/4, 5π/4,or 7π/4 phase shift. Identify the modulation scheme and explain it with neat diagrams, waveforms and relevant equations.

 (C.O.No.3) [Comprehension Level]

1. A Satellite based navigation system uses DSSS as this gives a signal gain by spreading the signal out over a wide bandwidth. It also enables different satellites to use the same channel without mutual interference. Formulate the result at the output of a transmitter and receiver for a direct sequence spread spectrum if the binary message signal is given by b(t) and the pseudo noise signal is c(t) and also implement the appropriate modulation technique and construct the block diagrammatic representation of the technique. (C.O.No.4) [Comprehension Level]

**Part C [Problem Solving Questions]**

**Answer all the Questions. Each question carries TEN marks. (3Qx10M=30M)**

1. Sampling is the process of converting CT signal to DT signal; The spectrum of signals g1(t) and g2(t) are shown in the below figure; Determine Nyquist sampling rate and Nyquist interval for the signals g1(t), g2(t), g12(t), g22(t), g23(t), g1(t)\*g2(t). (C.O.No.1) [Comprehension Level]



1. Line codes are used for data transmission of a digital signal over a transmission line. For the given binary sequence 101011100; draw the line code formats corresponding to
2. Unipolar NRZ ii) Polar NRZ [10M] (C.O.No.3) [Comprehension Level]
3. Polar RZ iv) Bipolar NRZ v) Manchester encoding
4. For the PN sequence generator shown in the figure below, obtain and draw the PN sequence.

 Assume the initial state of the shift register is Q3Q2Q1 = 001.

 (C.O.No.4)[Comprehension Level]



Figure: PN Sequence generator.