ROLL NO. _____

**Code: DE63/DE114** **Subject: DIGITAL COMMUNICATIONS**

# DipIETE – ET (Current & New Scheme)

**Time: 3 Hours** **June 2019** **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.**

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**Q.1 Choose the correct or the best alternative in the following: (2×10)**

a. Auto-correlation function $R_X(\tau)$ of a stationary process X(t) is
**(A)** a deterministic function with maximum value at $\tau = 0$
**(B)** a deterministic function which is periodic
**(C)** a stationary random process
**(D)** a periodic stationary process

b. Entropy gives
**(A)** Amount of information
**(B)** Rate of information
**(C)** Measure of uncertainty
**(D)** probability of message

c. As the bandwidth approaches infinity, the channel capacity becomes
**(A)** Infinite **(B)** Zero
**(C)** 1.44 s/η **(D)** One

d. The impulse response, h(t), of a Zero-order holding circuit is
**(A)** an impulse **(B)** a rectangular pulse
**(C)** a triangular pulse **(D)** a sinc pulse

e. A bandlimited low pass signal is sampled at twice its Nyquist rate with $f_S$ = 2000 sps. The signal is bandlimited to
**(A)** 250 Hz **(B)** 1000 Hz
**(C)** 500 Hz **(D)** 2000 Hz

f. In a linear DM system,
**(A)** only granular noise will be present
**(B)** only slope overload noise will be present
**(C)** both granular as well as slope overload noise can be eliminated
**(D)** granular noise will be present but slope overload noise can be avoided by proper design

g. The extent of maximum eye opening in the vertical direction indicates,
**(A)** IS1 **(B)** Timing Sensitivity
**(C)** Zero-crossing jitter **(D)** Noise Margin

h. The signal space diagram of a QPSK system has a dimension of
**(A)** 1 **(B)** 3
**(C)** 4 **(D)** 2

i. For a given set of m signals, using Gram-Schmidt Orthogonalization procedure, n orthonormal signals have been derived where
**(A)** $n = m$ **(B)** $n < m$
**(C)** $n \leq m$ **(D)** $n \geq m$

j. The maximum length of a PN sequence that can be generated using a 4-stage shift register is
**(A)** 15 **(B)** 8
**(C)** 16 **(D)** 4

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

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**Q.2** a. Discuss the various signal processing operations in digital communication with necessary diagram. **(8)**

b. A Gaussian channel has 1 MHz bandwidth, calculate the channel capacity if the signal power to noise spectral density ratio ($s/\eta$) is $10^5$ Hz. Also find the maximum information rate. **(8)**

**Q.3** a. With neat diagram, explain TDM. **(8)**

b. Compare Natural sampling and flat top sampling with necessary equations and waveforms. **(8)**

**Q.4** a. Derive the quantization noise and SNR of a PCM system for sinusoidal input signal. **(8)**

b. With neat diagram, explain Delta Modulation and demodulation process. **(8)**

**Q.5** a. What is an eye pattern? Draw a generalized eye pattern and label the various interpretations possible. **(8)**

b. Perform correlative coding with pre-coder and without pre-coder for the following data bits. **(8)**
`1100011011101`

**Q.6** a. Distinguish between coherent and non-coherent reception. **(4)**

b. What is QPSK? Draw the signal constellation of QPSK scheme and explain how a QPSK signal may be generated. **(12)**

**Q.7** a. With neat diagram, explain Matched filter receiver. **(10)**

b. Explain Gram-Schmidt Orthogonalization procedure. **(6)**

**Q.8** a. With the help of a neat block diagram, explain the working of a DS-SS scheme. **(10)**

b. What are PN sequences? Discuss their characteristics. **(6)**

**Q.9** Write short notes on (**ANY TWO**) **(16)**
(i) Signal Distortion in sampling
(ii) Applications of waveform coding techniques
(iii) Applications of Spread Spectrum Modulations
(iv) Applications of Digital Modulation techniques