

**AMIETE – ET (NEW SCHEME)**

Time: 3 Hours

**DECEMBER 2011**

Max. Marks: 100

**NOTE: There are 9 Questions in all.**

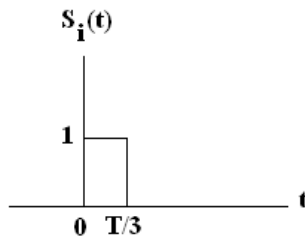
- Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.
- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will 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. Consider a discrete memoryless source with source alphabet  $S = \{s_0, s_1, s_2\}$  with probabilities  $\frac{1}{4}, \frac{1}{4}$  &  $\frac{1}{2}$  respectively. The entropy of the source is
- (A)  $\frac{3}{4}$  bit/symbol                      (B)  $\frac{3}{2}$  bit/symbol  
(C)  $\frac{2}{3}$  bit/symbol                      (D) 1 bit/symbol
- b. The sample and hold circuit, in its ideal form, produces an output waveform that represents a \_\_\_\_\_ interpolation of original analog signal.
- (A) flat                                      (B) ramp  
(C) staircase                              (D) unit step
- c. The Impulse response of matched filter to input  $s(t)$  is
- (A)  $s(T)$                                       (B)  $s(t - T)$   
(C)  $s(T - t)$                               (D)  $s^2(T)$
- d. One way to study inter symbol interference in a data transmission system is:
- (A) Constellation diagram              (B) ESD  
(C) PSD                                      (D) EYE diagram
- e. The auto correlation of AWGN is
- (A) Gaussian                              (B) Impulsive  
(C) Sinc function                          (D) None of the above

f. The energy of the signal

- (A)  $3T$
- (B)  $T/3$
- (C)  $T$
- (D)  $1/3$



g. The autocorrelation of PN sequence must be

- (A) as high as possible
- (B) as low as possible
- (C) both (A) & (B)
- (D) None of the above

h. A data transceiver to modulate & demodulate a signal is commonly referred to as

- (A) Repeater
- (B) Generator
- (C) Automodulator
- (D) Modem

i. The minimum sampling rate for the signal  $x(t) = \cos(200\pi t) \cdot \cos(100\pi t)$  is

- (A) 200 samples/sec
- (B) 400 samples/sec
- (C) 50 samples/sec
- (D) 100 samples/sec

j. Modulation is defined as a process in which characteristics of

- (A) modulating wave is varied in accordance with carrier
- (B) Carrier is varied in accordance with modulating wave
- (C) Both are varied in accordance with each other
- (D) None is varied

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

**Q.2** a. State and prove Shanon's Channel Capacity theorem (8)

b. Consider a sequence of symbols & alphabet with their probabilities of occurrence given here. Compute Huffman code for this alphabet. Find the average code word length and variance of average codeword length over the ensemble of letters (8)

Symbol	$S_0$	$S_1$	$S_2$	$S_3$	$S_4$
Probability	0.55	0.15	0.15	0.10	0.05

**Q.3** a. Compare natural sampling, instantaneous sampling and flat-top sampling techniques. (8)

- b. Write short note on:  
 (i) Pulse Amplitude Modulation  
 (ii) TDM (8)
- Q.4** a. Explain Delta Modulation. Draw their Transmitter & Receiver. Also obtain its SNR. (8)
- b. Compact disk records audio signals digitally using PCM. The audio signal BW is 15 kHz  
 (i) What is the Nyquist rate?  
 (ii) If  $M=65536$ , determine the number of binary digits required to encode a sample.  
 (iii) Determine the no. of bits/sec required to encode an audio signal.  
 (iv) Practical CD's use 44100 samples per second, if  $M$  is same again, determine the no. of bits/sec required to encode the samples.  
 (v) What is the SNR? (8)
- Q.5** a. What is waveform coding? Discuss its salient features. Represent 01100110 in unipolar NRZ, AMI, bipolar NRZ and Manchester format. (8)
- b. What is a duobinary signalling scheme? Depict using a block diagram. Show the impulse response of a duobinary conversion filter. (8)
- Q.6** a. Draw a signal space diagram for coherent QPSK system & FSK system. (4)
- b. Let  $P_{eI}$  and  $P_{eQ}$  denote the probabilities of symbol error for the inphase and quadrature channels of a band-pass system. Show that the average probability of symbol error for the overall system is given by  $P_e = P_{eI} + P_{eQ} - P_{eI} P_{eQ}$  (8)
- c. Compare QPSK and MSK. (4)
- Q.7** a. Explain a Matched Filter Receiver & give its properties. (10)
- b. Explain a maximum likelihood detectors. (6)
- Q.8** Write short notes on any **TWO**  
 (i) PN sequence  
 (ii) Comparison of slow FHSS and fast FHSS.  
 (iii) Comparison of FHSS and DSSS (8+8)
- Q.9** a. Describe the adaptive equalization techniques used in data transmission. (8)
- b. List any five applications of spread spectrum modulation. (8)