

AMIETE – ET (Current & New Scheme)

Time: 3 Hours

June 2019

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. Two orthogonal signals $S_1(t)$ and $S_2(t)$ satisfy the relation:

$$\begin{array}{ll} \text{(A)} \int_0^T S_1(t)S_2(t)dt = 0 & \text{(B)} \int_0^T S_1(t)S_2(t)dt = 1 \\ \text{(C)} \int_0^T S_1(t)S_2(t)dt = \infty & \text{(D)} \int_0^T S_1(t)S_2(t)dt = \pi \end{array}$$

b. Amount of information in a continuous signal is :

- (A) Zero (B) 2 bits
(C) 4 bits (D) Infinite

c. Quadrature multiplexing is a form of:

- (A) TDM (B) FDM
(C) TDM & FDM (D) None of these

d. The capacity of a channel is :

- (A) Number of digits used in coding
(B) Volume of information it can take
(C) Maximum rate of information transmission
(D) Bandwidth required for information

e. The signal to quantization noise ratio in a PCM system depends on

- (A) Sampling rate (B) No. of quantization levels
(C) Message signal bandwidth (D) None of these

f. In PCM system output S/N increases:

- (A) Linearly with bandwidth (B) Exponentially with bandwidth
(C) Inversely with bandwidth (D) None of these

g. A signal of maximum frequency of 10 kHz is sampled at Nyquist rate. The time interval between two successive samples is:

- (A) $100\mu\text{s}$ (B) $50\mu\text{s}$
(C) $1000\mu\text{s}$ (D) $5\mu\text{s}$

- h. Entropy is basically a measure of :
- (A) Rate of information (B) Average of information
 (C) Probability of information (D) Disorder of information
- i. If the sampling time is less than the Nyquist interval :
- (A) Simple filter can be used to obtain the original signal
 (B) Bandwidth increases
 (C) Channel capacity increases
 (D) Guard time become less
- j. Compander are used in communication system to:
- (A) compress bandwidth (B) improve frequency response
 (C) improve signal to noise ratio (D) All of these

**Answer any FIVE Questions out of EIGHT Questions.
 Each question carries 16 marks.**

- Q.2** a. Draw and explain coherent binary phase shift keying transmitter and Receiver. Also plot its constellation diagram and determine minimum distance between its constellation points. (8)
- b. Explain generation and detection of QPSK scheme. (8)
- Q.3** a. Consider the signals $S_1(t), S_2(t), S_3(t)$ and $S_4(t)$ defined as follows.
- $$S_1(t) = \begin{cases} 1 & \text{for } 0 \leq t \leq T/3 \\ 0 & \text{otherwise} \end{cases} \quad S_2(t) = \begin{cases} 1 & \text{for } 0 \leq t \leq 2T/3 \\ 0 & \text{otherwise} \end{cases}$$
- $$S_3(t) = \begin{cases} 1 & \text{for } T/3 \leq t \leq T \\ 0 & \text{otherwise} \end{cases} \quad S_4(t) = \begin{cases} 1 & \text{for } 0 \leq t \leq T \\ 0 & \text{otherwise} \end{cases}$$
- Using the Gram-Schmidt orthogonalization process find an orthogonal basis for this set of signals. (8)
- b. Determine the impulse response of matched filters. (8)
- Q.4** a. What is Pseudo noise sequence? (4)
- b. A pseudo noise sequence is generated using a feedback shift register of length $m = 4$. The chip rate is 10^7 chips per second. Find (i) PN sequence length. (ii) chip duration of PN sequence. (iii) PN sequence period. (8)
- c. Write properties of Maximal-Length Sequence. (4)
- Q.5** a. Show that discrete pulse amplitude modulation is efficient scheme in terms of power and bandwidth utilization. (8)
- b. Intersymbol interference (ISI) is a major source of bit error in a baseband pulse transmission system, explain mathematically. (8)

- Q.6** a. State and prove sampling theorem for low pass signal and band pass signal. (8)
- b. How TDM system introduces a bandwidth expansion? Explain with the help of neat diagram. (8)
- Q.7** Write short note on any two of the following (8+8)
- (i) Digital Multiplexer
(ii) Light wave Transmission
(iii) CDMA
- Q.8** a. What is Compression Law? What type of companding circuitry is used in actual PCM systems? (5)
- b. A PCM systems uses a uniform quantizer followed by a 7-bit binary encoder. The bit rate of the system is equal to 50×10^6 b/s.
(i) What is the maximum message bandwidth for which the system operates satisfactorily? (5)
(ii) Determine the output signal to (quantization) noise ratio when a full load sinusoidal modulating wave of frequency 1 MHz is applied to the input. (6)
- Q.9** a. A computer executes four instructions that are designated by the code words (00, 01, 10, 11). Assuming that the instructions are used independently with probabilities (1/2, 1/8, 1/8, 1/4), calculate the percentage by which the number of bits used for the instructions may be reduced by the use of an optimum source code. Construct a Huffman code to realize the reduction. (10)
- b. What is transition probability of Binary Symmetric Channel? List the theoretical and practical importance of Binary Symmetric Channel. (6)