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

DiplETE – ET (Current & New Scheme)

Time: 3 Hours   **June 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. Shannon's theorem emphasizes the fact of high reliability because
     (A) code data r is independent of error probability
     (B) code data r need not be zero
     (C) code data r need not exceed unity
     (D) symbol rate R need not be very high

  b. A pulse modulation technique as the width of a constant amplitude pulse is varied proportional to the amplitude of the analog signal at the time the signal is sampled.
     (A) Pulse Duration Modulation   **(B)** Pulse Length Modulation
     (C) Pulse Width Modulation   **(D)** All of these

  c. A source generates 4 messages, then the entropy of the source will be maximum when
     (A) One of the probabilities equal 1 and 2, others are zero.
     (B) All probabilities are equal.
     (C) The probabilities are 2/1, 4/1 and 2/ 1.
     (D) The two of the probabilities are 1/2 each and other is zero.

  d. When a signal is quantized such that the step size S is small in comparison with the peak to peak range of the signal, the mean square quantization error is equal to _____

     (A) S^2 (B) $\dfrac{S^2}{2}$

     (C) $\dfrac{S^2}{12}$ (D) $\dfrac{S^2}{6}$

e. In uniform quantizer, each additional bit provides an SQNR _____ of _____ dB.

(A) Increase, 6   (B) Decrease, 3
(C) Increase, 3   (D) Decrease, 6

f. The capacity of a telephone channel that has an S/N of 2047 if its bandwidth is 3.5 kHz is
(A) 30,000 bits per second   (B) 33,000 bits per second
(C) 35,000 bits per second   (D) 38,500 bits per second

g. Quantizing noise occurs in
(A) TDM   (B) PCM
(C) PAM   (D) CDMA

h. In PCM transmitter system, the steps included are sampling, _____ and encoding.
(A) Decoding   (B) Multiplexing
(C) Regeneration   (D) Quantizing

i. In _____, the amplitude of a carrier consisting of periodic train of rectangular pulses is varied in proportion to sample values of a message signal
(A) PAM   (B) PSK
(C) FSK   (D) ASK

j. Flat top sampling leads to
(A) Aliasing   (B) Amplitude Distortion
(C) Aperture Effect   (D) None of these

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

Q.2   a. A discrete memoryless source with source alphabet $\xi = [s_0, s_1, s_2]$ with the following probabilities:-

$p(s_0) = p_0 = \dfrac{1}{4}$, $p(s_1) = p_1 = \dfrac{1}{4}$ and $p(s_2) = p_2 = \dfrac{1}{2}$.

Then calculate the entropy of the discrete memoryless source.   **(3)**

b. Derive an expression for channel capacity of a discrete memoryless channel.   **(5)**

c. Distinguish between source coding and channel coding, how Huffman codes are generated, give example?   **(8)**

Q.3   a. State and explain the sampling theorem for the band – pass signal. Consider a signal g(t) having the upper cut-off frequency $f_u = 120$ kHz and lower cut-off frequency $f_1 = 70$ kHz.   **(8)**

b. Explain the principle of quadrature sampling of band - pass signal.   **(4)**

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    c. Explain TDM in brief with the help of block diagram. **(4)**

Q.4 a. What is the need of Robust Quantisation? Explain the model of Robust Quantisation. **(8)**

    b. Describe the working of a delta modulation system with neat block diagrams. Obtain an expression for the no slope overload condition in delta modulation system for a sinusoidal input signal. **(8)**

Q.5 a. Explain the working of modified duo binary system with a suitable block diagram. **(8)**

    b. What do you mean by Intersymbol interference? Explain method to reduce it. **(8)**

Q.6 a. Explain the concept of carrier synchronization in PSK. **(8)**

    b. How many message points does a QPSK represent, draw the signal space characteristic of a QPSK. **(8)**

Q.7 a. Explain Gram-Schmidt Orthogonalization procedure with the help of block diagram and mathematical analysis. **(8)**

    b. Write a note on correction receiver. **(8)**

Q.8 a. Explain the DS/BPSK spread spectrum with the help of suitable block diagram. **(8)**

    b. Define spread spectrum and enlist the properties of maximum length sequences. **(8)**

Q.9 a. Write short notes on any **ONE** of the following:- **(8)**
    (i) Digital Communications by Satellite
    (ii) Multipath Suppression

    b. Write applications of spread spectrum modulation. **(8)**