ROLL NO. _____

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

AMIETE – ET (Current & New Scheme)

Time: 3 Hours **June - 2017** **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. A bandpass signal has the spectral range of 20 kHz to 82 kHz. The acceptable range of sampling frequency is
(A) 40 kHz to 164 kHz **(B)** 40 Hz to 164 Hz
(C) 10 kHz to 41 kHz **(D)** 10 Hz to 41 Hz

b. The data rate required to transmit speech whose band is limited to 3.6 kHz PCM channel with 8-bit accuracy is
(A) 57.6 Mbps **(B)** 5.76 Mbps
(C) 57.6 kbps **(D)** 5.76 kbps

c. The entropy of a message source generating 3 messages with probabilities 0.5, 0.25 and 0.25 is
(A) 1 bit/message **(B)** 1.5 bits/message
(C) 1.75 bits/message **(D)** 2 bits/message

d. Mutual information is symmetric and represented as
(A) I(X:Y) = I(Y:X) **(B)** I(X|Y) = I(Y|X)
(C) H(X;Y) = H(Y;X) **(D)** H(X|Y) = H(Y|X)

e. The distortions caused by the use of PAM to transmit an analog information-bearning signal is referred as
(A) Channel noise **(B)** Aperture effect
(C) Slope overload noise **(D)** Granular noise

f. The SNR of a PCM system having 2^8 number of quantization levels is
(A) 5.28 dB **(B)** 52.8 dB
(C) 0.528 dB **(D)** 528 dB

g. To avoid slope overload noise, the condition to be satisfied for step size Δ is
(A) $\frac{Ts}{\Delta} \geq \max\left|\frac{dm(t)}{dt}\right|$ **(B)** $\frac{Ts}{\Delta} \leq \max\left|\frac{dm(t)}{dt}\right|$
(C) $\frac{\Delta}{Ts} \geq \max\left|\frac{dm(t)}{dt}\right|$ **(D)** $\frac{\Delta}{Ts} \leq \max\left|\frac{dm(t)}{dt}\right|$

h. The fourier transform of $rect\left(\frac{t}{T}\right)$ is

(A) sin(fT) **(B)** sinc(fT)
(C) Tsin(fT) **(D)** Tsinc(fT)

i. The height of the eye opening of an eye pattern defines
(A) Jitter **(B)** Time interval
(C) Noise Margin **(D)** Sensitivity to timing errors

j. If R_b is the data rate and B as the Channel bandwidth, then the Bandwidth efficiency η is

(A) $\eta = \frac{R_b}{B}$ bps/Hz **(B)** $\eta = \frac{B}{R_b}$ Hz/bps

(C) $\eta = 2R_b$ bps **(D)** $\eta = \frac{R_b}{2}$ bps

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

Q.2 a. What is autocorrelation function? Give its properties. **(6)**

b. Explain the properties of power spectral density function **(10)**

Q.3 a. Explain Nyquist Criterion for Distortionless Base Band transmission. **(12)**

b. Explain eye pattern. **(4)**

Q.4 a. Explain the Low pass filtering of analog signal using flat top sampling process with necessary waveforms. **(10)**

b. Explain Time Division Multiplexing (TDM). **(6)**

Q.5 a. Explain Delta Modulation (DM) with neat diagram. **(10)**

b. Derive the SNR for PCM systems. **(6)**

Q.6 a. Differentiate between Probability of errors (Pe) and Bit Error Rate (BER). **(6)**

b. Explain Synchronization. **(10)**

Q.7 a. Explain Correlation Receiver. **(8)**

b. Explain Maximum Likelihood Decoding of coherent detection of signals in Noise. **(8)**

Q.8 a. Explain the generation and properties of PN sequences. **(6)**

b. With neat diagram, explain how ranging is achieved using Direct-Sequence Spread Spectrum technique. **(10)**

Q.9 a. What do you mean by Direct-sequence spread coherent binary phase shift keying? Explain it with the help of suitable block diagrams for transmitter and receiver. **(12)**

b. What is processing gain? **(4)**