



**MAULANA ABUL KALAM AZAD UNIVERSITY OF
TECHNOLOGY, WEST BENGAL**

Paper Code : EC-601

DIGITAL COMMUNICATION

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for and any ten of the following : 10 × 1 = 10
- i) In the present day standard digital voice communication, the amplitude of the voice signal is sampled at a rate of around
- 2000 samples/sec
 - 800 samples/sec
 - 16000 samples/sec
 - 8000 samples/sec.
- ii) Which of the following modulation is digital in nature ?
- PAM
 - PPM
 - DM
 - None of these.
- iii) Quantization noise occurs in
- PAM
 - PWM
 - DM
 - None of these.

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- iv) Pulse stuffing is used in
- Synchronous TDM
 - Asynchronous TDM
 - Any TDM
 - None of these.
- v) The main advantage of PCM is
- less bandwidth
 - less power
 - better performance in presence of noise
 - possibility of multiplexing.
- vi) The number of bits per sample in a PCM system is increased from 8 to 16. The bandwidth of the system will increase
- 8 times
 - 2 times
 - $\frac{1}{2}$ time
 - 2^8 times.
- vii) The line code that has zero d.c. component for pulse transmission of random Binary data is
- UP-NRZ
 - UP-RZ
 - BPRZ-AMI
 - BPNRZ.
- viii) Flat-top sampling leads to
- an aperture effect
 - Aliasing
 - loss of the signal
 - none of these.
- ix) The main advantage of TDM over FDM is that it
- needs less power
 - needs less bandwidth
 - needs simple circuitry
 - gives better S/N ratio.
- x) A PAM signal can be detected by using
- an ADC
 - an integrator
 - a bandpass filter
 - a highpass filter.
- xi) Which of the following gives the minimum probability of error ?
- ASK
 - FSK
 - PSK
 - DPSK.

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GROUP - B**(Short Answer Type Questions)**Answer any *three* of the following $3 \times 5 = 15$

2. Describe the basic principle of optimum correlation receiver.
3. Write the statement of sampling theorem and derive the expression of interpolation formula regarding reconstruction from sampled signal. $1 + 4$
4. a) What is line coding ? Write down the desirable properties of a line code.
b) Given the data stream 1110010, sketch the transmitted sequence of rectangular pulses for each of the following line codes format :
i) AMI
ii) Manchester NRZ. $(1 + 2) + 2$
5. With a neat block diagram, explain the modulation and demodulation of BPSK.
6. Describe Gram-Schmidt orthogonality technique.

GROUP - C**(Long Answer Type Questions)**Answer any *three* of the following. $3 \times 15 = 45$

7. a) Draw a practical Linear Delta Modulator (LDM) circuit and explain its operation.
b) Explain the limitations of LDM.
c) How limitations of LDM are overcome in ADM ?
d) Determine the output SNR of a LDM system for 2 kHz sinusoidal input signal sampled at 64 kHz. Slope overload distortion is not present and reconstruction filter has a bandwidth of 4 kHz. $5 + 4 + 3 + 3$
8. a) A PCM system uses a uniform quantizer followed by an n bit encoder. Show that if the input to the system is a sinusoidal signal then SNR is approximately given by $(1.8 + 6n)$ dB.
b) Explain the role of companding in pulse code modulation.

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- c) The information in an analog signal waveform is to be transmitted over a PCM system with an accuracy of $\pm 0.1\%$ (full scale). The analog voltage waveform has a BW of 100 Hz and an amplitude range of -10 to $+10$ volts. Find the number of bits in each PCM word. Also find the minimum bit rate in the PCM signal and minimum transmission bandwidth required. $5 + 4 + 6$
9. a) What is Inter Symbol Interference (ISI) ?
b) What is Nyquist criterion for zero ISI ?
c) What are the limitations of ideal solution and how it can be solved with Raised Cosine pulse ?
d) A communication channel of bandwidth 75 kHz is required to transmit binary data at a rate of 0.1 Mbps using raised cosine pulses. Determine the roll off factor α . $3 + 3 + 5 + 4$
10. a) Draw the block diagram for generation and non-coherent detection of BFSK signal and explain the principle.
b) In a communication system a QPSK transmitter is used to transmit the data generated by a DM system which takes 10 kHz sinusoidal input and samples it at a rate 4 times greater than the Nyquist rate. Determine the bit rate of DM system and baud rate of output QPSK symbol.
c) What is the difference between MSK and QPSK ? $8 + 4 + 3$
11. Write short notes on any *three* of the following : 3×5
a) Orthogonal Frequency Division Multiplexing
b) Matched Filter
c) Eye pattern
d) Zero forcing equalizer
e) Minimum Shift Keying (MSK).

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