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**PRESIDENCY UNIVERSITY  
BENGALURU**

**SET A**

**SCHOOL OF ENGINEERING  
END TERM EXAMINATION - JAN 2024**

**Semester :** Semester V - 2021  
**Course Code :** ECE3011  
**Course Name :** Digital Communication  
**Program :** B.Tech.

**Date :** 08-JAN-2024  
**Time :** 9:30AM - 12:30 PM  
**Max Marks :** 100  
**Weightage :** 50%

**Instructions:**

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.
- (iv) Do not write any information on the question paper other than Roll Number.

**PART A**

**ANSWER ALL THE QUESTIONS**

**5 X 2M = 10M**

1. Wireless communication systems suffer from intentional or unintentional interferences by various transmitters which are using near frequency bands. This problem can be solved somewhat by using spread spectrum modulation, in which the intended signal is transmitted by a pseudorandom codeword, that carries the signature of the signal. However, there are certain drawbacks to this strategy. List the disadvantages of spread spectrum system.  
(CO1,CO4,CO3,CO2,CO5) [Knowledge]
2. Quantization is the process of mapping continuous infinite values to a smaller set of discrete finite values. In a Pulse Code Modulation (PCM) system, quantization plays a very important role in converting the amplitude of an analog signal to finite digital values. In an experiment, let the number of quantization levels and the number of bits per word in a PCM system is represented as  $L$  and  $n$  respectively. Express a mathematical relationship between these two parameters.  
(CO5,CO4,CO3,CO2,CO1) [Knowledge]
3. Quadrature Phase Shift Keying (QPSK) is a multilevel phase modulation technique, in which the input binary bits are divided into a group of two bits (known as dibits), Each dibit is transmitted by a specific value of phase. QPSK method outperforms all the earlier modulation methods in terms of efficiency, robustness and usage. List atleast three advantages of QPSK over Binary Phase Shift Keying (BPSK) modulation.  
(CO4,CO5,CO2,CO3,CO1) [Knowledge]
4. A bandpass signal is a signal, comprising of a band of frequencies, whose lowest frequency is not zero. Examples of such signal are that comes out of a bandpass filter. A continuous-time bandpass signal has an upper frequency of 12 kHz and lower frequency of 6 kHz. It is sampled ideally at Nyquist rate by an impulse train, for digital signal transmission. What could be the spacing between the samples, in sec.  
(CO1,CO5,CO4,CO3,CO2) [Knowledge]
5. Owing to the reason of different hostile circumstances, predominantly in a multipath consequence, it is not always likely to sample a continuous-time signal at Nyquist rate for digital transmissions. Therefore, the signal become under-sampled, and the phenomenon of spectral folding or aliasing occurs. Elucidate concisely with a simple figure the occurrence of aliasing.  
(CO4,CO2,CO1,CO5,CO3) [Knowledge]

## PART B

ANSWER ALL THE QUESTIONS

5 X 10M = 50M

6. Ability to transmit simultaneous of RF signals without interference or noise, still remains a challenge among the communication engineers for both analog and digital systems. Transmission of various analog signals simultaneously mostly employ Frequency Division Multiplexing (FDM), while in digital communications, 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.

(CO3) [Comprehension]

7. Calculation of signal-to-noise ratio (SNR) value in dB is one of the most important requirement 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.

(CO4) [Comprehension]

8. Binary Phase Shift Keying (BPSK) was one of the most accepted and popular technique of passband digital modulation before the advent of quadrature modulation methods. However, BPSK still finds suitable application in cheap, low speed data communication systems. In a trial investigation, an 8-bit binary bit stream  $b(t) = 10110011$  requires to be passband transmitted by BPSK modulation over a distance in space. (a) Draw the non-return-to-zero (NRZ) waveform of  $b(t)$ . (b) Draw the corresponding BPSK signal waveform.

(CO4) [Comprehension]

9. Binary Amplitude Shift Keying (BASK) was developed, similar to Amplitude Modulation (AM) method (actually DSB-SC) and it is one of the earliest techniques 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) Draw a block diagram of BASK transmitter and a non-coherent BASK detector.

(CO4) [Comprehension]

10. Pulse Code Modulation (PCM) system transmits all the bits which are used to code a quantized sample. Hence, transmission channel bandwidth and signaling rate required are very high in PCM. To overcome this problem, Delta Modulation (DM) is used. (a) Draw the block diagram representations of a DM transmitter and receiver. (b) List the advantages and drawbacks of Delta Modulation scheme.

(CO5) [Comprehension]

## PART C

ANSWER ALL THE QUESTIONS

2 X 20M = 40M

11. 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.

(CO4) [Application]

12. One of the simplest forms of frequency deviation is achieved by binary frequency shift keying, also known as BFSK. This technique employs two distinct frequencies to represent binary values. By shifting between these two frequencies, BFSK allows for the transmission of digital information. (a) With suitable illustrative block diagrams BFSK generator and coherent detector, together with waveforms, explain 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.

(CO5) [Application]