ROLL NO. _____

Code: AE67 Subject: DIGITAL COMMUNICATION

AMIETE – ET

Time: 3 Hours **DECEMBER 2013** **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 flat portion in sampling leads to

(A) Aliasing **(B)** Aperture effect
(C) ISI **(D)** Power loss

b. For 10- bit PCM system, the signal to quantization noise ratio is 62 dB. If the number of bits is increased by 2, then the signal to quantization noise ratio will be

(A) increases by 6 dB **(B)** increases by 12 dB
(C) decreases by 6 dB **(D)** decreases by 12 dB

c. A correlation receiver consists of

(A) a multiplier and an integrator **(B)** an integrator only
(C) a multiplier only **(D)** an adder and integrator

d. If carrier modulated by digital bit stream had one of the possible phases of 0,90,180 and 270 degrees, then the modulation is called

(A) BPSK **(B)** QPSK
(C) QAM **(D)** MSK

e. In a delta modulation system the granular (idling) noise occurs when a

(A) Modulation signals increases rapidly
(B) Pulse rate decreases
(C) Modulating signals remains constant
(D) Pulse amplitude decreases

f. At a given probability of error, binary coherent FSK is inferior to binary co PSK by

(A) 6dB **(B)** -2 dB
(C) 2dB **(D)** 3dB

g. A signal is sampled at 8 kHz and is quantized using 8 bit uniform quantizer. Assuming SNR_q for a sinusoidal signal, the correct statement for PCM signals with a bit rate of R is

(A) R= 32kbps, SNR_q = 25.8dB **(B)** R= 64kbps, SNR_q = 49.8dB
(C) R= 64kbps, SNR_q = 55.8dB **(D)** R= 32kbps, SNR_q = 49.8dB

h. For coherent BPSK, the probability of error is

(A) ½ erfc $\left(\sqrt{\frac{Eb}{2N_o}}\right)$ **(B)** ½ erfc $\sqrt{2Eb}$

(C) ½ erfc $\left(\sqrt{\frac{2Eb}{N_o}}\right)$ **(D)** ½ erfc $\left(\sqrt{\frac{Eb}{N_o}}\right)$

i. For the input signal S(t),which is zero outside the interval of $0 < t < T$, the impulse response of the matched filter is

(A) S(T-t) **(B)** S(t-T)
(C) S(T+t) **(D)** S(t-2T)

j. Maximum length sequence used in a spread spectrum system satisfies the balance property if

(A) number of 1's = number of 0's
(B) number of 1's is one more than number of 0's
(C) number of 1's is one less than number of 0's
(D) number of 1's is independent of number of 0's

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

Q.2 a. With neat block diagram explain the working of digital communication system. **(8)**

b. Define the following terms:
(i) Self information
(ii) Entropy **(4)**

c. A source consists of 5 symbols S_1,S_2, S_3, S_4 and S_5 with probabilities 0.3,0.25, 0.2,0.15 and 0.1 respectively. Obtain Huffman code find the efficiency and redundancy. **(4)**

Q.3 a. State and prove sampling theorem for low-pass signal.

b. Briefly explain Quadrature Sampling of Band – Pass Signals. **(7)**

c. A message signal $m(t)=1 + 2\sin 200\pi t + 4\sin 400\pi t$ is to be sampled at Nyquist rate of sampling. Find the sampling frequency. **(2)**

Q.4 a. With neat diagram explain the working of PCM system. **(6)**

b. Obtain an expression for signal to quantization noise ratio for midtread type PCM system. **(7)**

c. A mid-riser type PCM system has number of quantization level of 1024. Find the number of bits required. If the minimum SNR required is 40db, find the number of bits required. **(3)**

Q.5 a. Explain the role of equalizer in digital communication system. Discuss the adaptive equalization technique used in communication system. **(5)**

b. What is Inter symbol Interference? Derive an expression for ISI in base band transmission. **(6)**

c. A source outputs data at the rate of 50,000 bits/sec. The transmitter uses binary PAM with raised cosine pulse in shaping of optimum pulse width. Determine the bandwidth of the transmitted waveform. Given:

(i) $\alpha = 0$ (ii) $\alpha = 0.25$
(iii) $\alpha = 0.5$ (iv) $\alpha = 0.75$
(v) $\alpha = 1$ **(5)**

Q.6 a. Explain the working of BPSK system and obtain an expression for probability of error in BPSK system. **(10)**

b. Binary data is transmitted at a rate of 106 bits/sec over a microwave link having a bandwidth of 3 MHz. Assume that the noise power spectral density at the receiver input is $\eta/2 = 10^{-10}$ watt / Hz. Find the average carrier power required at the receiver input for coherent PSK and DPSK signalling schemes to maintain $P_e \leq 10^{-4}$. **(6)**

Q.7 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.8 a. Explain in detail the working of Direct – Sequence Spread Spectrum with coherent binary Phase shift Keying. **(8)**

b. Mention the properties of PN sequence. **(4)**

c. A direct sequence spread binary phase shift keying system uses a feedback register of length 19 for the generation of PN sequence. Calculate the process gain of the system. **(4)**

Q.9 Write short note on:

(i) Light wave transmission link **(8)**

(ii) Digital Radio **(8)**