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

DipIETE – ET (Current & New Scheme)

Time: 3 Hours   **December 2016**   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 signal is having a highest frequency component F. The minimum Nyquist rate to recover this signal is _____.
(**A**) 2F   (**B**) 1F
(**C**) 3F   (**D**) 4F

b. It is a process of converting an infinite number of possibilities to a finite number of conditions.
(**A**) Sampling   (**B**) Coding
(**C**) Quantization   (**D**) Aliasing

c. In delta modulation, the output signal to quantization noise ratio $\frac{S_O}{N_q}$ is (N is the number of bits) _____

(**A**) $\frac{3}{\pi^2}N^2$ (**B**) $\frac{3}{\pi^2}N^3$

(**C**) $\frac{3}{\pi}N^2$ (**D**) $\frac{3}{\pi}N^3$

d. The minimum frequency separation such that the pulses are orthogonal is $f_1 - f_0 =$ _____
(**A**) 1/T   (**B**) 2/T
(**C**) 1/2T   (**D**) 0

e. Slope over load distortion occurs in _____.
(**A**) PCM   (**B**) DPCM
(**C**) CVSD ADM   (**D**) Delta modulation

f. A special digital modulation technique that achieves high data rates in limited-bandwidth channels is called _____.
(**A**) Delta modulation
(**B**) Pulse-coded modulation (PCM)
(**C**) Quadrature amplitude modulation (QAM)
(**D**) Pulse amplitude modulation (PAM)

g. In each periods of a maximum- length sequence, the number of 1s more than the number of 0s, this property of maximum- length sequence is called
   (**A**) Run property   (**B**) Balance property
   (**C**) Correlation property   (**D**) Symmetric property

h. For each symbol 1 and 0 in PSK phase of carrier differs by _____ degree.
   (**A**) 45   (**B**) 90
   (**C**) 180   (**D**) 360

i. QAM is represented by:
   (**A**) Change in amplitude   (**B**) Change in phase
   (**C**) Change in phase and frequency   (**D**) Change in amplitude and phase

j. Is it true that Quantizing noise can be reduced by increasing the number of samples per second?
   (**A**) Yes   (**B**) No
   (**C**) not necessarily   (**D**) None of these

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

Q.2 a. A discrete memory less source has an alphabet of five symbols with probabilities 0.4, 0.2, 0.2, 0.1, 0.1 respectively. Compute Huffman code for this source, the average code word length and entropy of this code.   **(8)**

   b. Define the following terms:
      (i) Information   (ii) Entropy   **(4)**

   c. State and explain the channel coding theorem.   **(4)**

Q.3 a. State and prove sampling theorem for low pass signal and band pass signals.   **(10)**

   b. What is the need of sample and hold circuit, how does it help in quantization?   **(6)**

Q.4 a. Explain with the help of a neat block diagram the working of Delta Modulation. Also discuss its advantages over DPCM.   **(8)**

   b. A PCM signal uses a uniform Quantizer followed by a 7 bit binary encoder. The bit rate of the system is equal to 50×10^6 bits/sec.
      (i) What is the maximum message bandwidth for which system operates satisfactory?
      (ii) Calculate the output signal to quantization noise ratio when the full load sinusoidal modulating wave of frequency 1 MHz is applied to the input.   **(8)**

Q.5 a. Explain Inter symbol interference.   **(4)**

   b. Construct NRZ bipolar format for the binary sequence 011010110.   **(4)**

   c. Explain baseband binary data transmission system with diagram.   **(8)**

Q.6 a. Find the probability of error if E_b/N_o requirement is 8dB in the case of BPSK and QPSK. **(8)**

b. Draw the block diagrams of the modulator and demodulator of a differential PSK system and explain its working. The bit stream 10010011 is to be transmitted using DPSK technique. Determine the encoded sequence and transmitted phase sequence. Also find the decoded sequence. **(8)**

Q.7 a. Explain properties of Matched filters. **(8)**

b. The received signal in a binary communication system that employs antipodal signals is $r(t) = s(t) + n(t)$, where $s(t)$ is shown in the figure below and $n(t)$ is AWGN with power spectral density $N_0/2$ W/Hz.

Fig. 1

Obtain the impulse response and output of the matched filter matched to $s(t)$ **(8)**

Q.8 a. Explain Direct Sequence Spread Coherent Binary Phase Shift Keying system with the help of neat block diagrams. **(8)**

b. A feedback shift register PN generator produces a 31-bit PN sequence at a clock rate of 10MHz. What are the equation and graphical form of the autocorrelation function of the sequence? Assume that the pulses have values of ± 1. **(8)**

Q.9 Write short note on any **TWO** of the following : **(8+8)**
(i) Adaptive Equalizers
(ii) Digital Multiplexers
(iii) Eye pattern