Roll No. | | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 08

M.Tech.(ECE) (2016 Batch) (Sem.–2)

INFORMATION THEORY & CODING

Subject Code : MTEC-203

M.Code : 74280

Time : 3 Hrs. Max. Marks : 100

INSTRUCTIONS TO CANDIDATES :

1. **Attempt any FIVE questions in all.**
2. **Each question carries TWENTY marks.**

1. a) Define the following: Message rate, Information Rate, Entropy, Coding Efficiency, Channel Capacity. Discuss their values *i.e.* maximum or minimum. 10

   b) A voice-grade channel of the telephone network has bandwidth of 3.4 kHz.

      i) Calculate the channel capacity of the telephone channel for a signal-to-noise ratio 30 dB. 5

      ii) Calculate the minimum signal-to-noise ration required to support information transmission through the telephone channel at the rate of 4800 bits per second. 5

2) a) A band limited analog signal g(t) is continuous in both time and amplitude with finite energy and infinite duration. Illustrate its spectrum in frequency domain after the process of sampling both mathematically and graphically. Why do we use low pass filter before sampling? 10

   b) Consider four symbols $\{S_0, S_1, S_2, S_3\}$ and corresponding four codes listed as :

   Code I-{0, 10, 110, 1110, 1111}; Code II-{0, 01, 001, 0010, 0011}; Code III-{0, 01, 011, 110, 111}; Code IV-{00, 01, 10, 110, 111}. Two of these four codes are prefix codes. Identity them, and construct their individual decision trees. 10

3) a) Using Channel Capacity theorem, for an ideal system, prove that for Infinite bandwidth Energy to Noise density is -1.6 dB. Discuss Capacity boundary, trade-offs. 10

   b) Construct Two different Huffmann codes & prove that code has same average length & different variance σ^2. The symbol with probability is listed as X= {X1, X2, … X5} and P = {0.55, 0.15, 0.15, 0.10, 0.5}. 10

4) a) In PCM system, derive the expression for the probability of error of 1st kind. Discuss the parameters distortion in PCM encoded signals. 12

   b) An analog signal in samples, quantized and encoded into a binary PCM wave. The specifications of PCM system include the following: Sampling rate = 8 kHz, Number of representation levels = 64. The PCM wave is transmitted over a baseband channel using binary PAM. Determine the minimum bandwidth required for transmitting the PCM wave, assumed to be binary form. 8

5) a) Write a technical note :

i) Constellation Diagram.

ii) Symbol Rate & data rate.

iii) Bandwidth Efficiency. 10

b) Compare the characteristics and performance of binary and quaternary modulation techniques. 10

6) a) Draw and explain block diagram for MSK Transmitter and Receiver. 10

b) In coherent binary FSK system, symbols 0 and 1 are transmitted with equal probability. The system parameters are as follows: Average transmitted power = 1W. Noise power spectral density = 10^{-5} W/Hz, Transmitted bit rate = 10^{-4} b/s. Viewing the system as a binary symmetric channel, calculate the channel capacity C. 10

7) a) Define classes of codes. Also mention their examples. Draw examples of decision trees. What do you mean by 'Hamming codes are single error correcting binary perfect codes'? 10

b) Consider the (31, 15) Reed-Solomon code. 10

i) How many bits are there in a symbol of code?

ii) What is block length of bits?

iii) What is the minimum distance of the code?

iv) How many symbols in error can the code correct?

v) What is the length of an in-phase burst that the code can correct?

8) a) Define Syndrome. How is it used in error detecting and correcting in codes? Explain and prove the properties of Syndrome. 10

b) Draw Trellis diagram for Convolutional coder (Blocks having usual Meaning) as shown in the diagram shown. Trace the path for received bits are 10 00 10 00 00 and point out discrepancies. 10

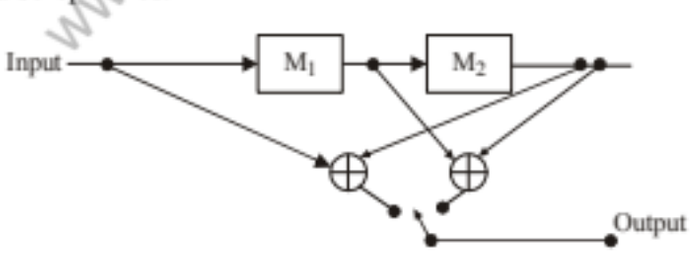

FIG.1

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.