

B.TECH/ECE/5TH SEM/ECEN 3105/2018
DIGITAL COMMUNICATION
(ECEN 3105)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

***Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.***

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**
 - (i) In digital transmission, the modulation technique that usually requires minimum bandwidth is
(a) Delta modulation (b) PCM (c) DPCM (d) PAM.
 - (ii) Use of non - uniform quantization leads to
(a) reduction in transmission bandwidth
(b) increase in maximum SNR
(c) increase in SNR for low level signals
(d) simplification in quantization process.
 - (iii) Which of the following digital modulation techniques is used for GSM mobile system?
(a) PSK (b) O-QPSK (c) MSK (d) GMSK.
 - (iv) PCM generation requires an LPF at the beginning to
(a) eliminate quantization noise (b) eliminate aliasing effect
(c) eliminate decoding noise (d) none of these.
 - (v) If the number of bits per sample in a PCM system is increased from 5 to 7, the increase in signal to quantization noise ratio will be
(a) 8 (b) 16 (c) 32 (d) 64.
 - (vi) A rectangular pulse of duration T is applied to a matched filter. The output of the filter is
(a) rectangular pulse of duration T
(b) rectangular pulse of duration 2T
(c) triangular pulse
(d) sine function.
 - (vii) The width of the main lobe of the PSD gives the bandwidth of MSK signal and is given by _____ times the baseband frequency (f_b)
(a) 0.5 (b) 0.25 (c) 0.75 (d) 2.0.

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- (viii) The spectral density of a real valued random process has
(a) an even symmetry
(b) an odd symmetry
(c) a conjugate symmetry
(d) no symmetry.
- (ix) In eye pattern, as eye closes,
(a) ISI increases (b) ISI decreases
(c) timing jitter increases (d) timing jitter decrease
- (x) In QPSK, the transmission bandwidth required is
(a) f_b (b) $2 f_b$ (c) $f_b/2$ (d) $4 f_b$
where f_b = Bit frequency

Group – B

2. (a) Describe flat-top sampling. What is aperture effect?
(b) Define quantization noise.
The amplitude of a sinusoid signal is 5V. If the SNR required in uniform quantization of the signal is 43.5 dB, find the step size.
(c) 12 telephone channels, each band limited to 4 KHz, are to be time division multiplexed by using PCM. Calculate the bandwidth of the PCM system for 128 quantization level and an 8 KHz sampling frequency.
 $(2 + 1) + (2 + 4) + 3 = 12$
3. (a) Discuss the advantage of DPCM over PCM.
(b) Explain the limitations of DM. How such limitations can be overcome in ADM?
(c) A DM system is designed to operate at 8 times the Nyquist rate for a signal with 4 KHz bandwidth and $\Delta = 200$ mV.
(i) Determine the maximum amplitude of 1 KHz input sinusoid for which the DM system does not show slope overload.
(ii) Determine the output signal to quantization noise ratio.
 $2 + (3 + 2) + (3 + 2) = 12$

Group – C

4. (a) Why pulse shaping is required in digital communication?
(b) Explain Nyquist criterion for zero ISI.
(c) A message signal of 2 KHz bandwidth is transmitted using PCM. Quantization error is 1% of m_p . Roll off factor = 0.2, sampling rate is 25% above Nyquist rate. Determine the transmission bandwidth.
(d) Draw the block diagram of the zero forcing equalizer.
 $3 + 3 + 3 + 3 = 12$

5. (a) What is line coding? Write down the desirable properties of a line code.
- (b) To transmit a bit sequence of 11001, draw the resulting waveform using following line code format (i) Polar-RZ(ii) AMI (iii) Manchester Coding.
- (c) Explain the operation of Regenerative Repeater in baseband data transmission.

(1 + 3) + 3 + 5 = 12

Group – D

6. (a) “In Integrate & Dump type filter, the integrator enhances the signal relative to the noise and this enhancement’ increases with bit duration (T)” :- justify the statement.
- (b) Find the transfer function of an optimum filter.

4 + 8 = 12

7. (a) What is the significance of the term ‘matched’ in matched-filter ?
- (b) Starting from $\eta_{\max} = \frac{2}{N_0} \int_{-\alpha}^{\alpha} |G(f)|^2 df$ show that maximum SNR of a matched filter is independent of signal shape but depends only on the signal energy. Symbols have their usual meaning.
- (c) For the given signals, sketch the impulse responses of the filter matched to these signals.



- (d) Describe the operation of an Integrate & Dump filter.

2 + 5 + 2 + 3 = 12

Group – E

8. (a) The bit rate for the digital system is 34 Mbps. For QPSK modulation scheme, what is the baud rate?
- (b) For a bit sequence of 100110, draw the resulting waveform for QPSK modulation scheme.
- (c) With suitable diagram, explain the working principle of QPSK transmitter. Draw its signal space diagram.
- (d) What are the advantages of OQPSK over QPSK.

1 + 2 + (5 + 1) + 3 = 12

9. (a) With a suitable block diagram, explain the principle of BFSK modulator and demodulator.
- (b) A binary data stream 0010010011 is to be transmitted using DPSK. Show the encoding & decoding sequences.

7 + 5 = 12