

AMIETE – ET (Current Scheme)

Time: 3 Hours

JUNE 2015

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. The minimum sampling rate for the signal, $x(t) = 10 \cos(100\pi t) \cdot \cos(250\pi t)$ is
- (A) 350 samples/sec (B) 250 samples/sec
(C) 100 samples/sec (D) 500 samples/sec
- b. The average code word length of a discrete memoryless source is 1.8 bits/source-symbol and entropy is 1.5 bits/symbol. The efficiency of the source encoder is _____
- (A) 12% (B) 83%
(C) 18% (D) 15%
- c. 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
- d. The minimum transmission bandwidth of the T1 carrier system is _____
- (A) 1544 kHz (B) 772 kHz
(C) 2048 kHz (D) 1234 kHz
- e. The major function of a PN sequence for use in spread spectrum system is to
- (A) Remove the noise
(B) Spread the bandwidth of message signal
(C) To convert analog to digital signal
(D) To allow frequency hopping
- f. The auto correlation of AWGN is _____
- (A) Gaussain (B) Impulsive
(C) Sinc Function (D) None of these

- g. The only one signal waveform that produces zero inter symbol interference (ISI) is _____
- (A) $\sin(2\pi B_0 t)$ (B) $\cos(2\pi B_0 t)$
 (C) $\text{sinc}(2B_0 t)$ (D) $\sin(B_0 t)$
- h. A data transceiver to modulate & demodulate a signal is commonly referred to as _____
- (A) Repeater (B) Generator
 (C) Automodulator (D) Modem
- i. The asymptotic value of E_b/N_0 required to achieve the data rate equal to the channel capacity when the channel bandwidth tends to infinity is equal to _____
- (A) -1.6 dB (B) -3dB
 (C) 0 dB (D) infinite
- j. The PDF of envelope of narrow band noise is :
- (A) Uniform (B) Gaussain
 (C) Very large (D) Coherent detector

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

- Q.2** a. Explain the Huffman encoding algorithm. Using this algorithm compute the Huffman code for a discrete memoryless source. The source has an alphabet of five symbols with their probabilities given below:

Symbol	s_1	s_2	s_3	s_4	s_5
Probability	0.55	0.15	0.15	0.1	0.05

Find the coding efficiency. (10)

- b. Define channel capacity. Derive an expression for the channel capacity of a binary symmetric channel. (6)

- 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. Represent 0110100010 in NRZ unipolar format, Non return to zero polar format, Non return to zero bipolar format & Manchester. What is the advantage of Manchester coding over other types? (8)

- b. What is Eye Pattern? Explain the eye pattern with the help of distorted binary wave. (8)

- Q.5** a. (i) The BPSK modulation is used in a channel that adds white noise with single-sided PSD $N_0 = 10^{-10}$ W/Hz. Calculate the amplitude A of the carrier signal to give $P_e = 10^{-6}$ for a data rate of 100 Kbps. **(4)**
- (ii) Find E_b/N_0 in dB to provide $P_e = 10^{-6}$ for BPSK and coherent FSK. **(4)**
- b. What is a CPFSK modulation scheme? How it is related with the MSK modulation scheme? Explain MSK transmission and reception. **(8)**
- Q.6** a. Explain the quantization error and derive an expression for maximum signal to noise ratio in PCM system that uses linear quantization. **(8)**
- b. Discuss the methods of implementing adaptive equalizers. **(8)**
- Q.7** a. What is frequency hop spread spectrum? Differentiate and illustrate the slow frequency hopping & fast frequency hopping. **(8)**
- b. Determine the processing gain & jamming margin in a DSSS system, given $T_b = 4.095$ m-sec, $T_c = 1$ μ sec. Assume a maximum of $P_e \leq 10^{-5}$. Also find number of feedback stages required. **(8)**
- Q.8** a. What is a matched filter? Derive the condition for maximum output of a matched filter. **(10)**
- b. Write short note on detection of signals with unknown phase in noise. **(6)**
- Q.9** Write short note on:
 (i) Light wave transmission link
 (ii) Digital Radio **(8+8)**