### Code: AE67 Subject: DIGITAL COMMUNICATIONS

## **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.

<b>Q.1</b> Choose the correct or the best alternative in the following:		e correct or the best alternative in the following:	Q.1
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 $(2\times10)$ 

- 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

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- f. At a given probability of error, binary coherent FSK is inferior to binary coherent 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 = 64 kbps,  $SNR_q = 49.8 \text{dB}$
- (C) R = 64 kbps,  $SNR_q = 55.8 \text{dB}$
- **(D)** R = 32kbps,  $SNR_q = 49.8dB$
- h. For coherent BPSK, the probability of error is
  - (A)  $\frac{1}{2}$  erfc  $\left(\sqrt{\frac{\text{Eb}}{2N_0}}\right)$
- **(B)** ½ erfc  $\sqrt{2Eb}$
- (C)  $\frac{1}{2}$  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)

- $(\mathbf{D}) S(t-2T)$
- 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<sub>1</sub>,S<sub>2</sub>, S<sub>3</sub>, S<sub>4</sub> and S<sub>5</sub> with probabilities 0.3,0.25, 0.2,0.15 and 0.1 respectively. Obtain Huffman code find the efficiency and redundancy. (4)

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- **Q.3** a. State and prove sampling theorem for low-pass signal. **(7)** 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. **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. 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  $P_e \le 10^{-4}$ . **(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)**

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

**Q.9** Write short note on:

- (i) Light wave transmission link (8)
- (ii) Digital Radio (8)