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**Presidency University**

**Bengaluru**

 **SCHOOL OF ENGINEERING**

**Make-Up Examinations, July 2024**

**Date**: 10/07/2024

**Time**: 1-30 PM to 4-30 PM

**Max Marks**: 100

**Weightage**: 50%

**Even Semester**: V

**Course Code**: ECE 3011

**Course Name**: Digital Communication

**Department:** ECE

 **Instructions:**

1. *Read the all questions carefully and answer accordingly.*
2. *Do not write any matter on the question paper other than roll number.*

**PART A**

**Answer any SIX Questions. Each question carries 10 marks. (6Q × 10M= 60M)**

1. Baseband signal cannot be transmitted using radio links as they require impractically large antennas. This necessitated the need for moving to higher frequency spectrum leading to passband communication. Draw a neat block diagram of a typical digital communication system, enumerating the function of source encoder and decoder blocks. (CO: 01 BL: Knowledge)
2. In real-life engineering, natural sampling and flat-top sampling methods are more practical than instantaneous sampling method and are used extensively. Bring out a clear difference between these three sampling methods by suitable diagrams and explanations. (CO: 01 BL: Knowledge)
3. (a) An analog signal is expressed by the equation $x\left(t\right)=3Cos500πt+10Sin300πt-Cos100πt$. Determine the minimum sampling frequency.

(b) Find the Nyquist rate and Nyquist interval for the signal:

$x\left(t\right)=\frac{1}{2π}Cos\left(4000πt\right).Cos(1000πt)$ (CO: 01 BL: Application)

1. The process of transforming sampled amplitude values of a message signal into a discrete amplitude value (levels) is known as quantization. Quantization approximates each of input sample values to a nearest prefixed level. Nowadays, non-uniform quantization methods are exclusively used, instead of uniform quantization with fixed level size. Briefly explain the A-law companding method with suitable plot and equations. (CO: 02 BL: Comprehension)
2. Calculation of signal-to-noise ratio (SNR) value in dB is one of the most fundamental requirements of a digital communication system. In an experiment, a signal of bandwidth 5 kHz is sampled and coded by a uniform PCM system. The coded signal is then transmitted over a channel at a bit rate of 60 kbps. Determine the maximum SNR of quantization error in dB for this PCM system.

 (CO:02 BL: Application)

1. Time Division Multiplexing (TDM) is used to simultaneously transmit several different discrete-time signals over a single channel. With the help of a neat diagram, explain the scheme of TDM for N number of signals. Also, show the schematic of two discrete-time signals being time division multiplexed. (CO:03 BL: Comprehension)

1. Binary Amplitude Shift Keying (BASK) was developed, in line with Amplitude Modulation (AM) technique (actually DSB-SC) and it is one of the earliest methods established for digital passband transmission of signals. (a) Explain the basic principles of BASK and On-Off Keying (OOK) with suitable diagrams of waveforms. (b) Depict a block diagram of BASK transmitter and a non-coherent BASK detector. (CO:03 BL: Knowledge)
2. To overcome the drawbacks of a PCM system, the Delta Modulation (DM) scheme is used. (a) Draw the block diagram representations of a DM transmitter and receiver. (b) List the advantages and drawbacks of Delta Modulation scheme. (CO:04 BL: Knowledge)

**PART B**

**Answer any TWO Questions. Each question carries 20 marks. (2Q × 20M= 40M)**

1. A signal is pulse code modulated to convert its analog information into a binary bit stream, i.e., a sequence of 1s and 0s. Instead of a pulse train, PCM produces a series of numbers or digits, and hence this process is known as analog to digital conversion. Each one of these digits, though in binary code, represent the approximate amplitude of the signal sample at that instant. (a) List the basic elements of a PCM system. (b) Draw a neat block diagram of a PCM system and briefly describe the functions of each block. (CO:02 BL: Comprehension)
2. (a) With suitable illustrative block diagrams, draw the BFSK generator and the coherent detector, together with waveforms, briefly explaining the conception of BFSK.

(b) Differential phase shift keying (DPSK) is a common form of phase modulation that conveys data by changing the phase of the carrier wave with the notion of differential sampling. Draw the block diagram of DPSK transmitter and receiver and briefly explain its operation. (CO:03 BL: Application)

1. The cumulative use and demand of wireless transmission has posed severe problems in limited spectrum efficiency and multipath propagation. The use of spread spectrum communication has considerably reduced these problems. (a) Explain the concept and characteristics of spread spectrum modulation with a suitable schematic diagram. (b) List the types of techniques used for spread spectrum modulation. (c) With an appropriate illustration, enumerate the model of Frequency Hopping Spread Spectrum (FHSS). (CO:04 BL: Comprehension)