ROLL NO. _____

Code: AE21 **Subject: DIGITAL COMMUNICATIONS**

AMIETE – ET (OLD SCHEME)

Time: 3 Hours **OCTOBER 2012** **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. Source encoding is required to

(A) secure the data
(B) to convert binary output into symbol sequence
(C) eliminate or reduce the redundancy in the message
(D) to provide wireless communication

b. Entropy is defined as

(A) average information per message
(B) information per bit
(C) information and work
(D) $\log_b \frac{1}{P(x_i)}$ where $P(x_i)$ is probability of occurrence of message x_i

c. The sampler can be described by

(A) $S(t) = \delta(t - nT_s)$ **(B)** $S(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT_s)$

(C) $S(t) = \delta(t)$ **(D)** $\delta(t - T_s) = 0$

d. In delta modulation, the incoming message signal is over sampled i.e. the sampling rate is much higher than Nyquist rate. This is done to

(A) increase the correlation between input samples of signal
(B) to reduce bit rate
(C) to increase bandwidth
(D) to corrupt the signal

e. More is the eye opening in eye diagram:

(A) more is the distortion **(B)** less is the distortion
(C) more is the sampling time **(D)** less is the sampling time

f. In differential PSK

(A) changes in frequency of carrier contains the transmitted information
(B) changes in amplitude of carrier contains the transmitted information
(C) the shifting levels contain transmitted information
(D) changes in phase of carrier contains the transmitted information

g. The output Signal to Noise Ratio, $(\text{SNR})_o$ of matched filter depends only on

(A) Ratio of input noise to output noise
(B) Ratio of output noise to power spectral density of white noise at I/P
(C) Ratio of signal energy to power spectral density of white noise at I/P
(D) Correlation of input signal to output signal

h. Processing Gain i.e. the interference and Noise Immunity tolerance of a spread spectrum system is a function given by

(A) $G_P = \frac{B_T}{B_M}$ **(B)** $G_P = \frac{B_M}{B_T}$

(C) $G_P = \frac{2B_T}{B_M}$ **(D)** $G_P = \frac{1}{2}\frac{B_M}{B_T}$

Where B_T = bandwidth of transmitted signal.
B_M = bandwidth of message signal.

i. A Pseudo-Noise Sequence is defined as:

(A) White Noise
(B) Codes having non-uniform distance properties
(C) Zero codes
(D) Coded sequence of 1's & 2's with certain auto-correlation properties

j. A zero memory source generates two messages with probability 0.8 and 0.2. These are coded as 1 and 0.2. The code efficiency is

(A) 0.2 **(B)** 0.5
(C) 0.7 **(D)** 1.0

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

Q.2 a. Explain DM system. Also discuss the slope overload distortion and granular noise present in it. Find the signal amplitude for the maximum slope overload error in a DM system. If the step size is 1V with a repetition period of 1msec. the information signal frequency of 100 Hz. **(8)**

b. A waveform, $x(t) = 10\cos\left(1000t + \frac{\pi}{3}\right) + 20\cos\left(2000t + \frac{\pi}{6}\right)$ is to be uniformly sampled.
(i) What is the maximum allowable time interval between sample values that will ensure perfect signal reproduction?
(ii) If we want to reproduce one hour of this waveform how many sample values need to be stored? **(8)**

Q.3 a. Explain the necessity of syndrome decoding. Also calculate the syndrome vector. **(8)**

b. With a neat sketch for illustration, explain the encoding of a cyclic code in systematic form with an (n-k) – Stage Shift Register. **(8)**

Q.4 a. Explain 'TURBO CODES' and compare its performance with convolutional codes. **(8)**

b. A decimal number N was transmitted using seven bit even parity Hamming code. After transmission, it was received as 1101101. Is there any error introduced during transmission? What is the value of N? **(8)**

Q.5 a. Derive an expression for output signal to quantization noise ratio in commercial PCM system. **(8)**

b. Compare QPSK and MST digital modulation. **(8)**

Q.6 a. What is a matched filter? What is probability of error in a matched filter? Give any two properties of matched filter. **(8)**

b. What is eye pattern? Explain how it is helpful in understanding ISI problem? **(8)**

Q.7 a. Give a few applications of spread spectrum techniques. **(8)**

b. A PN sequence is implemented by using a feedback shift register of length 8. If the chip rate is 10^{10} chips/sec, determine the PN sequence length, chip duration and PN sequence period. **(8)**

Q.8 a. Why do we need digital modulation techniques? **(4)**

b. Differentiate coherent and non-coherent techniques? **(4)**

c. Draw block diagram of DPSK transmitter and receiver and explain it. **(4)**

c. What is probability of error in ASK? **(4)**

Q.9 Explain any **TWO** of the following:

(i) Algorithm for decoding of convolutional codes.
(ii) Frequency hopping.
(iii) M-ary Quadrature amplitude modulation. **(8+8)**