Code: DE63   **Subject: DIGITAL COMMUNICATIONS**

DipIETE – ET (Current Scheme)

Time: 3 Hours   **JUNE 2015**   **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. The purpose of source encoding is to _____
   (A) increase the information transmission rate
   (B) decrease Signal to Noise Ratio
   (C) decrease the information transmission rate
   (D) decrease probability of error

b. Two messages m_1 and m_2 have a probability of 0.5 each. The entropy is _____
   (A) 0.25   (B) 0.5
   (C) 0.75   (D) 1

c. An analog signal is band limited to 'B' Hz sampled at Nyquist rate and samples are quantized into 4 levels each with probability $\frac{1}{4}$. The information rate is _____
   (A) 4 bits/sec   (B) B bits/sec
   (C) 4 B bits/sec   (D) 0.25 B bits/sec

d. 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) $\frac{3}{\pi}N^3$

e. 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) $\frac{S^2}{2}$

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

f. If carrier is modulated by a digital bit stream having one of the possible phases of $0°, 90°, 180°$ and $270°$, then modulation is called _____

   (A) BPSK   **(B)** QPSK
   (C) QAM   **(D)** MSK

g. In a 4-ary FSK, the frequencies are separated by f_s. Then they are _____

   (A) in phase   **(B)** in phase opposition
   (C) orthogonal   **(D)** none of these

h. Companding is used _____
   (A) to overcome quantizing noise in PCM
   (B) in PCM transmitters, to allow amplitude limiting in the receivers
   (C) to protect small signals in PCM from quantizing distortion
   (D) in PCM receivers, to overcome impulse noise

i. In spread spectrum technique _____

   (A) a modulated signal is modulated again
   (B) a modulated signal is modulated twice again
   (C) the power of a modulated signal is increased
   (D) the noise component of a modulated signal is decreased

j. Which of the following is the application of digital modulation technique?
   (A) CDMA   **(B)** T1 system
   (C) Digital Multiplexers   **(D)** Digital Radio

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

Q.2 a. Draw the block diagram of digital communication system and explain the function of each block.   **(2+5)**

b. 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.   **(4)**

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

Q.3 a. With the help of block diagrams, discuss the reconstruction of a message process from its samples.   **(10)**

b. What is PAM? Explain briefly transmission bandwidth requirement of PAM.
                                                                                   (6)

Q.4 a. What is Delta Modulation? What is its main advantage over DPCM? With the help of block diagrams, explain the operation of DM Transmitter and DM Receiver. **(10)**

b. Draw the basic elements of a PCM system and explain the function of each element briefly. **(6)**

Q.5 a. Explain briefly the power spectra of discrete PAM signals. **(6)**

b. Construct the Manchester format for the binary sequence 0110100011. **(4)**

c. What is the necessity of Eye Pattern? Explain its significance in data transmission system with neat illustrations. **(3+3)**

Q.6 a. With the help of neat sketches, explain QPSK transmitter and receiver. **(8)**

b. Compare the M-ary digital modulation techniques, M-ary PSK, M-ary QAM and M-ary FSK. **(5)**

c. List out the non-coherent binary modulation techniques. **(3)**

Q.7 a. Explain the function of correlation receiver with the help of suitable block diagrams. **(8)**

b. What is meant by non-coherent receiver? Compare the differences between quadrature receiver using correlators and quadrature receiver using matched filters. **(2+6)**

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

b. A spread-spectrum communication system has the following parameters:-
Information bit duration, T_b = 4.095 ms, PN chip duration, Tc = 1 µs and bit energy-to- noise density ratio $\left(\dfrac{E_b}{N_0}\right)$ is10. Then calculate:
   (i)   Processing gain
   (ii) Jamming merging **(2+2)**

c. Draw the block diagram of maximum length sequence generator and explain briefly. **(4)**

Q.9 Write short notes on any **TWO** of the following:-

   (i)   Light Wave Transmission
   (ii) Digital Communications by Satellite
   (iii) Multipath Suppression **(2×8)**