

Lib

31/12/09

10:30 to 2:30

- N. B. : (1) Question No. 1 is **compulsory**.
 (2) Attempt **five** questions including the **Compulsory** question.
 (3) Assume suitable data if **necessary**.
1. (a) In case of cyclic code, state the conditions to be satisfied for a valid generator polynomial. Hence, obtain a valid generator polynomial for a (7, 4) cyclic code. 5
 (b) Distinguish between hard decision decoding and soft decision decoding. 5
 (c) Derive and sketch the magnitude spectrum of a duobinary signal pulse. 5
 (d) Describe diversity combining techniques. 5
 2. (a) Consider a systematic block code whose parity check bits are given by— 10

$$P_1 = m_1 + m_2 + m_4$$

$$P_2 = m_1 + m_3 + m_4$$

$$P_3 = m_1 + m_2 + m_3$$

$$P_4 = m_2 + m_3 + m_4$$
 - (i) Find the generator matrix and parity check matrix for the code.
 - (ii) Find the error detecting and error correcting capabilities of the code.
 - (iii) Sketch the encoder realisation.
 - (b) For a (7, 4) cyclic code with generator polynomial $g(x) = x^3 + x + 1$, 10
 - (i) Sketch shift register implementations for encoder and syndrome calculator.
 - (ii) For the message {1010}, find the codeword using the above encoder. Verify by calculation.
 - (iii) For the received codeword { 1001010 }, find the syndrome using the syndrome calculator in (1). Verify by calculation.
 3. (a) A Convolution code is described by — 12

$$g_1 = \{ 110 \}, g_2 = \{ 101 \}, g_3 = \{ 1 \cdot 11 \}$$
 - (i) Sketch the encoder and find the codeword for the message { 10011101 }
 - (ii) Sketch the state transition diagram.
 - (iii) Find the transfer function and free distance for this code.
 - (b) Explain Viterbi algorithm for decoding of convolutional code with an example. 8
 4. (a) State and prove Nyquist Criterion for a bandlimited channel with zero ISI. 10
 (b) Derive and plot the impulse response of the ideal Nyquist Channel. Hence, justify the statement. "For an ideal Nyquist Channel, the sum of the resulting ISI does not converge." 10

5. (a) The unequalised pulse in a PAM system has the following values at sampling times. 12

$$X_m = \begin{cases} 0 & m = -2 \\ 0.1 & m = -1 \\ 1.0 & m = 0 \\ -0.2 & m = +1 \\ 0.1 & m = +2 \\ 0 & \text{Otherwise} \end{cases}$$

- (i) Design a three tap zero forcing equalizer.
- (ii) For the coefficients determined in (1), obtain the equalizer output for $m = \pm 2, \pm 3$. Hence, determine the residual ISI and its span in time.

(b) With a neat sketch, explain the working of preset equalizer. 8

6. (a) Explain LMS algorithm. Explain the effect of steps size on the following parameters : 10
Convergence rate, excess mean square error and lag error.

(b) Explain with a neat sketch, the working of decision feedback, equalizer. Obtain 10
equation for coefficients of feed forward and feedback filter.

7. Write detailed notes on any two :— 20

- (a) Trellis-coded modulation
- (b) Slow and fast frequency hopping
- (c) Multi-carrier system.