

Con. 5303-07.

[REVISED COURSE]

CD-6033

(3 Hours)

[Total Marks : 100]

N.B. : (1) Question No. 1 is **compulsory**.(2) Attempt in all **five** questions.(3) **Figures** to the **right** indicate **full marks**.(4) Draw **neat** diagram whenever **necessary**.

1. (a) Suppose that 5 digits are transmitted over a noisy channel with per digit error probability of 0.01. What is the probability that upto 2 digits will be in error ? Also calculate mean and variance of the error. Use Binomial probability distribution. 7

(b) Explain ergodic process. 3

(c) Write in brief on the following :- 10

(i) Gaussian and White Process

(ii) Probability density function.

2. (a) Justify that the probability of error in a matched filter does not depend on the shape of input signal. Derive the relevant expression. 10

(b) Explain integrate and dump receiver and derive an expression for the probability of error. 10

3. (a) Channel capacity is given by 10

$$C = B \log_2 \left( 1 + \frac{S}{N} \right) \text{ bits/sec}$$

In the above equation when the signal power is fixed and white gaussian noise is present, the channel capacity approaches an upper limit with increase in bandwidth 'B'. Prove that this upper limit is given as -

$$C_{\infty} = \lim_{B \rightarrow \infty} C = 1.44 \frac{S}{N_0}$$

(b) Explain 8-ary PSK along the following line - 10

(i) Modulation

(ii) Demodulation

(iii) Plot of PSD with relevant frequencies and hence bandwidth

(iv) Signal space representation and hence Euclidian distance. What is significance of Euclidian distance ?

4. (a) For the Input binary sequence :- 10

$$\{b_k\} = \{ +1, -1, +1, -1, -1, -1, 1, 1 \}$$

Find the transmitted phase sequence and sketch the transmitted waveform of QPSK.

(b) Draw a block diagram of coherent detection scheme for demodulation of binary FSK signals. Explain each block in brief. 10

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5. (a) Show that the minimum probability of error for FSK is given by –

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$$P_e = \frac{1}{2} \operatorname{erfc} \left[ 0.61 \sqrt{\frac{E_s}{N_0}} \right]^{\frac{1}{2}}$$

where  $E_s$  and  $N_0$  are signal energy and noise density respectively.

(b) The generator matrix of (6, 3) systematic block code is given by –

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

- (i) Find the code vectors
- (ii) Find the parity check matrix
- (iii) Find the error syndrome.

6. (a) Compare (i) PCM (ii) DM.

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(b) Find PSD of NRZ signal.

5

(c) A (7, 4) linear block code is the following parity check matrix :-

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

- Find :
- (i) The generator matrix
  - (ii) All code words
  - (iii) Numbers of errors that can be detected and corrected
  - (iv) For the received code word  $r = 1\ 0\ 0\ 0\ 1\ 0\ 0$ , find syndrome.

7. (a) Explain different types of early cipher system and what are their disadvantages.

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(b) Write short note on (i) Confusion (ii) Diffusion

(c) Explain Viterbi Algorithm.

(d) Write short note on Lampel-Ziv Coding.