ROLL NO. _____

**Code: DE63** **Subject: DIGITAL COMMUNICATIONS**

**DipIETE – ET**

**Time: 3 Hours** **DECEMBER 2014** **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)**

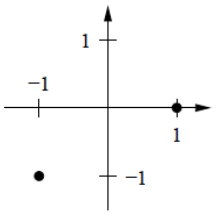
a. A binary code is defined by the generator matrix

$$G = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 \end{pmatrix}$$

The minimum distance of this code is

**(A)** 2 **(B)** 3
**(C)** 4 **(D)** 5

b. A binary modulation scheme uses the following two signal points




_____is the error probability if we communicate over an AWGN channel where the noise has power spectral density N0/2 = 0.2. The receiver uses an ML detector.

**(A)** Q(1.5) **(B)** Q(2.5)
**(C)** Q(3.5) **(D)** none of these

c. 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

d. The bandwidth efficiency of QPSK is

**(A)** 1 bit/sec/Hz **(B)** 1.5 bit/sec/Hz

**(C)** 2 bit/sec/Hz **(D)** 0.5 bit/sec/Hz

e. In uniform quantizer, each additional bit provides an SQNR _____of _____dB.

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

f. In which of the following format spectrum has a dc null.

**(A)** NRZ **(B)** RZ
**(C)** Polar **(D)** Bipolar

g. For a maximal length sequence generated by an n-stage LFSR, how long is the generated maximal length sequence (before it starts repeating)?

**(A)** $2^n$ **(B)** $2^{n-1}$
**(C)** $2^n$-1 **(D)** $2^n$+1

h. _____is the processing gain in DS-SS

**(A)** $T_b/T_c$ **(B)** $T_c/T_b$
**(C)** $T_b * T_c$ **(D)** $T_b - T_c$

i. Correlative coding is a technique by which a transmission speed of ___ is achieved on a channel of bandwidth W by introducing controlled ISI

**(A)** W/2 **(B)** W
**(C)** 1.5W **(D)** 2W

j. Slope over load distortion occurs in _____

**(A)** PCM **(B)** DPCM
**(C)** CVSD ADM **(D)** Delta modulation

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

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**Q.2** a. Draw the bandwidth efficiency curve w.r.t $E_b/N_o$. Compute the value of $E_b/N_o$ required to achieve the data rate equal to the channel capacity if the channel bandwidth tends to infinity . **(8)**

b. 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 the minimum variance and maximum variance Huffman code for this source and the average code word length of each code. . **(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 $f_l$ = 70 kHz. **(8)**

b. Explain TDM in brief with the help of block diagram. A signal $m_1(t)$ is bandlimited to 3 kHz and three other signals $m_2(t)$, $m_3(t)$ and $m_4(t)$ are bandlimited to 1 kHz each. **(8)**
(i) Set up a system for multiplexing the above signals with each signal sampled of its Nyquist rate.
(ii) What is the output rate of commutator?
(iii) What is the speed of commutator in rotations per second?
(iv) Sketch one frame of TDM-PAM signal
(v) If the output of the commutator converted to binary signal with M=256 what is the output bit rate
(vi) Determine the minimum channel bandwidth required for TDM-PCM signal

**Q.4** a. Obtain the expression of SNR of PCM system for a sinusoidal input signal. Hence, determine the bit rate and SNR of PCM of one telephone voice channel. **(8)**

b. Draw and explain the block diagram of delta modulation. Discuss its merits and limitations. **(8)**

**Q.5** a. Explain Inter symbol interference. **(8)**

b. Explain Duo binary signalling. **(8)**

**Q.6** a. Explain the difference between DPSK and PSK. How should PSK senders and receivers be adjusted, if they are to be used for DPSK? Name one advantage of DPSK over PSK and name one advantage of PSK over DPSK. **(8)**

b. Show that probability of error in 16-PSK is higher than 16-QAM. **(8)**

**Q.7** a. Obtain the output of matched filter if input g(t) as shown in Fig.1 is applied **(8)**

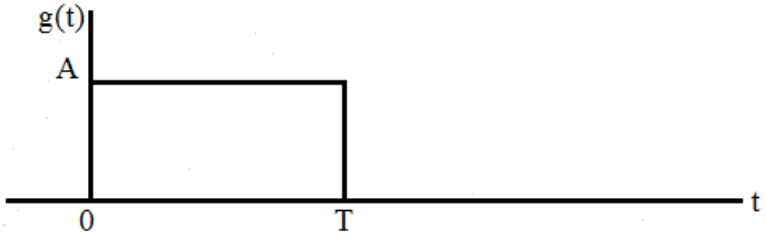


**Fig.1**

b. Explain the correlator receiver. Obtain its signal output and noise output. **(8)**

**Q.8** a. Explain the DS/BPSK spread spectrum with the help of suitable block diagram. **(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: **(2×8)**
(i) Digital Radio (ii) CDMA

(iii) Digital Multiplexer