ROLL NO.

Code: AE67/AE118 **Subject: DIGITAL COMMUNICATIONS**

AMIETE – ET (Current & New Scheme)

Time: 3 Hours **DECEMBER 2018** **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 probability of error is minimum for
(A) PSK **(B)** ASK
(C) FSK **(D)** MSK

b. When the number of quantization levels is increased from 4 to 256, the bandwidth required for the transmission of PCM signal is increased by a factor of
(A) 3 **(B)** 4
(C) 5 **(D)** 6

c. The bit rate of a digital communication system is 34 Mbit/s. the modulation scheme is QPSK. The baud rate of the system is
(A) 64 Mbit/s **(B)** 34 Mbit/s
(C) 17 Mbit/s **(D)** 8.5 Mbit/s

d. The Nyquist sampling rate for the signal $g(t) = 10\cos(50\pi t)\cos^2(150\pi t)$, where *'t'* is in seconds, is
(A) 150 samples per second **(B)** 200 samples per second
(C) 300 samples per second **(D)** 350 samples per second

e. Eight voice signals, each limited to 4 kHz and sampled at Nyquiat rate are converted into binary PCM signal using 256 quantization levels. The bit transmission rate for the time – division multiplexed signal will be
(A) 8 kbps **(B)** 64 kbps
(C) 256 kbps **(D)** 512 kbps

f. Entropy of N random variables is the _____ of the entropy of individual random variable.
(A) Sum **(B)** Product
(C) Sum of squares **(D)** Average

g. PAM signals can be demodulated by using a
(A) Low pass filter (LPF) alone **(B)** A Schmitt trigger followed by a LPF
(C) A differentiator followed by a LPF **(D)** A clipper followed by a LPF

h. Matched filter
(A) is a non - linear filter **(B)** produces maximum output SNR
(C) Both (A) & (B) **(D)** None of these

i. Spread spectrum signals are used for
(A) Ranging (**B)** Determination of position
(C) Ranging & Determination of position **(D)** None of these

j. Some advantages of spread spectrum are
(A) Low susceptibility **(B)** Immunity to jamming
(C) Reduced interference **(D)** All of these

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

Q.2 a. Explain in detail the Information capacity theorem and derive a mathematical expression for capacity of a discrete – time memoryless Gaussian channel. **(8)**

b. A discrete memoryless source emits seven symbols whose probabilities of occurrence are given as

Symbol	S0	S1	S2	S3	S4	S5	S6
Probability	0.25	0.25	0.125	0.125	0.125	0.0625	0.0625

Compute the Huffman code for this source. **(8)**

Q.3 a. Explain the process of sampling with proper mathematical derivation and diagrams. Draw the spectrum of an under sampled signal and explain aliasing. **(8)**

b. Explain Time Division multiplexing (TDM) with a neat block diagram of a TDM system. **(8)**

Q.4 a. A PCM system uses a uniform quantizer followed by a 7-bit binary encoder. The bit rate of the system is equal to 50×10^6 b/s**.** **(4+4)**
(i) What is the maximum message bandwidth for which the system operates satisfactorily?
(ii) Determine the output signal to quantization noise ratio when a full load sinusoidal modulating wave of frequency 1 MHz is applied to the input.

b. Explain the process of pulse code modulation using a neat block diagram of the basic elements of a PCM system. **(8)**

Q.5 a. Explain the Nyquist's criterion for distortionless baseband binary transmission. **(8)**

b. Explain the Duobinary signaling scheme with a neat block diagram. **(8)**

Q.6 a. Explain Quadrature Phase Shift Keying using proper mathematical expressions and using neat signal space diagrams explain the concept of constellation points and decision boundary. **(8)**

b. What do you mean by Non coherent orthogonal Modulation? Explain it with the help of Generalized binary receiver block diagram for non coherent orthogonal Modulation **(8)**

Q.7 a. With proper mathematical expressions and neat diagrams explain the operation of a correlation receiver. **(8)**

b. Explain the Maximum likelihood decoding principle for a signal corrupted by Additive White Gaussian Noise. **(8)**

Q.8 a. Explain in detail the generation of Pseudo noise sequences and its properties. **(8)**

b. Explain in detail slow and fast frequency hop spread spectrum techniques with necessary mathematical expressions and diagrams. **(8)**

Q.9 a. Explain signal space dimensionality and processing gain. **(8)**

b. Explain direct sequence spread spectrum technique with neat block diagrams. **(8)**