ROLL NO. _____

Code: AE67 Subject: DIGITAL COMMUNICATIONS

AMIETE – ET (NEW SCHEME)

Time: 3 Hours **JUNE 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. If g(t) is a dirac delta function, its Fourier transform G(f) will be

(A) $e^{-j2\pi ft}$ (B) 1

(C) $\sin^2(ft)$ (D) $\frac{1}{a + j\omega}$

b. Bandwidth of MSK i.e Minimum Shift Keying is

(A) f_b (B) $2f_b$

(C) $1.5\ f_b$ (D) $f_b/2$

c. The $(S/N)_q$ of a delta modulation at a bit rate of 64 kbps and (base and signal) BW of 4 kHz is

(A) 22 dB (B) 20 dB
(C)12 dB (D) 40 dB

d. 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

e. Higher is the probability of occurrence of an event

(A) Higher is the information associated with it
(B) Zero is the information associated with it
(C) Higher the failure
(D) Lesser is the information associated with it.

f. Shannon's-Hartley law is

(A) C=B log(1+S/N) bits/sec **(B)** B=C log(1+S/N) bits/sec

(C) $C = B\log(\frac{1+S}{N})bits/sec$ **(D)** $C = B\log(\frac{1}{N}+S)bits/sec$

g. The golden rule for encoding messages with unequal probabilities is to

(A) Encode a message with high probability by a longer code word.
(B) Encode all messages with equal length code.
(C) Encode a message with high probability by a shorter code word.
(D) Encode a message by arbitrary choosing variable length codes.

h. The detector that minimizes P_e if $P(S_1) = P(S_2)$ is known as

(A) Ratio detector **(B)** Discriminator
(C) Minimum likelihood detector **(D)** Maximum likelihood detector

i. Aliasing is

(A) Signal interruption **(B)** Bandwidth saving
(C) Signal overlapping or folders **(D)** Multiplexing technique

j. The major problem is a unipolar format of coding is

(A) DC component **(B)** Synchronization
(C) Aliasing **(D)**Complexity

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

Q.2 a. A discrete memoryless source X has five symbols: x_1, x_2, x_3, x_4, and x_5 with $P(x_1)=0.4$, $P(x_2)=0.2$, $P(x_3)=0.2$, $P(x_4)=0.1$ and $P(x_5)=0.1$. Tabulate the code words of the Huffman code for the source & find average code word length. Calculate the entropy. What is your observation? **(10)**

b. Explain in brief Source Coding theorem. **(6)**

Q.3 a. "The process of uniform sampling a signal in the time domain results in a periodic spectrum in the frequency domain with a period equal to sampling rate". Prove it. **(8)**

b. What kind of distortion is introduced in flat top sampling? What is Aperture effect? **(8)**

Q.4 a. What are the three processes involved in PCM? **(4)**

b. What is the maximum value of quantizing error and why? **(4)**

c. Draw block diagram of a Regenerative repeater. **(4)**

d. Show graphically the dependence of probability of error in a PCM receiver on the ratio of peak signal energy to noise power spectral density measured at receives I/P. **(4)**

Q.5 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.6 a. Draw the QPSK modulator & demodulator and find the probability of error in QPSK. Draw the waveforms also. **(8)**

b. For an FSK system, the following data are observed. Transmitted binary data rate=2.5×10^6 bits/sec. Power Spectral Density (PSD) of noise=10^{-20} watts/Hz. Amplitude of received signal=$1\,\mu$V. Determine the average probability of symbol error assuming coherent detection. **(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, $T_c=1\,\mu$sec. Assume a maximum of $P_e\le10^{-5}$. Also find no of feedback stages required. **(8)**

Q.8 a. Consider the signals $S_1(t)$, S_2 (t), $S_3(t)$ and $S_4(t)$ as shown in Fig. 1. Use the Gram Schmidt orthogonalization procedure to find an orthogonal basis for this set of signals. **(8)**

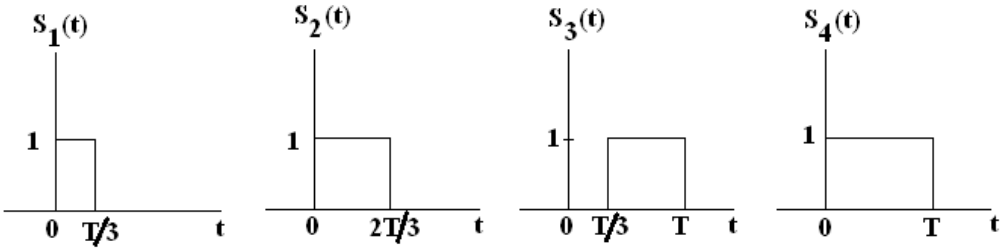

Fig. 1

b. Draw the vector & receiver part of a matched filter and explain its functions. **(8)**

Q.9 Write short notes on any **TWO**:
(i) Code Division Multiple Access
(ii) Multipath Suppression
(iii) Light Wave Transmission Links **(8+8)**