

Q.P. Code : 1980

(3 Hours)

[Total Marks : 100

- N.B. : (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions out of the remaining **five** questions.
 (3) Draw **diagrams** wherever **necessary**.
 (4) **Figures** to the **right** indicate **full** marks.

1. Attempt any 4

- (a) In Digital Communication E_b/N_0 is the parameter considered rather than S/N_0 . Justify. 5
- (b) Explain Shannon Hartley Theorem. 5
- (c) Derive the condition for maximum entropy of a source. How does it vary with probability? 5
- (d) Assess the different parameters for choosing a PCM waveform type. 5
- (e) Compare - 5
- (i) Systematic and Non-Systematic Codes
- (ii) 16-PSK and 16-QAM
2. (a) Draw the block diagram of OQPSK transmitter. A bit stream $b(t) = 001011011010$ is to be transmitted. Sketch the waveform at the o/p of each block. 8
- (b) Explain the transmitter and receiver of a DEPSK system with a block diagram. Interpret why errors occur in pairs in a DEPSK system? Support with a suitable example. 8
- (c) Describe the properties of Matched Filter. 4
3. (a) Derive expression for probability of error for an Optimum Filter. Hence derive the Transfer Function of an Optimum Filter. 10
- (b) Explain the concept of QAM. Draw and Explain QAM transmitter and receiver. 10
4. (a) For $K=4$, $1/3$ rate convolution encoder, the generator vectors are given as $g_1 = (1000)$, $g_2 = (1111)$ and $g_3 = (1011)$. Draw the block diagram of the encoder. Draw the code tree for the same. If the input bit stream to the encoder is given by the 4 bit sequence 1011, find the coded output bit stream. 10
- (b) The generator polynomial for a (7,4) systematic cyclic code is $x^3 + x^2 + 1$. 10
 Find the code polynomial for message vector 1111 and hence the coded vector. Assuming it suffers transmission error, find the syndrome at the receiver.

[TURN OVER

5. (a) A DMS 'S' produces the symbols A, B, C and D with probabilities 0.4, 0.25, 0.15 and 0.20 respectively. 10
- (i) Justify whether the output of this source can be compressed so that the average code word length is 2 bits.
 - (ii) Create a Huffman code for this source and calculate its efficiency.
- (b) The binary data [1 0 111 0 0 1 0 1] is applied at the input of a modified duobinary encoder. 10
- (i) Prepare the encoder and decoder output without precoding.
 - (ii) Suppose during transmission, the 3rd bit is in error. Construct the receiver output.
 - (iii) Recommend a technique to avoid error propagation and illustrate how this can be achieved.
6. (a) Derive the PSD for a Unipolar NRZ waveform. 10
- (b) For a (6,3) systematic linear code, the parity check digits are given as 10
- $$C_4 = d_1 + d_2 + d_3$$
- $$C_5 = d_1 + d_2$$
- $$C_6 = d_1 + d_3$$
- (i) Find the generator matrix.
 - (ii) Obtain the code vectors.
 - (iii) Determine error detection and correction capabilities.
 - (iv) Decode received word 000111.
7. Write a short note on - (any 4) 20
- (i) Viterbi Decoding
 - (ii) Lempel Ziv Coding
 - (iii) Equalization
 - (iv) BCH Codes
 - (v) Eye Pattern