

Roll No. 

--	--	--	--	--	--	--	--	--	--

Total No. of Pages : 02

Total No. of Questions : 08

**M.Tech. (ECE) (2018 Batch) (Sem.-1)**  
**INFORMATION THEORY AND CODING**

Subject Code : MTEC-PE2Y-18-3

Paper ID : [75179]

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWELVE marks.

- Q1 How information depends on probability and why? Define what is Entropy, mutual information and its properties. State and explain Shannon's first fundamental theorem of source coding.
- Q2 A source  $X$  generates eight different messages  $(x_i, i = 1, 2, \dots, 8)$  with probabilities  $p(x_i) = \{0.27, 0.23, 0.12, 0.15, 0.1, 0.07, 0.02, 0.04\}$ . Construct a Shannon Fano code with  $D=2$  and calculate the efficiency of the code.
- Q3 State and explain the low pass sampling theorem. Explain the process of reconstruction of signal from its samples. Also, illustrate the effect of aliasing error.
- Q4 Explain pulse code modulation (PCM) system with the help of block diagram. What are the merits and de-merits of PCM system over DPCM system?
- Q5 What is Inter-symbol Interference (ISI)? What are the causes of ISI? What is Nyquist criterion for zero ISI? Write the expression of any two pulse shapes which follow Nyquist criterion and used in baseband shaping for data transmission..
- Q6 With the help of proper block diagram and mathematical expressions, explain the generation and detection of coherent QPSK signal. Derive the power spectral density of QPSK signal and plot it.

Q7 Consider a (6, 3) block code whose generator matrix is :

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

- a) Find code words of the message -110, 101 and 111.
- b) Find H, the parity check matrix of the code.
- c) Compute the syndrome for the received vector  $r = 0 \ 0 \ 1 \ 1 \ 1 \ 0$ , Is this a valid code vector?

Q8 Write a short notes on the following :

- a) Viterbi decoding algorithm for convolution codes.
- b) Hamming and BCH codes.