



- Notes :
1. All questions carry marks as indicated.
  2. Solve Question 1 OR Questions No. 2.
  3. Solve Question 3 OR Questions No. 4.
  4. Solve Question 5 OR Questions No. 6.
  5. Solve Question 7 OR Questions No. 8.
  6. Solve Question 9 OR Questions No. 10.
  7. Solve Question 11 OR Questions No. 12.
  8. Due credit will be given to neatness and adequate dimensions.
  9. Assume suitable data whenever necessary.
  10. Illustrate your answers whenever necessary with the help of neat sketches.
  12. Use of non programmable calculator is permitted.

1. a) The CDF for a certain random variable is given as, 8

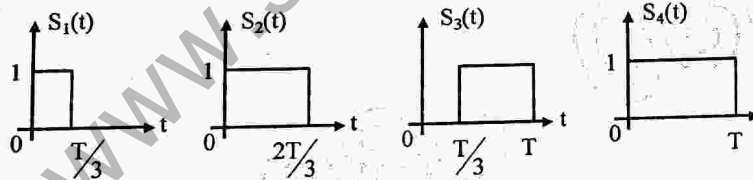
$$F_X(x) = \begin{cases} 0 & -\infty < x \leq 0 \\ kx^2 & 0 < x \leq 10 \\ 100k & 10 < x < \infty \end{cases}$$

- i) Find the value of k; ii) Find the value of  $P(x \leq 5)$   
iii) Find the value of  $P(5 < x \leq 7)$ ; iv) Find the expression for PDF.

- b) State and explain Central-Limit Theorem. 5

OR

2. a) Consider the given signals  $S_1(t)$ ,  $S_2(t)$ ,  $S_3(t)$  and  $S_4(t)$  as shown in figure. Find orthonormal basis functions for this set of signals. Using Gram-Schmidt orthogonalization procedure. 7



- b) Explain the concept of matched filter in detail. 6

3. a) A zero memory source emits messages  $x_1$ ,  $x_2$  and  $x_3$  with probabilities 0.45, 0.35 and 0.2 respectively. Find optimum (Huffman) binary code for this source as well as for its second order extension (i.e. for  $N = 2$ ). Determine code efficiency in each case. 8

- b) Explain Adaptive Transform coding. 5

OR

4. a) Find L - Z source code for the binary source sequence given below: 7  
10101101001001110101000011001110101100011011

- b) With the help of block diagram explain CELP coding. 6

5. a) Explain generation and detection of DPSK in detail. 7  
 b) Explain MSK transmitter and receiver. 6

OR

6. a) Explain QPSK transmitter and receiver. 7  
 b) Explain CPFSK. Draw its signal space diagram. 6

7. a) Obtain the field elements of  $GF(2^3)$  whose modulo polynomial is,  $P(x) = x^3 + x + 1$ . 10  
 Show that  $\alpha^5$  is primitive element of  $GF(2^3)$ .

b) Explain Automatic Repeat Request (ARQ) for error control. 4

OR

8. A convolutional code is described by: 14  
 $g_1 = [1 \ 0 \ 0]$ ;  $g_2 = [1 \ 0 \ 1]$  and  $g_3 = [1 \ 1 \ 1]$

- i) Draw the encoder corresponding to this code.
- ii) Draw the code tree for this code
- iii) Draw the state transition diagram for this code.
- iv) Draw the Trellis diagram for this code
- v) The output of demodulator detector is (101001011110111), using Viterbi algorithm find transmitted sequence.

9. a) Explain Trellis coded modulation encoder in detail. 6  
 b) Explain Turbo encoding and decoding with suitable block diagram. 7

OR

10. a) What are the different parameters of Reed solomon codes and obtain the generator polynomial for (7, 3) double error correcting R-S code using  $GF(2^3)$  whose modulo polynomial is  $x^3 + x + 1$ . 8

b) Write a note on LDPC codes. 5

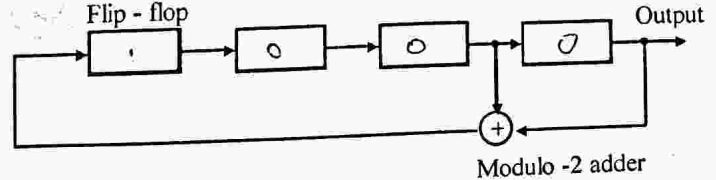
11. a) What is spread spectrum? Explain DS-SS technique in detail. 10

b) A spread spectrum communication has the following parameters: 4  
 Information bit duration  $T_b = 4.095$  m sec.; PN Chip duration  $T_c = 1$   $\mu$ sec.

Find processing gain and jamming margin in dB given that  $E_b/N_0 = 10$ .

OR

12. a) Figure shows four stage feedback shift register. The initial state is 1000. Find the output sequence of shift register. Demonstrate the balance and run property of PN sequence. Also plot autocorrelation function of PN sequence produced by this shift register. 8



b) Explain slow frequency hopping with suitable example. Draw its block diagram. 6

\*\*\*\*\*